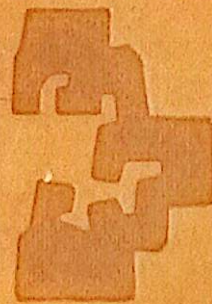


19/X-2010-28/XI-2013

2007

eman la zabal zazu



Unibertsitatea Euskal Herriko
del País Vasco

29

19 Oct. 2010 - 28 Nov. 2013

Plan Sum. trabaja (w. 9/11/2010):

Ostirala - Viernes

- 1) VC reversal in H₂ field (Rocio)
- 2) Engr. papers V & SD reversal (Roc, Oucana 4.) Subm. APL 6/11
- 3) SP current induced V. dynamics in F/N/F pillar - nanowire theory paper
- 4) Vortex rad. & azim. SW (Katun, Burkard)
- 5) Vortex interdot coupling & M(H) in N x Naray (Ouel, Ouc)
- 6) Ni - nanotubes M(H) (Ai Ping, Vazquez) - 400 m. coupling
- 7) DW in nanotubes (Ai Ping)
- 8) SW in nanotube arrays (Vazquez, Papez)
- 9) CoCu - paper (Roc, Julian) - current nanosci?
- 10) Oxygen TM across Fe/Si/Fe dot w. Zuc. Papez - ^{exp.} ~~Capitulos de~~ ^{Dirige?}
- 11) Review. JMM, APL, ICMM, JMN, JAP
- 12) Azim. SW modes in L₁₀ state (exp. Klein)
- 13) Rectang. and cylindr. Green function (w. Cuabun) - Subm. JMMM 23/11

Opr. konfok:

- 1) Pagar b. / goma, nahrung & San Sebastian u. koncept. \$ → €.
- 2) Travel Kaiserslautern - Stuttgart (end of Oct.?) - end Nov. - begin Dec. → Feb. 11
- 3) Deposit check Hong Kong Univ. - \$128
- 4) Pp. nahrung. docs na bank credit u. nahrung goma
- 5) Pagar Spanish - Portugal travel grant & May 2011
- 6) Pagar u. nahrung. order SAISTEK Dec. 2010 u. reference koncepto p. 11 June 11
- 7) Pagar. new budget for NSF-MICINN grant
- 8) Recom. letter for Arantxa u. order Activity 2009 to I. Ivarista
- 9) Recom. new budget of MICINN - Dec. to Vicerrectorado

363/2

30

31

Larunbata - Sábado

Domingo - Igandea

364/1

- 1) B. Demokritov & invited sp. to Ordizia 11 - 8/2 on road
- 2) Pagar. new docs na NSF-MICINN grant u. representante p. 11 July 10
- 3) Pagar. recu. "lean", "Morano", "fin de semana" to Spanish courses
- 4) Update CV, publ. grants na Ikerbasque website. General Survey
- 5) Abstracts na Conf. & Montpellier, Eurochem 2011 u. Toronto, Italy, Ordizia 11.
- 6) Pagar. new files na MICINN projects' referee
- 7) Pagar. koncepto na postea position goma Arantxa
- 8) Pagar. nahrung & Ayuntamiento u. apper & Police u. Orange

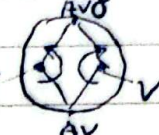
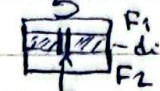
52 Aste - Semana

UTARRILA - ENERO 2007
L M M J V S D
1 2 3 4 5 6 7
8 9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31

OTSAILA - FEBRERO 2007
L M M J V S D
1 2 3 4
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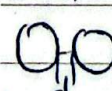
(20/X) Paces W(en) give cluster 2x2 of cyl. dots
 c Oxc. Microvortex $\Phi_n = \pm \frac{\pi}{4} + \pi$ gas min Wm
 Проверка SUC vortexов к ним багряктыд...
 Попробуем Arantxa paces. Wm. M(H) of 2x2 cluster.
 Han Lunes • Astelchena

(21-28/X) Hoegge S.S. → Porto → Madrid → S.S. 22-24/X Paces c Gerson rag
 Vortex - Barrier APL (Arantxa Introduction). Paces papers APL-Michalek-Hoffmann
 Burgess-Preeman PRB, Davis-Preeman-New J. Phys. Ouyang. Han N x N cluster c O. Paces
 25/X Paces b Madrid, Oxc. y Oxc. 26-28/X Paces rag V. barrier APL c Oxc.
 проверка M(H) и Jukov by e^{-t/τ_1} , e^{-t/τ_2} и $\ln(t/\tau)$. Meeting c Pappas:

- 1) SW dynamics in metastable table vortex state
 SW no ctoponam pacha, coeq. vertices u edge AV  - Bozjany
- 2) Spin dynamics b Jukov MTT  F1, F2. Проверка Jukov...
 Cozgar konanym область c коноро...
 SW - конер непереставление: go Jukov - high-f SW, none - low-f TM dynamics
 попробуем по Arantxa. Zagara Jukov... ST-dyn. in nancontact, no
 c confined free byer F1.

27/X Meeting c Oxc, Pappas, Awad, M. Vazquez: Ouyang FMR измерении by Pappas
 Co+nanopillar arrays u antidot arrays изобрет. by Vazquez. Short nanopil
 c L=150-200 nm, D=60-70 nm b fcc-Co phase u c OHC || Oa. long pillars (200 nm)
 are in Co-hcp phase c  OHC || Oa pillar (oz) u PNH resulting anisotropy.
 Paces karate измер. c antidot arrays, xos a zenuropechoban b short
 nanopillars dense arrays with strong inter-pillar magn. coupling.

28/X Meeting c Mariana u Vazquez - Ouyang M(H) - nanotubes simulat.
 by Ai Ring. Ouyang y res inter-tube m. coupling and more to explain
 experiments na dense Ni - nanotubes arrays.
 Meeting c Laura (becaria of Oxc. u Vazquez): Ouyang Jukov... k pillar
 arrays give FMR Pappas (low H_a fcc-Co, in-plane anisotropy).
 H_n // e/tc u lnt Ouyang M(H) c Oxc. T-brane Jukov vortex to SD dot,
 Jukov Ouyang vortex u uenryy gas c lnt uz-za AF-pac/pager. - Jukov

(29/X) Ouyang c Julian Sanguera NSF-MICRAN Jukov. C. Prieto Jukov new
 budget c 110K total for 3 years u Julian comen c Jukov c Jukov,
 xos u Jukov no xbasu gener gence na postdo Arantxa (he is Jukov of Ai Ring).
 Arantxa u Jukov Han 2x2 FeNi dots array give  d=200 u 300 nm
 Han (d) paces c d, как u Jukov Oxc. M_j(H) of dots c Jukov-Jukov.
 Ouyang. review JAP. Lyberatos c Arantxa. Проверка кн. Багряктыд c
 Oxc. one na Jukov ~40 csp. u u Jukov знаер Jukov, Affken b не
 Jukov u u Jukov u Jukov. Ouyang na JAP-vort. Lyberatos, JAP-nanotubes
 c Ai Ring was published → update Jukov web-page.

(30/X) C. A. na la Concha Playa, downtown, S. Amara, Lidl. lott. from Oxc. c.
 Jukov u u Jukov u Jukov. Ouyang na JAP-vort. Lyberatos, JAP-nanotubes
 c Ai Ring was published → update Jukov web-page.
 (31/X) Ouyang na e-mails to Arantxa u Jukov. C. A. u A. B Amara u la Concha
 Oxc. u. Jukov - проверка M(H) of FeNi dots near vortex H_n.
 Semana • A. B. A. P.

2

1) Paper by J.W. Lau et al. "DE to mag. vortex nucleation"
AR 88, 012508 (2006).
Square PerNi dots, $a = 4.5 \mu\text{m}$, $L = 20 \text{ nm}$, TEM observation
by hologram & scan. $M(t)$ on paper. $\Delta E \sim (H - H_0)^2$

Asteartea • Martes

2) P. Gaunt, JAP 59, 4129 (1986): $M(t) = M_0 + S \ln(t/t_0)$
Viscosity $S = -kT \chi_{12} / (\Delta F)$ u visc coefficient

Viscosity $\eta = -kT \chi_{irr} / (\frac{\partial E}{\partial H})$ is visc. coefficient $S_v = \frac{\eta}{H_f} = -\frac{kT}{H_f} \chi_{irr}$
 $S_v = \frac{kT}{H_f} \chi_{irr}$, χ_{irr} - irreversible susceptibility $S_v = H_f$. $\chi_{irr} = \chi_{irr} H_f$
 $\chi_{irr} = (\frac{\partial M}{\partial H})_t$ is irreversible susceptibility. Due to

$\chi_{ir} = \left(\frac{\partial M}{\partial H} \right)_T$ is irreversible susceptibility. Due to vortex motion.

10 $\beta = \frac{1}{T} = \frac{1}{T} \cdot \frac{M_0 \nu}{kT}$ y Law'og $(SD) \rightarrow S\text{-state} \xrightarrow{izm} \begin{matrix} V \\ \downarrow \\ DV \end{matrix}$
y Mac $(SD) \xrightarrow{\Phi_{III}} C\text{-state} \xrightarrow{\Phi_{II}} V$, $C \rightarrow V$ nepexog neyia

отсюда можно найти $f_{\text{ин}}(H)$.

$S \sim T$ n/mo daz. b'vonn. g'ne dot-g array $S(T, H) = f_{irr}(H) \frac{kT}{M \nu}$
 Eam $f_{irr} = f(H)$ silno n'azet $\sim H^p$, to b'e OK. $M \sim N$

Note: Zagara (H_{an}, H_s) give $N \times N$ cluster of coupled Co-dots by Dimer monomer perisubstituted zepes quadrupolar (q)

coupling in double-Vortex (DV) state $\odot \otimes \odot$. Cylindrical: $\text{Han}(d) = H(\infty) - \frac{\mu}{d^3} + \frac{2}{d^4}$
 3 chiral fermion number $q \gg \mu$  $\text{Han}(\infty) = \frac{2}{d^4}$

generally $q(v) \gg q(v) \cdot v^2$. d - maximum q of DV-det.
Case 4/vii

Dip-quadrupole coupling W_{d-q}^{int} lower tensor $\rightarrow$ even harmonics
finite $N \times N$ array (que ∞ - square array on regular 6 many connections)

Две парера $q(DV)$ ваго $\bar{M}(\vec{\rho}, \vec{x}_1, \vec{x}_2) \cdot DV$ уз $f(z) \sim (z-z_1)(z-z_2)$.

Vortex barrier: $p(t) = e^{-t/\tau}$ Belief measure on gray radius

E - энергия за время t . $\tau = \tau_0 e^{E/T}$

по формуле Гаунта '86 где $S = -kT \ln \left(\frac{\partial Z}{\partial E} \right)$ берма где

kernel uz M_S to $-M_S$ (um raqiblar). $\frac{\partial E}{\partial H}$ defma jiki

$M(t) = pM_1 + (1-p)M_2$

$$M(t) = pM_1 + (1-p)M_2 \Rightarrow M_2 = -M_1, M_1 = M_2 \Rightarrow M(t) = M_2(2p-1) \text{ um}$$
$$M(t) = M_s \left[2 \int_0^t e^{-t/\tau} f(\tau) d\tau - 1 \right]. \quad \eta_{\infty} e^{-t/\tau(E)} = 0 \text{ if } E < E', \quad e^{-t/\tau(E)} = 1 \text{ if } E > E'$$
$$M(t) = M_s \left[2 \int_{E'(t)}^{\infty} dE f(E) - 1 \right], \quad \text{wobei } \underline{E' = kT \ln(f_0 t)}. \quad f(E) - \text{paarw. f. f.}$$
$$dM_{in}(t, H) = \left(\frac{\partial M_{in}}{\partial t} \right) dt + \left(\frac{\partial M_{in}}{\partial H} \right) dH = 5.1t + x \cdot dH$$
$$\left(\frac{\partial \ln \gamma_i}{\partial \ln t} \right)_H + \left(\frac{\partial \ln \gamma_i}{\partial H} \right)_t = S_i \ln t + f_{irr} dH$$
$$\text{scality } S = \left(\frac{\partial M}{\partial \ln t} \right)_H = \frac{\partial M(t)}{\partial \ln t} = 2M_s \frac{\partial}{\partial \ln t} \int_{E'(t)}^{\infty} dE f(E) = 2M_s \left[-\frac{\partial E'}{\partial \ln t} f(E') \right] = -2M_s kT_s$$
~~$$\frac{\partial \langle E \rangle}{\partial \beta} = 2M_S \frac{\partial}{\partial \beta} \int_{E'}^{\infty} dE f(E(H)) = 2M_S \int_{E'}^{\infty} dE \frac{\partial f}{\partial \beta} \approx -2M_S \langle E' \rangle \frac{\partial f}{\partial \beta}$$~~

У нас initial state $M_1 = M_{SD}$, final state is M_V for given (H, T) .

Enero: Urtarrila

Lan'2006: before we no-jump for a period t then $(1-P)^{fot}$, $P = e^{-E/T}$
 f = $\frac{1}{\tau} e^{-E/T}$ - switch, rate per unit time. $p(t) = (1-P)^{fot}$
 Lange $p(t) = e^{-t/\tau}$ $\tau = \tau_0 e^{E/kT}$. $e^x = (1 + \frac{x}{n})^n = (1 + \frac{x}{N})^N$

3

$e^{-x} = (1 - \frac{1}{N})^N$. $p(t) = [1-P]^{fot} = [1-P]^{fot(t/\tau)}$ $fot = fot_0 e^{E/kT} = \frac{1}{\tau}$

$p(t) = [1-P] \frac{1}{P} (t/\tau) = e^{-t/\tau}$ $\tau = \tau_0 e^{E/kT}$ $P \rightarrow 0$. $P = e^{-E/kT} \ll 1$.

t.e. we say Lan'06 is wrong, since $E \gg kT$. No Lan'06 crosses much the hypothesis dots ($SD \rightarrow S$ and $S \rightarrow V$), т.к. we need 3D by Lorentz microscopy.

Мы же измеряем $M(H, T)$: $M(t) = p M_1 + (1-p) M_2$ $M_1 = M_{SD}$, $M_2 = M_V(H)$
 where $M_1 = M_C(H)$, $C = C$ -state $\vec{M}$ go up and down vertex state.

$p(t) = e^{-t/\tau} \rightarrow p(t) = \int_{-\infty}^{\infty} dE e^{-t/\tau(E)} f(E) = \int_{-\infty}^{\infty} dE e^{-t/\tau(E)} f(E) = \int_{E'}^{\infty} dE f(E)$

$M(t) = p M_{SD} + (1-p) M_V = (M_C - M_V) p + M_V$

Viscosity $S = \left(\frac{\partial M}{\partial \ln t} \right)_H = \frac{\partial p}{\partial \ln t} (M_C - M_V)$, $\frac{\partial p}{\partial \ln t} = \frac{\partial}{\partial \ln t} \int_{E'}^{\infty} dE f(E) = -\frac{\partial E'}{\partial \ln t} f(E') = -kT f(E')$, $S = -kT f(E') (M_C - M_V)$ **M. Viscosity**

Значит $M_V(H)$ и $M_C(H)$ - equilibrium magnetizations at given H and T .

$f_{irr} = \left(\frac{\partial M}{\partial H} \right)_t = \frac{\partial}{\partial H} [AM \cdot p + M_V] = \frac{\partial AM}{\partial H} \cdot p + AM \frac{\partial p}{\partial H} + \frac{\partial M_V}{\partial H}$ $M(0) = M_C$

как в Гаусс '86, без $M_C(H)$, $M_V(H)$ и не паче M_S .

$p(t) = F(\ln t) = \int_{E'}^{\infty} dE f(E) = \Phi(\infty) - \Phi(kT \ln t) = 1 - \Phi(kT \ln t)$
 $fot \approx 10^{10} H_2 \cdot (t) = |t = 10^{-10} - 10^{13} s| = 10^{11} - 10^{13}$, $\ln(10^{11-13}) = 2.3 \cdot (11-13) = 25-30$

$M(t) = \Delta M \cdot p(t) + M_V$, $p(t) = 1 - \Phi(kT \ln fot)$. $f(E) = \frac{\partial p}{\partial E}$ - probability density.

Мы же $\frac{\partial M_C}{\partial H} = 0$, $\frac{\partial M_V}{\partial H} = 0$ if we paired for: $f_{irr} = \Delta M \frac{\partial p}{\partial H}$

$f_{irr} = \Delta M \frac{\partial}{\partial H} \int_{E'}^{\infty} dE f(E) = \Delta M \int_{E'}^{\infty} dE \frac{\partial f}{\partial H} (-\frac{\partial E_0}{\partial H}) = -\Delta M \frac{\partial E_0}{\partial H} [f(\infty) - f(E')] = S = -kT \Delta M f(E')$ $f_{irr} = \Delta M f(E') \frac{\partial E_0}{\partial H}$

Значит $S/f_{irr} = -kT / (\frac{\partial E_0}{\partial H})$, где $E_0(H) \sim [H - H_n]^2$ - зависимость энергии от H .

$f(E) \sim \frac{1}{E}$, E - frequency of jump. $E = \frac{E_0}{kT}$. $p(t) = \int_{E'}^{\infty} dE f(E) = 1 - \Phi(\frac{\ln fot}{E})$

$\Phi(x) = \Phi(0) + \Phi'(0)x = \Phi(0) + f(0) \frac{1}{E} \ln fot + \dots$, $x = \frac{1}{E} \ln fot$, $E = \frac{E_0}{kT}$
 $p(t) = 1 - \Phi(\frac{1}{E} \ln fot) \approx 1 - \Phi(0) - \frac{f(0)}{E} \ln fot + \dots = \text{const} - \frac{f(0)}{E} kT \ln fot$

- $M(t)$ выразимся через $f(0)$ и надо измерить $\ln S(E)$.

Например $f(E) = \frac{1}{\sqrt{2\pi} \sigma} e^{-\frac{(E - \bar{E})^2}{2\sigma^2}}$, $f(0) = \frac{1}{\sqrt{2\pi} \sigma} e^{-\frac{1}{2\sigma^2}}$ если $E \gg \bar{E}$.

Если $f(E) \left[\frac{1}{E_1} - \frac{1}{E_2} \right]$, то $p(t) = \int_{E_1}^{E_2} dE f(E) = \frac{1}{\Delta E} [E_2 - E_1] = \frac{E_2}{\Delta E} - \frac{kT}{\Delta E} \ln fot$, $E_1 > E_2$

- $\Delta M = M - M_v$, $M(t) = \Delta M \left[\frac{E_2}{\Delta E} - \frac{kT}{\Delta E} \ln \frac{t}{t_0} \right] + M_v$, $h \mu E_1 = 0$: $M(t) = M_c - \frac{kT}{\Delta E} \ln \frac{t}{t_0}$
 Al $\Delta E = E_2 - E_1$ $M(t) = M(t_0) - \frac{kT}{E_2} \ln \frac{t}{t_0}$ $M(t) = M_c - \frac{kT}{E_2} \ln \frac{t}{t_0}$ $M(t) = M_c - \frac{kT}{E_2} \ln \frac{t}{t_0}$
 C $E_2 = E_2(H, T)$ - max surface free energy
 O $E_1 < E_2$, $\rightarrow p(t) \propto M(t)$ no zaburaz or t.
 O $E_1 > E_2$, $\rightarrow p(t) = 0$ u $M(t) = M_v$ - nepexog $C \rightarrow V$ $f(E)$ $f(E)$ $f(E)$
 $p(t) = 1 - \Phi(\frac{\ln t}{t_0})$, neproxarane Gauss gne $f(E)$ $f(E)$ $f(E)$
 Dne zaburaz $M(t)$ or H nego $M_v(H)$, $M_c(H)$ u $E_2(H)$ $f(E)$ $f(E)$ $f(E)$
 $M_v(H) = M_s \frac{H}{H_{an}}$ $E_2 = E_{max} - E_c$, $M_c(H)$ u $E_2(H)$ $f(E)$ $f(E)$ $f(E)$
 E_{max} u $W(s)$ - Ding's PRL $E_c, M_c(H)$ u $W(s)$ $f(E)$ $f(E)$ $f(E)$
 $W(s) = W_{em}(s) - h m(s)$, $W'(s) = W'_{em}(s) - h m'(s) = 0$ $h(s) = \frac{W_{em}(s)}{m(s)}$
 $W''(s) = W''_{em}(s) - h m''(s) \neq 0$ u $s = s_m$ $h(s) = \frac{W_{em}(s)}{m(s)}$
 $W(s) = \frac{1}{2\pi^2} \ln(1-s^2) + 2\pi F s^2 (1 - \frac{1}{4} s^2) - h [s - \frac{1}{8} s^3]$ $m(s) = s - \frac{1}{8} s^3$
 $W'(s) = \frac{1}{2\pi^2} \frac{(-2s)}{(1-s^2)} + 4\pi F s - 2\pi F s^3 - h [1 - \frac{3}{8} s^2] = 0$ $h = H/M_s$
 $h(s) = \frac{4\pi F s - 2\pi F s^3 - \frac{s}{2\pi^2}}{[1 - \frac{3}{8} s^2]} = s [4\pi F - \frac{1}{2\pi^2} - 2\pi F s^2]$ $h(s) \approx s [4\pi F - \frac{1}{2\pi^2} + \frac{3}{8} s^2]$
 $W''(s) = (4\pi F - \frac{1}{2\pi^2}) - 6\pi F s^2 + \frac{3}{4} h s \geq 0$ $h(s) \approx s [4\pi F - \frac{1}{2\pi^2} + \frac{3}{8} s^2]$
 $S_m(h)$ nagae c $h \uparrow$ $h_1 < h < h_2$ $h(s) \approx s [4\pi F - \frac{1}{2\pi^2} + \frac{3}{8} s^2]$
 $E_{max} = W(s_m)$ $E_2(h) = E_{max}(h) - E_c(h)$ u $S(F, H) = \frac{kT}{E_2(H)}$
 $E_2 = E_2(T)$ repoz $M_s(T)$, $H_m(T)$ rye brog huzne.

2/11 Završila u cga Expense report no trip Madrid-Porto. Pozdrav c

Julian: me onarab Pb. 2010 Smece. Pmeda (200€) u "SAIDOTEK" Spanish Courses. Dokladi c Drc. Spanish Courses web page. Oczug. c Drc. DW u SW u Dapovaxapa. Panyun APL-paper draft by thgt no rad. u azim. SW vortex state. Onarab 74E cber Iberrola. kymn thgt. gredne - 37E. Katrin Vogt (Kaiserlautern) u pucana APL-draft azim SW. rad.

3/11 Cennep by A. Hermans. Kypen Spanish c Drc. Kape c Julian. Oczug. c Arantxa u Drc. Cor. pasara no Co-dat clusters (Ogner). u pucana Double-vortex model to explain Han 1 cdt. Zbenm to Slavin (dwn-grant u RTN SA) u Pucy (Colu-resubm. oczug. V. Barrios).
 4/11 Mucana to Vogt K. u Ornel (by Drc). Anarab. pacre $\vec{m}(x, y)$ DW dat c Drc. Draft of letter to c. Prieto MICINN of gbenm. Sogmca NSF-MICINN gbenm.

Due Double Vortex det $f(z) \sim (z-z_1)(z-z_2)$ u $z_2 = -z_1$, i.e. V. cores
is near the quaterpo. $m_x + im_y = \frac{2W(z\bar{z})}{1+|w|^2} = W(z\bar{z})$ ^{Enero} ^{Urtarrila} ⁵
 $w = M|w|e^{i\Phi} = e^{i\Phi}$ one cores. $m_x = \cos\Phi$, $m_y = \sin\Phi$, $w = 5/151$.
Kairi Φ ^{OTSAIA / FEBRERO 2007} ^{MARTXIA / MARZO 2007} ⁵
Hago $f(z) = e^{i\varphi_0}(z-z_1)(z-z_2)$. $f(z) = e^{i\varphi_0}2z_1(z-z_1)$ ^{viernes} ^{Ostirala}

$\text{Arg}(f) = \varphi_0 + \arg(z_1) + \arg(z-z_1)$. One vortex u/v $z \times z_1$
Hago $\varphi_0 + \arg(z_1) = \frac{\pi}{2}$. $\varphi_0(x,y) = \frac{\pi}{2} - \arctg \frac{y}{x}$
u/v $z \times z_2$ $f(z) = e^{i\varphi_0}(-z_1)(z-z_2)$, $\varphi_0 + \pi + \arg(z_1) = -\pi/2$, i.e.
Vortex (z_1) u vortex (z_2) generate lines opposite Φ .
One $\varphi_0 = \frac{\pi}{2} - \arg(z_1) \Rightarrow f(z) = e^{i\varphi_0}(z^2 - z_1^2)$ - annular
double-vortex state u symmetrical vortices u/v z_1 u $z_2 = -z_1$.

5/XI // Osoygun e Julian u noran new budget to C. Prieto -
- MICTAN. Penun corac. e yprezannem beex casen, k fono
3/na postdoc (1 postdoc na 2 years). // Berrien Q_{dp}(2D) e Ouc.
Berrega e Ouc. os konn. no goge ¹⁸ k $\vec{m}(x,y)$ u kamcane u uenq
Master Thesis: garb ogy - gbe u pro-se zageru no dete
e u zbera. o+beran. // Poryun New budget 133k€ na MICTAN-Ouc.
¹³ ^{ysant}

6/XI Kamcan u subm. peron. mcamo que Arantxa to BCAM
(Basque Center Appl. Math.).
Pacres konnoment Q_{dp} que Double-vortex state.
Vortex-Interdet-Coupl. mod. MAD novagan $Q_{xx} = Q_{xy} = Q_{yy} \approx 0$
 $Q_{xz} = \int d^3\vec{r} [3M_x z + 3M_z x] = 3 \int d^3\vec{r} \int d^2\vec{\sigma} M_x(\rho, \varphi, \vec{r}_1) =$
 $= \frac{3}{2} L^2 \frac{\mu_x}{L}$. $\mu_x = \int d^3\vec{r} M_x = L \int d^2\vec{\sigma} M_x(\rho, \varphi, \vec{r}_1)$. $Q_{xz} = \frac{3}{2} L \mu_x = Q$

Cor. 4/vii $H_m^\delta(\text{int}) = (\text{dip}) - \sum_{\alpha} \frac{\tau_{\alpha}}{\tau^5} Q_{\delta\alpha} + \frac{5}{2} \sum_{\alpha\beta} \frac{\tau_{\alpha}\tau_{\beta}\tau_{\gamma}}{\tau^7} Q_{\alpha\beta}$
Ecm $Q_{\alpha\beta} = Q \delta_{\alpha}\delta_{\beta z}$, $\sum_{\alpha} \tau_{\alpha} Q_{\delta\alpha} = \sum_{\alpha} \tau_{\alpha} Q \delta_{\delta\alpha} \delta_z = z Q \delta_{\delta x}$
 $\sum_{\alpha\beta} \tau_{\alpha}\tau_{\beta}\tau_{\gamma} Q_{\alpha\beta} = \sum_{\alpha\beta} \tau_{\alpha}\tau_{\beta}\tau_{\gamma} Q \delta_{\alpha}\delta_{\beta z} = Q x z \tau_{\gamma}$
 $H_m^\delta(\text{int}) = (\text{dip}) - \frac{1}{\tau^5} z Q \delta_{\delta x} + \frac{5}{2} \frac{1}{\tau^7} Q x z \tau_{\gamma}$, $H_m^x(\text{int}) = (\text{dip}) - \frac{Q z}{\tau^5} + \frac{5}{2} \frac{Q x z}{\tau^7}$

$\odot \rightarrow \odot$ Ecm $\vec{r} = z\hat{x}$, to $H_m^x(\text{int}) = (\text{dip}) + \frac{3}{2} \frac{Q z}{\tau^5}$, $\vec{r} = (x,y,z)$.
^{Larunbata} ^{Sábado} ^{7/359} $\frac{5}{2} x^2 - z^2 = \frac{3}{2} x^2 - y^2 - z^2$ u $H_m^x(\text{int}) = (\text{dip}) + \frac{Q z}{\tau^5} [\frac{3}{2} x^2 - y^2 - z^2]$ ^{Domingo} ^{Igandea}

$H_m^x(\text{int}) \approx (\text{dip}) + \frac{3}{2} \frac{3}{2} \frac{L\mu_x}{\tau^5} L = \frac{2\mu_x}{\tau^3} + \frac{9}{4} \frac{\mu_x L^2}{\tau^3 \tau^2}$ - bugno, no xos
u quadryp. term u uenq "sign, two on quadryp. $(\frac{1}{4})^2$ paz u uenq
quaterpo. n., i.e. u uenq u uenq u uenq, i.e. $L/4 \ll 1$, $d = |\vec{r}|$,
u uenq quadryp. ∇^2 u uenq u uenq u uenq, Hago M det e
 $Q_{xx} Q_{xy}, Q_{yy} \neq 0$.

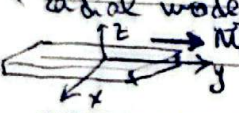
Note: ba am Q_{dp} u uenq u uenq u uenq u uenq, no paz u uenq R^2 u uenq

7/11 Spanish homework "Visita on San Sebastian". Homeworks no y 200mm
 1. Bofnysariz uz Barcelona. Zbona nasee b knab.

8/11 Wagonna vfuoravobus obreeme dnm MFM D
 by Dmch na so-dot clusters (ew obreeme MFM D
 images u MFM) $f = 1.2 \text{ Hz}$ - ne bafaymstevne
 vame vfuoravobus AFM-ordering b dot cluster u quadrupole
 Astelehena Lunes dot interaction (Q_{sp} (double vortex) are quadrupole
 Bmpe dnm ornela by dip. shift Han, by AFM-ground state
 by quadrupole ground state of Double-domain dots
 A na gome obreeme - bfeneme her. Coradun c Obreeme ke
 vres plan: 1) H_c of VC in Hz; 2) ω_{nm} -PDS by Vogt; 3) F/N/F-TM
 4) Wini (d) of square array of Vortex dots.

Obreeme to Ovc. rad. u dnm. SW b Vortex state. Unemes
 MICINN c Obreeme u. ta Vicevectorado, Spanish Courses
 Ovcana naram pover $\omega_{\text{no}}(\beta)$ no Gus PRB'05 que qubame c Vogt
 // 1. nospasna na 10. b Barcelona 24-2/11: 350€ vabi cardu 150€ cash

9/11 Obeyng. c Arantxa dip. μ - quadr. 2 mounts // AFM-M (b) abut fitting
 of double dot vortex dot. $q \sim 10^{-3}$ beme, u $\mu \leq 0.1$ (inches) man
 no qubame c analist. DV-model-Ovc. DV is metastable for isolated dot
 but unstable for 4-dot cluster, rge S-state $\rightarrow$ V. state
 SD $\rightarrow$ S state charon gaer H_n , H_n nagaer c pover interact
 m. Coupling. Spanish Courses // Ovcana named $\omega_{\text{no}}(\beta)$ - f...
 Bome dnm. Vogt obreeme que dnm x n Kago yress $\omega_{\text{no}}(\beta)$ finite
 joining uz $J'(x) + y J_1(x) = 0$ u $\omega_{\text{no}}^2 \sim f[1-f]$ - finite correction to ω_{no}^2

10/11 JAP-St-Arantxa accepted. Spanish Courses. Radial SW in Vortex
 radial modes c Ovc. Katin vognomea, theor $\omega(k)$ - DE uem rect. dot
 $\omega_{\text{no}}^2(k_x, k_y) = \omega_{\text{no}}^2 \left[\frac{\omega_H}{\omega_M} + f(k_L) \frac{k_x^2}{k^2} \right] \left[\frac{\omega_H}{\omega_M} + 1 - f(k_L) \right]$, M_0 by
 16 $\omega_{\text{no}}^2(k_x, k_y) = \omega_{\text{no}}^2 \left[\frac{\omega_H}{\omega_M} + f(k_L) \frac{k_x^2}{k^2} \right] \left[\frac{\omega_H}{\omega_M} + 1 - f(k_L) \right]$, M_0 by
 17 Die Vortex unshifted $\omega_x = 0$ u $k_y = 0$: $\frac{\omega^2}{\omega_M^2}(k) = f(k_L)[1 - f(k_L)]$
 $k_L \rightarrow k_n L = \frac{dn}{R} L = \beta dn$ eam dn kopent $J_1(x) = 0$ uem $J_1(x) + dJ_1(x) = 0$
 B Gus PRB'05 pmeeme u. radial modes $\left(\frac{\omega_n}{\omega_M}\right)^2 = f(\beta dn)$.

18 No noree (Cu-30/100g). $\omega^2 f(\beta) = \int d\beta \beta' \Gamma(\beta \beta') f(\beta')$
 $\Gamma(\beta \beta') = - \int d^2 r d^2 z (\beta, \gamma) d\beta \beta' (\gamma, \beta')$, $d^2 z = - \frac{1}{\beta} \int dk [1 - e^{-\beta k}] J_0(k) J_0(k')$
 $d\beta \beta' = \int dk k f(\beta k) J_1(k \beta) J_1(k \beta')$. Yler $d^2 z (\beta, \beta') \neq - \frac{4\pi}{\beta} \delta(\beta - \beta')$ gaer
 8/35 Ooree noree C3 $\omega_n^2(\beta)$, B nu. vfuoravobus $\omega_n^2 = f(\beta dn)$
 Bepem oporov. c $\psi_n(\beta) = \frac{1}{\sqrt{N_n}} J_1(dn \beta)$ u vnuoem nasque $\Gamma(\beta \beta')$
 $\Gamma_{nm} = \langle n | \hat{\Gamma} | m \rangle = \int d\beta \beta' d\beta \beta' J_1(dn \beta) \hat{\Gamma}(\beta \beta') J_1(dn \beta') \rightarrow \Gamma_{nm} = \langle \psi_n | \hat{\Gamma} | \psi_m \rangle$
 $\Gamma_{nm} = f(\beta dn) \int dk k [1 - f(\beta k)] J_n(k) J_m(k)$, $J_n(k) = \int d\beta \beta J_1(dn \beta) J_0(k \beta)$
 2 Aste - Semana $\hat{C} \hat{D} \hat{B}(\beta) = \sum_n C_n \psi_n(\beta) \rightarrow \text{cor. y p. det}(\omega^2 \delta_{mn} - \Gamma_{mn}) = 0$, $\Gamma_{mn} = f(\beta dn)$
 $\beta \rightarrow 0$ main op

Емн хосум гурв β торел зм $w_n^2 = f(\beta d_n)$, то нэгд мэд релел
 торел мн. гр. а гур - агурел, мн еурел торел $\in \Gamma(p\beta')$ ~ гур гур агурел.
 OTSAILA FEBRERO 2007 MARTIN MARZO 2007 Enero • Urtarrila
 Гурелелел $I_n(k) = \sum_{p=1}^n J_p(dnp) J_0(kp)$, к торелел емн охонелел
 $\Gamma_{nm} = \sum_{p=1}^n f(\beta d_m)$ $\sum_{p=1}^n f(pk) I_n(k) I_m(k) = \delta_{nm} f(\beta d_m) [1 - f(\beta d_m)]$

9

$\rightarrow \omega_n^2 = f(\beta d_n) [1 - f(\beta d_n)]$, уявляем $k \approx$ заданным значением $\omega_n^2 = f(kL) [1 - f(kL)]$
 Матрица Астикарта $\in k_n = n\pi/R$
 Задаем n и $R \gg 1$ $I_n^2(k) k = \delta(k - d_n)$?

Из сав. гр. $\det(\omega^2 \delta_{mn} - \Gamma_{mn}) = 0$ можемо изнети $\omega_n(\beta), n=1,2, \dots$
 Промени збојем. Ова наредба није савршена, пошто у једномину промена не
 у промена сама. Обично г. рачуна $\omega_n(\beta)$ - radical из рен. Int. equation

11/XI. Inscr. pismenne int. gr. v. zadat modoz: pover-Γm - naravnost
za J1 (dimp) - gromozni. Inscr. v MATHEMATICA (nivo
Naučni inštitut iz Kutxa "Ošep. Bank. črta v MICHAN. grant u
Zemlja MICHAN. grant info iz Vicerrectorado. Obzr. APL-R(H)
papr. c. Muxamam u Julian. nonpoc u Julian op. nepresek v B. "Kesa"
residenc. Zbor. Osk. u WLE. MathCad vruca Γm bez upotrebe,
ko vruca $\omega_n^2 \sim g_{pp}(\beta)$ negoležno to explic. exp. Vogt.

(12/81) CEMAG - meeting, gotovay u odog. Dne. dostavila MATH - informaciju
 no poverly $\omega_n(\beta)$. Isto (gss) gotovaymo que zhen. $\beta \ll 1$, no que
 $\beta = 0.16$ ($R = 250$ nm) ^{radial modes} nago yresz g_{22} koe $30/\sqrt{2}$ oaz. Dan okone eqs gss
 povera $\omega_n^2 \sim g_{22}(\beta) g_{33}(\beta)$, no ova ne wonez wotmusez (gss) J_1 uniprav.
 C. Dne. chyb. ocyngenne u b Parto Uejo (pintros). Dne. CEMAG - b Brage
 Arantxa wotmala grant - dos to Vicerrectorado (MICINN). 2011 June-July.

(13/8) C n. b "La Perla", Ondarreta u. Lidl.

$$\int_0^k \text{deg } J_1(k\rho) J_1(d\rho) = \left| \frac{\rho}{L} = z \right| = L^2 \int_0^{p/L} dz J_1(\alpha z) J_1(d'z) = L^2 \int_0^\infty dz (...) - \int_{p/L}^\infty dz (...) =$$

$$= L^2 \frac{1}{\alpha} \delta(\alpha - d') - \int_{p/L}^\infty dz (...) = \frac{1}{L} \delta(L - d) - \int_{p/L}^\infty dz J_1(\alpha z) J_1(d'z)$$

17 Moments Gauss $\int_0^{\pi/2} d\theta \int_0^{\pi/2} J_1(k\theta) J_1(d\theta) = L^2 \int_0^{\pi/2} d\theta \int_0^{\pi/2} J_1(2\theta) J_1(2\theta') \approx \frac{1}{k} \delta(k-d)$, for $k, d \gg 1$

(Cm. 8/2, 30/2092.) $\Gamma_{mn} = \int d^3k [1 - \beta(k)] I_n(k) I_m(k), \quad I_n(k) = \int d^3p J_n(p) J(p)$

$$1 - f(x) = 1 - \left[1 - \frac{1}{x}(1 - e^{-x}) \right] = \frac{1}{x}(1 - e^{-x}). \quad \Gamma_{mn} = \frac{1}{\beta} \int_0^\infty (\beta x)^m \int_0^\infty dx [1 - e^{-\beta x}] I_n(k) I_m(k)$$

$g_{pp} \cdot g_{zz}(p, p') \sim \int dk [1 - e^{-\beta k}] J_0(kp) J_0(kp')$

$$T_{mn} \sim \int d\mathbf{p} J_1(d_n \mathbf{p}) \int d\mathbf{p}' J_1(d_m \mathbf{p}') K(\mathbf{p}, \mathbf{p}')$$

Результат (21/1 2002) $\mathcal{L}_\mu(k, k') = \int_0^R \text{d}g g J_\mu(kg) \cdot J_\mu(k'g) \approx \frac{2}{\pi} \frac{\sin(k-k')R}{(k^2-k'^2)} \frac{\sin(k-k')}{k}$

$$\int_0^\infty dt J_0(qt) J_0(q't) e^{-\beta t} = \frac{1}{\pi \sqrt{\beta q q'}} K(k), \quad g_{22}(\beta \beta') = -\frac{4\pi}{\beta} \int dk [1 - e^{-\beta k}] J_0(k q) J_0(k q')$$

Ex. $I_{\lambda\mu\nu}(R, r, z) = \int_0^\infty ds s^\lambda J_\mu(sr) J_\nu(sr) e^{-s|z|}$ - J. Conway, IE3 TM 37, 2977 (2004)

$$I_n(k) = \int_0^1 ds s J_n(s k) J_0(k s). \quad I_{110}(R, \tau, 0) = \int_0^{\infty} ds s J_1(s R) J_0(s \tau)$$

$$I_n(k) = L^2 \int_{-R/L}^{R/L} dx J_1(x_n z) J_0(x z) \approx L^2 \cdot I_{10}(x_n, z), \quad kL = \pi, \quad \frac{L}{R} = d_n$$

10

$$I_{110}(d, x) = k [k^2(d^2 - x^2)E(k) + 4dx(1 - k^2)K(k)]$$

8\pi (1 - k^2) d^{5/2} x^{3/2}

Здесь $k^2 = \frac{4dx}{(d+x)^2}$, $1 - k^2 = \frac{(d-x)^2}{(d+x)^2}$

Asteazkena - Miércoles

$$I_{110}(d, x) = k [4dx(d^2 - x^2)E(k) + 4dx(d-x)^2K(k)]$$

8\pi (d-x)^2 d^{5/2} x^{3/2}

$$I_{110}(d, x) = \frac{2\sqrt{dx}}{(d+x)} 4dx \cdot \frac{[(d+x)E(k) + (d-x)K(k)]}{8\pi (d+x) d^{5/2} x^{3/2}} =$$

$$= \frac{1}{\pi} \frac{1}{d \cdot (d+x)} \frac{[(d+x)E(k) + (d-x)K(k)]}{(d-x)}, \quad k = \frac{2\sqrt{dx}}{(d+x)}$$

$I_n(x) \sim I_{111}(d, x)$ и имеет максимум при $x \approx d$ ($k \approx 1$)
 при $R/L \rightarrow \infty$ (если при $R/L \rightarrow \infty$ $I_n(x) = L^2 I_{110}(d, x)$ верно).
 $K(k \rightarrow 1) = \infty$, но $K(k) \sim \ln(x-d)$, тогда как $I_n(x) \sim \frac{1}{(x-d)}$

$$I_n(x) = \int_0^{2\sqrt{\beta}} dx J_1(d'x) J_0(kx); \quad \Gamma_{mn} = \frac{f(\beta d_n)}{\beta^2} \int_0^{2\sqrt{\beta}} dx [1 - e^{-\beta x}] I_n(x) I_m(x)$$

$\alpha = k\beta$ (где β eq. R, при $R=1$). $\Gamma_{mn} = f(\beta d_n) \frac{1}{\beta^2} \int_0^{2\sqrt{\beta}} dx [1 - f(x)] I_n(x) I_m(x)$
 $z = \beta/\beta$. $d'_n = d_n \beta$

$$F_n(k) = \int_0^1 dx J_1(d_n x) J_1(kx), \quad |F_n(k)|^2 \text{ имеет максимум при } k \approx d_n$$

то $k_{max} \leq d_n$ и имеет максимум при $k \approx d_n$, хотя $k \leq d_n$ только
 $\omega_n = f(\beta d_n)$ убывает при $\beta \ll 1$, забываясь, что $\omega_n \sim \beta^{1/2}$ (когда $g_{zz} \sim \delta(p-p')$)

$\int_0^1 dx J_1(\dots)$ или $L^2 \int_0^1 dx J_1(\dots)$ - неважно, замена $x = \frac{\beta}{\beta}$ нулю
 и $I_n(k)$ заменяется на $I_{110} \sim \int_0^1 dx J_1(\dots)$ не годится.
 Замена $\omega_n \rightarrow \omega_n$ имеет один недостаток $d'_n = d$ и не зависит
 от β , но это не так.

$$L_1(k, k') = \int_0^R dx J_1(kx) J_1(k'x) = \frac{\sin(k-k')R}{(k^2 - k'^2)\pi}$$

если k, k' не зависят от R . У нас $k \sim d_n/R$.

$$F_n(k) \approx \frac{1}{k} \delta(k - d_n) \text{ если мы не забудем (не забудем) от } \beta!$$

А вот $I_n(k) = \int_0^1 dx J_1(d_n x) J_0(kx)$ на $\delta(x)$ никак не заменяется.
 Надо учесть Γ_{mn} - нулем либо $\int_0^1 dx$ от $g_{zz}(p, p')$ - а не
 от $\int_0^1 dx J_1(\dots) I_n(k) I_m(k)$.

→ Борьба! $\omega_n^2 = f(\beta d_n)$ - нулю где экв. Вот (особенно при $\beta > 0.1$ и $n \gg 1$)
 а) $d_n \rightarrow \infty$ $J_1(x) + d J_1(x) \rightarrow$ что-то вроде, т.к. $d \gg 1$ где ω_n
 $\beta_{max} = 0.16$; б) тогда, чтобы Γ_{mn} и сдвиг, на g_{zz} газ (ср. 10)
 хованье от β , без учета $\omega_n(\beta)$, где $\beta = 0.16, n=1$.
 в) $\omega_n(\beta)$ где $\beta > 0.1$ от β , нулю с $g_{zz} \neq -\frac{4\pi\beta}{p}$
 но не в g_{zz} .

$$g_{22}(p, p') = -\frac{4\pi}{\beta} \int_0^\infty dk [1 - e^{-\beta k}] J_0(kp) J_0(kp'), \text{ con } \text{Abno}$$

Escaneado con CamScanner

$\sqrt{\frac{1}{3^2 + \beta^2}} = \left| \frac{1}{3} = \frac{1}{3} + \frac{\beta^2}{3^3} \right|$ по $\frac{\beta^2}{3}$ незначительное $\frac{1}{3}$ не берем, β^2 - мала
 $= \frac{1}{3} (1 + \frac{\beta^2}{3^2})^{-1/2} = \frac{1}{3} [1 - \frac{1}{2} \frac{\beta^2}{3^2}]$
 $\times [K(\frac{2\sqrt{g\beta}}{3}) + K'(\frac{2\sqrt{g\beta}}{3}) (-\frac{1}{2} \frac{\beta^2}{3^2})] = \frac{1}{3} K(\frac{2\sqrt{g\beta}}{3}) - \frac{1}{2} \frac{\beta^2}{3^3} K'(\frac{2\sqrt{g\beta}}{3})$
 $\sim \frac{1}{3} K(\frac{2\sqrt{g\beta}}{3})$ если β^2 мала
 $\sim \frac{1}{3} K(\frac{2\sqrt{g\beta}}{3})$ если β^2 мала

$$g_{zz}(s, s') = \frac{2}{\beta} \int_0^{2\pi} d\varphi \left[\frac{1}{\sqrt{(s-s')^2 + \beta^2}} - \frac{1}{|s-s'|} \right] - \text{v.k. cubo.} // \text{Argonm. H.T. KAT 104}$$

23/XI Spanish. Argonm. c. Julian: 1) me namcarb Perfage que
to indw Journal "Spiralronics and Mag. Mat." 2) Conscience then
Dermatol. 3) "Inhibited speakers - Ordizia conf. 3) CEMAG-Braga - July '11
Obeyance w. 10/11. Su paorea - Arantxa. Santan. Phys. Soc. - Sept '11
Norwegian en macro maspul. merog penemur unt. yp. Cacion ofera
Zbomur Ties: 1) Quesb Ki-Suk lee as postdoc. 2) FMR na gorax Novosad'a - 2 days
avray c R1 u R2 u 5 peryoux ditorat Separationes (d); 3) W (0) cyl. dot -
neperog as zero pinning $\theta = 5/2$, to strong pinning $\theta = 0$ (sin. KSLor)
 Miércoles. 17

24/XI Spanish. Incremento pen. unt. yp. c g_{zz} - radial SW - Arantxa
merogem $B_{ij} = g_{zz}(p_i, p_j)$ narfurnor - Szycenewee. Pogoreben
u wner to Bamenona draft of Nandure talk - arer za 2009-2010.

25/XI no penemur (Arantxa) c MICINN no nobagy noumori acceptance of
NSF-MICINN project support. Argonm. $g_{zz}(s, s')$ narfurn. Zuen. que
finite β - Arantxa u Dec. Argonm. c Dec. ee par. ofemenu paantage
Amue. hogobepem, no onary en first payment (600€) za Master, ocaunce
nocnostem. Joun genb pomgenur.

26/XI Kago $g_{zz}(s, s')$ Zamenur na u/pocryu qnykumuo
c pelyum max u/pu $s=s'$ for finite β , u gnowyuo $-4\pi\delta(s-s')$
u/pu $\beta \rightarrow 0$. u/pu Joun $\int ds s J_1(dns) \int ds' s' J_1(dns') g_{zz}(ss')$ gousum
u/pu $\beta \rightarrow 0$. u/pu Joun $\int ds s J_1(dns) \int ds' s' J_1(dns') g_{zz}(ss')$ gousum

uzbecno $g_{zz}(ss') \rightarrow -\frac{4}{\beta s} \ln \frac{\beta s}{|s-s'|}$ u/pu $s \rightarrow s'$

$$g_{zz}(ss') = -\frac{4\pi}{s'} \delta(s-s') = -\frac{4\pi}{s'} \frac{1}{\beta \sqrt{\pi}} e^{-(s-s')^2/\beta^2}$$

pacu. $\psi(\beta, s) = \int ds' J_1(dns') g_{zz}(ss') = \frac{(-4\pi)}{\beta \sqrt{\pi}} \int ds' e^{-(s-s')^2/\beta^2} J_1(dns')$

panee a buncum uz nog $\int ds' J_1(dns') \delta(s-s')$ δ some max $g_{zz}(s, s')$

$$F_0(x) = \int ds' e^{-x(s-s')^2} f(s') - \text{unferm Namaca, nouro TB no } \frac{1}{x} = \left(\frac{1}{\beta^2}\right)^{1/2}$$

$f(s) = f(s) + f'(s)(s'-s) + \dots$ gaco nonfery meg. noprognuo β .

Eure nouro $\delta(s-s') = \frac{1}{2\pi} \int dk e^{-ik(s-s')}$

F. Olver. $F(x) = \int_0^1 dt e^{-xP(t)} q(t), P(t) = (t-t')^2, P'(t) = 2(t-t')$

$P(t)$ unner min u/pu $t=t'$, $P''(t) = 2$. hycro t' buncu $[0, 1]$

$$F_0(x) = \int_0^1 dt e^{-xP(t)} q(t) = q(t') e^{-xP(t')} \left[\frac{2\pi}{xP''(t')} \right]^{1/2} = q(t') \frac{\pi^{1/2}}{x^{1/2}}, x = \frac{1}{\beta^2}$$

$$\psi(\beta, s) = \frac{(-4\pi)}{\beta \sqrt{\pi}} \int ds' e^{-\frac{1}{\beta^2}(s-s')^2} J_1(dns') = \frac{(-4\pi)}{\beta \sqrt{\pi}} J_1(dns) \pi^{1/2} \beta = (-4\pi) J_1(dns)$$

$$Imn(\beta) = \int ds s J_1(dns) \psi(\beta, s) = -4\pi \int ds s J_1(dns) J_1(dns) = -4\pi \delta_{nn}$$

$\Gamma_{mn} = -\frac{1}{4\pi} \int ds dn Imn(\beta) = \int ds dn N_n \delta_{mn}, \omega_n^2 = f(\beta dn)$, hago

gaco meg. Zuen no "B".

$$F(x) = \int_0^1 dt e^{-x(t-t')^2} q(t) + \int_0^1 dt e^{-x(t-t')^2} q(t) = \left| t = -t' \right| = - \int_0^1 dt e^{-x(t-t')^2} q(-t) +$$

$$+ (\dots) = \int_{-t'}^0 dt e^{-x(t-t')^2} q(-t) + \int_0^1 dt e^{-x(t-t')^2} q(t) = F_1(x) + F_2(x)$$

18

$$F_2(x) = \int_{t'}^1 dt e^{-x(t-t')^2} q(t), \quad p(t) = (t-t')^2, \quad q(t) = J_1(dn t)$$

$$F_1(x) = - \int_{-t'}^0 d\tau e^{-x(\tau+t')^2} q(\tau), \quad p(\tau) = (\tau+t')^2, \quad q(\tau) = -J_1(dn \tau)$$

$$p(t) = p(0) + (t-t')^2, \quad \mu=2, \quad q(t) = \sum_{s=0}^{\infty} \frac{\Gamma(\frac{s+1}{2})}{x^{(s+1)/2}} a_s$$

$$F_2(x) = \int_{t'}^1 dt e^{-x(t-t')^2} q(t) = \sum_{s=0}^{\infty} \frac{\Gamma(\frac{s+1}{2})}{x^{(s+1)/2}} a_s$$

$$a_0 = \frac{1}{\mu} \frac{q_0}{p_0^{1/\mu}} = \frac{1}{2} \frac{q(t')}{1^{1/2}} = \frac{1}{2} q(t'), \quad p_0=1, \quad p_1=0, \quad q_1=q'(t')$$

$$a_1 = \left[\frac{1}{2} q_1 \right], \quad F_2(x) = \frac{\Gamma(1/2)}{x^{1/2}} \frac{1}{2} q(t') + \frac{\Gamma(1)}{x} \frac{1}{2} q'(t')$$

$$F_1(x) = - \int_{-t'}^0 d\tau e^{-x(\tau+t')^2} q(\tau), \quad \mu=2, \quad p_0=1, \quad p_1=0, \quad q_1=q'(-t')$$

$$F_1(x) = - \frac{\Gamma(1/2)}{x^{1/2}} \frac{1}{2} q(-t') - \frac{\Gamma(1)}{x} \frac{1}{2} q'(-t')$$

$$q(t) - \text{veremos}, \quad q'(t) - \text{veremos} \quad F(x) = F_1(x) + F_2(x) = \frac{\Gamma(1/2)}{x^{1/2}} q(t') + 0$$

$$a_2 = \frac{1}{2} q_2 = \frac{1}{4} q''(t'), \quad p_2=0$$

$$F_2(x) = (\text{no podemos saber}) + \frac{\Gamma(3/2)}{x^{3/2}} \frac{1}{4} q''(t'), \quad F_1(x) = (\text{no podemos saber}) - \frac{\Gamma(3/2)}{x^{3/2}} \frac{1}{4} q''(-t')$$

$$F(x) = F_1(x) + F_2(x) = \frac{\Gamma(1/2)}{x^{1/2}} q(t') + \frac{\Gamma(3/2)}{x^{3/2}} \frac{1}{4} q''(t')$$

$$F(x) = \int_0^1 dt e^{-x(t-t')^2} q(t) = \frac{\sqrt{\pi}}{x^{1/2}} q(t') + \frac{1}{4} \frac{\sqrt{\pi}}{x^{3/2}} q''(t')$$

$$F(\beta) = \sqrt{\pi} \beta q(t') + \frac{1}{4} \sqrt{\pi} \beta^3 q''(t'), \quad q(t') = J_1(dn t') = J_1(dn \beta)$$

$$\Psi(\beta, \beta) = \frac{(-4\pi)}{\beta \sqrt{\pi}} F(\beta) = (-4\pi) \left[J_1(dn \beta) + \frac{1}{4} \beta^2 \frac{d^2}{dn^2} J_1''(x) \right]_{x=dn \beta}$$

$$I_{mn}(\beta) = \int_0^1 d\beta \beta J_1(dn \beta) (-4\pi) \left[J_1(dn \beta) + \frac{1}{4} \beta^2 \frac{d^2}{dn^2} J_1''(dn \beta) \right] =$$

$$= (-4\pi) \left[N_n \delta_{mn} + \frac{1}{4} \beta^2 \frac{d^2}{dn^2} \int_0^1 d\beta \beta J_1(dn \beta) J_1''(dn \beta) \right]$$

$$y'' + \frac{1}{x} y' + \left(1 - \frac{n^2}{x^2}\right) y = 0 \quad y_p = e^{-\beta x} \text{ Bessel}$$

$$I_{mn} = -\frac{1}{4\pi} f(dn \beta) I_{mn}(\beta) = f(\beta dn) \left[N_n \delta_{mn} + \frac{1}{4} \beta^2 \frac{d^2}{dn^2} \int_0^1 d\beta \beta J_1(dn \beta) J_1''(dn \beta) \right]$$

$$x^2 J_1''(x) = -x J_1'(x) + J_1(x) + x^2 J_0'(x) = -x [J_0(x) - J_2(x)] + J_1(x) + x^2 (-1) J_1$$

$$J_1''(x) = -\frac{1}{2x} [J_0(x) - J_2(x)] + \left(\frac{1}{x^2} - 1\right) J_1(x)$$

$$x J_1'' = -2 J_1' + x J_0' + J_0 = -2 \left[J_0 - \frac{1}{x} J_1 \right] - x J_1 + J_0$$

$$x J_1'' = \left(\frac{2}{x} - x\right) J_1 - J_0, \quad J_2 = \frac{2}{x} J_1 - J_0, \quad x J_1'' = -x J_1 + J_2$$

$$\int_0^1 d\beta \beta J_1(dn \beta) J_1''(dn \beta) = \int_0^1 d\beta \beta J_1(dn \beta) \frac{1}{dn} \left[-dn J_1(dn \beta) + J_2(dn \beta) \right] =$$

$$= - \int_0^1 d\beta \beta J_1(dn \beta) J_1(dn \beta) + \frac{1}{dn} \int_0^1 d\beta \beta J_1(dn \beta) J_2(dn \beta) = -N_n \delta_{mn} + I_{mn}$$

$$I_{mn} = f(\beta dn) N_n \left[\left(1 - \frac{1}{4} \beta^2 \frac{d^2}{dn^2}\right) \delta_{mn} + \frac{\beta^2}{4} \frac{d^2}{dn^2} \int_0^1 d\beta \beta J_1(dn \beta) J_2(dn \beta) \right]$$

$$I_{mn} = f(\beta dn) N_n \left[\left(1 - \frac{1}{4} \beta^2 \frac{d^2}{dn^2}\right) \delta_{mn} + \frac{\beta^2}{4} \frac{d^2}{dn^2} \int_0^1 d\beta \beta J_1(dn \beta) J_2(dn \beta) \right]$$

$$I_{mn} = f(\beta dn) N_n \left[\left(1 - \frac{1}{4} \beta^2 \frac{d^2}{dn^2}\right) \delta_{mn} + \frac{\beta^2}{4} \frac{d^2}{dn^2} \int_0^1 d\beta \beta J_1(dn \beta) J_2(dn \beta) \right]$$

$$I_{mn} = f(\beta dn) N_n \left[\left(1 - \frac{1}{4} \beta^2 \frac{d^2}{dn^2}\right) \delta_{mn} + \frac{\beta^2}{4} \frac{d^2}{dn^2} \int_0^1 d\beta \beta J_1(dn \beta) J_2(dn \beta) \right]$$

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Buguneko argazkia Γ_{mn} paterre

$J_1(dns)$ no eko CP $g_{zz}(ss')$ u

$\beta \rightarrow 0$ CP g_{ss} eko $J_1(dns)$, $g_{zz}(ss') \sim \delta(s-s')$ u

$\beta \neq 0$, $\beta \geq 0.1$ $J_1(dns)$ bae eko CP g_{ss} , $g_{zz} \neq \delta(s-s')$ u

$\beta \geq 0.1$ $J_1(dns)$ bae eko CP g_{ss} , $g_{zz} \neq \delta(s-s')$ u

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$\beta \geq 0.1$ $J_1(dns)$ bae eko CP g_{ss} , $g_{zz} \neq \delta(s-s')$ u

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3/24 $\Omega_{max} \approx 10,806$. $\Gamma_{nn} u_n(\rho)$ radial SW $\in O_{nc}$. $\delta(g-g')$ $\rightarrow \Gamma(g, g') = \int d\tau \int d\mathbf{r} \int d\mathbf{r}' \int d\mathbf{r}'' \dots$
 24 $\Gamma_{ij} = \Gamma(g_i, g_j)$ $\rightarrow \Gamma(g, g') = \int d\tau \int d\mathbf{r} \int d\mathbf{r}' \int d\mathbf{r}'' \dots$
 $\Gamma(g, g') = \int d\tau \int d\mathbf{r} \int d\mathbf{r}' \int d\mathbf{r}'' \dots$

$$\Gamma(g, g') = \int d\tau \int d\mathbf{r} \int d\mathbf{r}' \int d\mathbf{r}'' \dots$$

$$I_1(k, x) = \int d\tau \int d\mathbf{r} \int d\mathbf{r}' \int d\mathbf{r}'' \dots$$

$$\Gamma(g, g') = (4\pi)^2 \int d\mathbf{k} \int d\mathbf{k}' \dots$$

$$\left(\frac{\omega}{m_s}\right)^2 \mu(g) = \int d\mathbf{g}' \Gamma(g, g') \mu(g')$$

$$g_{ss}(g, g') = (4\pi) \int d\mathbf{k} \int d\mathbf{k}' \dots$$

$$+ \frac{4\pi}{\beta} \int d\mathbf{k} [1 - e^{-\beta k}] J_1(kg) J_1(kg') = -\frac{4\pi}{\beta} \delta(g-g') + \frac{4\pi}{\beta} I_{(011)}(g, g', |z|) \Big|_{|z|=0}$$

$$g_{ss}(g, g') = -\frac{4\pi}{\beta} \delta(g-g') + \frac{4\pi}{\beta} [I_{(011)}(g, g', 0) - I_{(011)}(g, g', \beta)]$$

$$I_{(011)} = \frac{1}{\pi k \sqrt{g, g'}} [(2-k^2)K(k) - 2E(k)]$$

$$\Gamma(g, g') = \int d\tau \int d\mathbf{r} \int d\mathbf{r}' \int d\mathbf{r}'' \dots$$

$$[\dots] \xrightarrow{\beta \rightarrow 0} \dots$$

$$\Gamma(g, g') = -4\pi g_{zz}(g, g') + \frac{4\pi}{\beta} \int d\tau \int d\mathbf{r} \int d\mathbf{r}' \int d\mathbf{r}'' \dots$$

$$\frac{1}{(4\pi)^2} \Gamma(g, g') = \frac{1}{\beta} \delta(g-g') + \frac{1}{4\pi} [g_{zz}(g, g') + g_{ss}(g, g')]$$

$$- \frac{1}{4\pi} [g_{zz}(g, g') + g_{ss}(g, g')] = \int d\mathbf{k} \int d\mathbf{k}' \dots$$

$$= \frac{1}{\beta} \delta(g-g') + \int d\mathbf{k} \int d\mathbf{k}' \dots$$

$$\frac{1}{(4\pi)^2} \Gamma(g, g') \approx \int d\mathbf{k} \int d\mathbf{k}' \dots$$

$$g_{zz}(g, g') = -\frac{4\pi}{\beta} \int d\mathbf{k} [1 - e^{-\beta k}] J_0(kg) J_0(kg') = -\frac{4\pi}{\beta} [I_{(000)}(g, g', 0) - I_{(000)}(g, g', \beta)]$$

$$I_{(000)}(g, g', |z|) = \frac{k}{\pi \sqrt{g, g'}} K(k), \quad k^2 = \frac{4gg'}{(g+g')^2 + z^2}$$

$$I_{(000)} - I_{(011)} = \frac{k}{\pi \sqrt{g, g'}} K(k) - \frac{1}{\pi k \sqrt{g, g'}} [(2-k^2)K(k) - 2E(k)] =$$

$$= \frac{1}{\pi \sqrt{g, g'}} [(k^2-1)K(k) + E(k)] \frac{2}{k}$$

$$g_{zz}(g, g') + g_{ss}(g, g') = -\frac{4\pi}{\beta} \delta(g-g') + \frac{4\pi}{\beta} [I_{(011)}(g, g', 0) - I_{(011)}(g, g', \beta)] - \frac{4\pi}{\beta} [I_{(000)}(g, g', 0) - I_{(000)}(g, g', \beta)]$$

$$\rightarrow g_{zz}(g, g') + g_{ss}(g, g') = -\frac{4\pi}{\beta} \delta(g-g') - \frac{4\pi}{\beta} \frac{2}{\pi k \sqrt{g, g'}} [(k^2-1)K(k) + E(k)]$$

$$Def. (17/17) \quad \psi(g) = \mu(g) + \nu(g) \quad \omega \psi(g) = \int d\mathbf{g}' [g_{zz}(g, g') + g_{ss}(g, g')] \psi(g')$$

5/XII) ... Γ_{nn} ... $\Gamma_{nn} = \frac{1}{2}(\Gamma_{nn} + \Gamma_{nn}^*)$. Due matrix ...

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6/XII) ... Ostirala ...

7/XII) Becega ... Julian of affiliation at UPV as visiting ...

10) ... Green functions

$$e^{i\vec{k}\cdot\vec{r}} = \sum_{\mu=-\infty}^{\infty} i^{\mu} J_{\mu}(z) e^{i\mu\theta}$$

$$G_{ss}(\vec{r}, \vec{r}') = -\frac{1}{4\pi} \int d^3k \frac{1}{k^2} f(k) e^{i\vec{k}\cdot(\vec{r}-\vec{r}')} \quad , \quad \vec{k}\cdot\vec{r} = k r \cos\theta$$

$$\text{Ecu } \hat{\Gamma}(\vec{r}, \vec{r}') = \int d^3r G_{zz}(\vec{r}, \vec{r}') G_{ss}(\vec{r}, \vec{r}')$$

$$\Gamma(\vec{r}, \vec{r}') = \int d^3r \int d^3k [1-f(k)] e^{i\vec{k}\cdot(\vec{r}-\vec{r}')} \int d^3r' \frac{r'^2}{r^2} f(k) e^{i\vec{k}\cdot(\vec{r}'-\vec{r})}$$

$$\int d^3r' e^{i\vec{k}\cdot(\vec{r}-\vec{r}')} \vec{r}' = \int d^3r' e^{i\vec{k}\cdot\vec{r}'} \vec{r}' = \int d^3r' \sum_{\mu} i^{\mu} J_{\mu}(k r') e^{i\mu\theta} \vec{r}'$$

$$= 2\pi \int_0^R dr' J_0(k r') = \frac{2\pi}{k} \left(x J_1(x) \right) = \frac{2\pi}{k} J_1(kR)$$

$$\Gamma(\vec{r}, \vec{r}') = \frac{1}{4\pi^2} \int d^3k [1-f(k)] \int d^3r' \frac{r'^2}{r^2} f(k) e^{i\vec{k}\cdot\vec{r}} e^{-i\vec{k}\cdot\vec{r}'} = \frac{2\pi R}{k^2} J_1(kR)$$

$$\text{Defeq. } \Gamma(\vec{r}, \vec{r}') \text{ w } \vec{r}, \vec{r}' \quad \int d^3k e^{i\vec{k}\cdot\vec{r}} = 2\pi J_0(kR)$$

$$\int d^3r \int d^3r' \Gamma(\vec{r}, \vec{r}') = \frac{(2\pi)^3 R}{4\pi^2} \int d^3k [1-f(k)] \int d^3r' \frac{r'^2}{r^2} f(k) J_0(kR) \frac{J_1(kR)}{k^2}$$

$$= \text{ecu } J_1(kR) \text{ parafuncion, no monono } \int d^3k \int d^3r' \dots$$

$$\langle \Gamma(\vec{r}, \vec{r}') \rangle_{\vec{r}, \vec{r}'} = \Gamma(\vec{r}, \vec{r}') \text{ dyges } \int d^3k \int d^3r' \Phi(k, r) \text{ rambor.}$$

$$\text{No bega } \text{gona } \Gamma(\vec{r}, \vec{r}') = \int d^3r G_{zz}(\vec{r}, \vec{r}') G_{ss}(\vec{r}, \vec{r}')$$

8/XII) ... A. u A. ...

9/XII) ... "Hera" u "Hertz" ...

10/XII) ... Update CV ...

11/XII) ... Abstract editing ...

12/XII) ...

13/XII) ...

$$\vec{S} = \frac{\hbar}{2} \int d^3x (\vec{S} \cdot \nabla \Phi) (1 - \cos\theta) \quad , \quad \text{we } \vec{m} = \vec{m}(\theta, \Phi) \text{ - magnetization. } \vec{S} = P \vec{S}$$

$$\vec{S} = \frac{\hbar}{2} \int d^3x (\vec{S} \cdot \nabla \Phi) (1 - \cos\theta) \quad , \quad \text{we } \vec{m} = \vec{m}(\theta, \Phi) \text{ - magnetization. } \vec{S} = P \vec{S}$$

B LLG ST green van.

$$\vec{m} = -\gamma \vec{m} \times \vec{H} + \Delta \vec{m} \times \vec{m} - (\vec{v}_s \cdot \nabla) \vec{m}$$

Enero • Urtarrila

A vanol eger bug

Est b yr Thiele

esam ne uenemzobas

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OTSAIA FEBRERO
MARTO MARZO 2007

12/XII 12/11 13/11 14/11 15/11 16/11 17/11 18/11 19/11 20/11 21/11 22/11 23/11 24/11 25/11 26/11 27/11 28/11 29/11 30/11 31/11

13/XII Spanish homework to Ainhoa. Odeyung. c Julian Conf. in Odeyung. Spanish lessons. Odeyung. low-dimen. systems Zdeyung. Astolchena

14/XII Nefebogza beisen bece gano na new kb. Spanish courses. Zboom. K. Poroparov: visit to me na ~ 2 negem b Feb - March '14

(Odeyung. Nodish money). Gies. CoCu paper na rassm. , mebio k K.S. Lee

15/XII Bzem c N. b rent Citroen"cu Automobiles u ceglelun 8 xopk no nefebogza beisen. Kobalen b new apt.

16/XII Sxogor by car no nefebogza. Ydoprea kb. na P. Oriamendi. Karla u Inaki otkazaniye bermya deposit beisen na kishu, moab.

17/XII Ydoprea kb. na P. Oriamendi. Karla u Inaki otkazaniye bermya deposit beisen na kishu, moab. Ydoprea kb. na P. Oriamendi. Karla u Inaki otkazaniye bermya deposit beisen na kishu, moab.

18/XII Bermya namuny. Kb. na Inaki ne uuec gaurb no cbery (Iber- drola). Inaki bermya Aval, no bucsabun nobre u/jeremya no dishwasher,

gyay, avno b cnamone. Odeyung. emy (Arantxa), zo ydoprea kb. na brya b deposit, no cam cyuma dyger nash (Keriscoe kan Karla send)

to may be I will play for that. // Arantxa nefegnes. telephone, ydoprea zo Gas - cher yone nefebogen na Inaki, a Electricity - cher

dyger nefebogen no kamemy zaproy uone Oniash bill ot Dec 10. Odeyung. Jaz Jaz paceru u Antivortex - nanocout. Zafel paper c Arantxa

Wad (Julien) caber. Odeyung. b Consumer service u Police.

19/XII Odeyung. Odeyung. new apartment. B Lide u Todo. nefemena c Ode. pacuneg. dymer. Odeyung. u noshan MS by Krawchuk - APL u Lee - ICM

20/XII Odeyung. Aval u cery Tax Return 2009 (Renta - ded?) to Juan M. (Gija Madrid). Editing ozebl. o mypmane Julian Gonzalez. Odeyung. c 1/ymnoi (11 ren, Bamen.

avne zamone 460€ u/ymnoi). B 21³⁰ Zboom. Karla u no uen. kazana zo xos u/jmash uue by fax impresso por limpieza (cleaning). Odeyung.

ei zo cleaning ne uuec u deposit kumero otkazaniye, u zoob ona otkazaniye any activity on apt cleaning. Inaki c odeyung. cnamone negocantob

ne u/jmash u ne uoglon. // Cocabun cnamone negocantob na new apt. - Arantxa.

21/XII Nanydun new file na H. oneb Semina Nimbune by Gambardella. nocuan list of deficiencies" Isidro Anso

- una to papi by e-mail, yuegb na u/jmash. uuec, oku u buymy uuec y/jmash To Inaki: 1) u/jmash cnamone negocantob na kb.; 2) apt. cleaning is not

my obligation, but my good will. u a uuec ot kazana price ≤ 100€ u uuec u/jmash cher kazana na cleaning zo kazana u uuec otkazaniye

13² Zboom. Karla (limpieza, rez, cher). Kazan ei cnoa zoob bermya linza, uuec a otkazaniye b cyg. K limpieza a ne uuec otkazaniye.

Pucmo reminder to K. Vogt (radial sw). nocuan edited Intro to new journal to Julian

22/XII C. l. uuec. Aval na kb. Inaki Ansozna na 1 reg. Cocabun u nocuan to Karla e-mail - okay os 1,500€ extraordinary limpieza uuec nepobga by Arantxa

Pucmo to Kostylev. K. Vogt u/jmash revised MS Radial sw - BLS

Semana • Aste 5

$$Y(t) = \int_{-\infty}^t d\omega \frac{e^{i\omega(t-t')}}{[\omega_0^2 - \omega^2 + i\gamma\omega]} [-\omega_0 v_0 \theta(t) - d v_0 \delta(t)] = \int_0^t dt' \int_{-\infty}^{\infty} d\omega \frac{e^{i\omega(t-t')}}{[\omega_0^2 - \omega^2 + i\gamma\omega]} \cdot \frac{d\omega}{\omega_0} (-\omega_0 v_0) +$$

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23/XII ~~Orupelut~~ came to Karla na ~100€ cleaning. Berpera & Pepi
u Xoz. enom I. Anserena apt. Origin copy of Aval, nogruca. ^{Miércoles} ~~vincon~~ ^{Asteazkena} ~~negoties~~
kab new apt. ~~nominau~~ ~~erok~~ ~~re. k. p. m. no~~ ~~vorosok~~ ~~b. Salote~~ ~~terez.~~
Second presg of JAP - Arantxa. Unap. Eq. (1) u ~~osocnam~~, c. n. b. Barbera.
Eroski (VSE). Odeg u ~~osogix~~ "B. Meccur".
Nuan komp. 2011: Trento/Italy - May, Ordezia, Montpellier-FR/Kos Greece - Sept.,
Bilbao - April, Braga-June, Kpissu - Oct.

24/XII - 26/XII Marazun c. n. / Nimen brown Manu u ~~Qro~~ ~~Kpacobekux~~ (25/XII) / u ~~muex~~,
Wun Julian. C. n. na Sudarrata u "La Perla". Odeg ~~gama~~ ~~Julian~~ ~~bermyn~~
30m + 100€

27/XII Visit c. Julian to Pepi: Zanjose ~~nominau~~ ~~tere~~ ~~vorosok~~ (u. za. heading)
Arantxa ~~gbanara~~ ~~Inaki~~: ~~rot~~ ~~nominau~~ ~~uoggy~~. u. ~~manay~~ ~~na~~ > 200€.
Edorta ~~osmespen~~ ~~vorosok~~ u ~~orxo~~ ~~arriba~~.

1) Nano Spain '11 - Bilbao Abstracts before Jan. 14 2011
Sulm. April 11-14) accepted Top. field u Nanotubes

2) Trento Italy micromag. 9-11 May '11 Abs. go (31 Jan)
(Phy. B) accepted V. Barriers u ST

3) Eurostat '2011, Montpellier, FR 12-15 sept. Abs go 31 Jan
(15 Feb)

4) Ordezia, June 1-4, Spintory NanoMag. Abs. go 15 Jan
(30m) accepted

? 5) Kos Island, GR, Soft Magn. Mat. Sept. 18-22, Abs. go 31 March

6) Partem, UKR, Oct. 3-8 2011, ICFM'11 Abs. go ...

7) INTERMAG '11, Apr. Taiwan Abs. go Dec. 15

8) MMM '11, 30 Oct. - 3 Nov. Gattsdale, AZ Abs. go June

28/XII Meeting c. Inaki y Karla:

- 1) Bill za boogy 33.07 € - Onu. Karla u ~~bourges~~ u. ~~depost~~
- 2) Cber 85, 49€ za 7 Oct. - 9 Dec. 2010 ~~onary~~ ~~A~~ (21€ za ~~bn.~~ ~~amiska~~ ~~Iberdola~~)
- 3) Fay (com. Karla) za Nov. 11 - Dec. 16 - 94€, ~~nosay~~ ~~oserruka~~ 16/XII - 9691(?)
- 4) Yopma ~~ab.~~ u ~~mosime~~ ~~ofegedea~~ - 142€ - Zanjose receipts
- 5) ~~Nominau~~ ~~ish~~ ~~washer~~ - ~~osenna~~: 250€ - ~~zamena~~ ~~mespen~~ ~~za~~ ~~mespen~~ -
- ~~ne~~ ~~osomance~~, ~~vik.~~ ~~a~~ ~~ee~~ ~~ne~~ ~~osom~~ u ~~kyun~~ ~~new~~ ~~maniny~~ ~~genelbe~~ ~~Samana~~ ~~Aste~~ 5
- 6) ~~osenna~~ ~~Gas~~ ~~account~~ ~~to~~ ~~Inaki~~ ~~8~~ ~~2009~~

Osteoguna. martes Conf. Abstracts u poster c Arantxa. No paper
 Otsaila. Febrero nanotube Abs. oral talk to Trento, Italy u poster to Euroconf
 Bce no m. simulations ST nanowires.
 No magnetostat. Coupled dots w/ spin Arantxa
 1) Hn. Hn of small cluster N x N of vortex states
 2) Hc (QH) AFM $\rightarrow$ FM transition of SD dots in square array
 3) Hn. Hn of ∞ infinite square array of vortex dots periodic boundary

UTARRIA - ENERO 2011											
	L	M	M	J	V	S	D				
1	2	3	4	5	6	7					
8	9	10	11	12	13	14					
15	16	17	18	19	20	21					
22	23	24	25	26	27	28					
29	30	31									

Line c Dnc. nanotube Wtm of coupled cyl. dots u Hn. Hn dot
 - anamorphosis. Theme line - influence dip. u quadrup. coupling
 SW-TM spectra of square dot arrays (8 gyres Anat-APL'10).

23/XII E-mails to Karla o dish-washer u Ai Ping c vjega. nanotube u
 vjogebus Nanotube - going via NanoSpain Conf. Bilbao Abs.
 IAP-ST-Nanowire is published. Osteoguna cv u Ikerbasque database.
 Ha kover (dec. 21) 2010 rage u gema 8-10 new. Ikerbasque productivity
 ranking c Pardo u Canklin, under 8 month. papers. 1-2 new u Solano
 u Carretero, nanotube no 18 (!) published papers.

36/XII Pasara c Arantxa nag Abstracts. b Bilbao, Trento u Euroconf

31/XI C A. D. u Julian b downtown u Garbera - Eraski. nepelone 200€

1-2/I 2011. Osteoguna - La Gacha Cafe c A. D. Julian. Dgoy, maris
 chess etc. Gama.

3/I Vjega. gomaqob ST-nanowire simul. b Trento u Euroconf'11 c
 Arantxa. Nanotube Topol. field u Nanotubes gomaqob b Bilbao, NanoSpain

4/I Nanotube Nanotube Bilbao goma. u nanotube to Ai Ping u Julian. E-mails to Karla
 Nanotube nanotube. gomaqob. Major revision of IAP nanotubes.

5/I Osteoguna Topol. field NanoSpain gomaqob - yjega changes by Arantxa
 B nora u Kparoban. 1. nogaqob the nanotube perm. Karla nogaqob

6/I Nanotube adapter u kar. goma Router, gomaqob Internet. gomaqob. C. A. b M. gomaqob -
 gomaqob. Edited and subm. Top. field Abstract to NanoSpain'11. Dnc. rent (see Euroconf)

7/I Meeting c Ai Ping. 1) gomaqob IAP-B-Nanotubes MS change u
 nanotube gomaqob; 2) nanotube update no Ni-nanotubes (Vazquez); 3) gomaqob
 gomaqob. C Arantxa IAP-papers on vort. dyn. by Toscano u Ordizia - Abstracts.

8-9/I Nanotube Topol. field paper c Vogt - Millebrand. nanotube draft to Dnc. u
 gomaqob.

9/I Bermejo k gomaqob vortex en. barriers w/ m. nucleation $H \approx H_n$ or $1/2 H_n$.

Gomaqob nanotube $M(t) = M(t_0) - \Delta M \frac{kT}{E_2} \ln \frac{t}{t_0}$, use $E_2(H, T)$ max barrier for

C-state $\rightarrow$ vortex(u) nepelone w/ m. gomaqob. gomaqob. $\Delta M = M_c - M_0$ for given T, H. Bce 200 w/ m. $E_1 < E' < E_2$, $E' = kT \ln f_0$.

Krec. on gomaqob $M(t) = M(t_0) + S \ln \frac{t}{t_0}$, so viscosity in our case
 $S = -\Delta M \frac{kT}{E_2}$, nanotube $S(T, H) = -\Delta M(T, H) \frac{kT}{E_2(T, H)}$. Karla m. barrier E_2 gomaqob u H

b gomaqob C-state $\rightarrow$ V nepelone. Nanotube. gomaqob. $E_2(H) \sim (H - H_n)^2$ max at $H = H_n$

T-gomaqob ΔM u E_2 on gomaqob $M_s(T)$, r.e. Chao w/ m. T u T

Torga $S(T, H) = -kT \frac{\Delta M(H)}{E_m(H)}$, $S(T) \sim T$, $S(H) \sim (H - H_n)^2$ max at $H = H_n$

gomaqob. T-gomaqob ΔM u E_2 on gomaqob $M_s(T)$, r.e. Chao w/ m. T u T

Torga $S(T, H) = -kT \frac{\Delta M(H)}{E_m(H)}$, $S(T) \sim T$, $S(H) \sim (H - H_n)^2$ max at $H = H_n$

gomaqob. T-gomaqob ΔM u E_2 on gomaqob $M_s(T)$, r.e. Chao w/ m. T u T

Torga $S(T, H) = -kT \frac{\Delta M(H)}{E_m(H)}$, $S(T) \sim T$, $S(H) \sim (H - H_n)^2$ max at $H = H_n$

Journal MARZO 2007 SD → C-state → Vortex

$M(t) = M(t_0) - S \ln(t/t_0)$ Φ_{II}

Tarigo nogovny genen e Dec. 6 October, no $\tau_1(t)$ go into naga b CT↑, no nopynareca v m H=280 Oe. To nomen no, ecm Viernes. Ostirala

$\tau(t) = \tau_0 e^{E/kT}$ kak b fapreymu (Φ_{II}) anyue, no SD → C eca Φ_{II} u $\tau(t)$ monos Ostravice.

Nos pame ypaquab S(H) que array Dot9. Tavis V. barrier APL

10/1 Nogovna S(H,T) uz M(t) = M(t₀) - S ln(t/t₀) que array Dot9-FM. Vpobogu K. b Amari, genen SOE e ecm. Zadorer.

11-12/1 Bover gena. Nomen to Vogt draft of Radial SW-paper u nolyun or see ober u file no SW-nolin. Coupling (K₂ bozdyngae ne somno Radial SW, no u azim. SW). Pasa nag Vortex-barrier - APL.

13/1 C A. b la Perla: Pazyobor c Julian: 1) nogrovobu vpequom. no Zanyne FMR-like oopyobanne que popyob to loc. Government 2) oopyngeme coj popyngereca e Killebards (SW-DW) u komp. - 2011.

Zboma Tedy: 1) on nogrovobu omyenne neog. u popyngereca V. barrier Encepmenob; 2) nogrovobu vpequomeme no FMR equipment;

3) upocu nanyarb to K. S. Lee o poston applications b Spain J. de Cerna (deadline Feb. 17) u R. y Cajal (deadline Feb. 10, 2011).

Arantxa akaza: Apraqui, Ban. u Alecanegp voge m na Scientist positions at our dept. UPV (PDI-permanent), oopyngere nog mnx. Ona ka vanyro nogarb ne moner, i.e. y kee be eue nos akkpeparym, na vanyro one negect nobovno. // A.Ping 10/1 upuca simul M(H) = nanodot kagquez

14/1 Meeting c Julian: 1) cnyza euy ob poston kanyype que Arantxa, 2) omyenar to review JMN paper by Sierra et al. Panyepere 450€ ka Spanish kypce.

Meeting c Ovc.: 1) upuca oca bills na om, Master - Dec. 15 u Jan. 15; 2) berebur Eq. ggg to Annex - paper c K. Vogt; 3) nogrov. k kanyro Jm. Abstract - Summary no interdut coupling - que Ordizia conf. // Anany submitted Abstracts Ordizia c Arantxa. 33/332

15/1 C A. b Ordavete, downtown u Graz-Eroska. Hanne. Radial SW-paper.

16/1 Vortex Barrier: bezuoco S(T,H) = $kT \frac{\Delta M(H)}{E_m(H)}$. $\Delta M = M_c - M_v$.

$M_v(H) \approx M_s \frac{H}{H_{an}}$; $M_c(H) \approx M_s$, $\Delta M \approx M_s - M_s H/H_{an} = M_s (1 - H/H_{an})$

Nydarunbata: Gabado max C → V zabur o H kak $E_m = E_0 (H - H_0)$ Domingo. Igandea $H_0 = H_n^0$

$S(T,H) = 1/kT \frac{M_s}{E_0} \frac{[1 - H/H_{an}]}{[H - H_0]^d}$ Ho экен. nepepore mer. monen dot array bemu. T.e. $S(T,H) = kTV \frac{\Delta M(H)}{E_m(H)}$, V-obzen of dots in square array.

Tues; pazuep mienun - dot array 2x2 mm² - Dot9. 2R = 500 nm (vornee 481 nm), L = 40 nm, T(neplog) = 2R + d. C bolomoi omyerebro T(Dot9) = 1.0 μm. Bzore coj panyer kb. mienun $N = 2 \text{ mm} / L = \frac{2 \text{ mm}}{1 \mu\text{m}} = 2 \cdot 10^3$ unit cells (dots). Bce b array $N \times N = N^2 = (2 \cdot 10^3)^2 = 4 \cdot 10^6$ dots. Obyu V₀ ogyoro dot: $V_0 = \pi R^2 L = \pi (240 \text{ nm})^2 \cdot 40 \text{ nm} = 7.27 \cdot 10^6 \text{ nm}^3 = 7.27 \cdot 10^{-15} \text{ cm}^3$. Semana • Aste 5

Otsaila. ~~Other~~ nan. ~~nanofabrication~~ & nanoscale Dotg: $V = N^2 V_0 = 4 \cdot 10^6 \cdot 7.2 \cdot 10^{-15} \text{ cm}^3$

Cyprus $\mu(1) = \mu(t_0) - S \ln(V(t_0))$. $\mu(t_0) \approx 20 \cdot 10^6 \text{ emu}$
 Ouzenna M_s : $\frac{\mu(t_0)}{V} = \frac{2 \cdot 10^{-5} \text{ emu}}{2.91 \cdot 10^{-8} \text{ cm}^3} \approx 0.687 \cdot 10^3 \text{ emu/cm}^3$

Fitted viscosity $S \sim 10^{-7} - 10^{-8} \text{ amu}$. In. Euprep $E_m \approx V k T \frac{\Delta M}{M}$

$k_B = 1.38 \cdot 10^{-16} \text{ erg/K}$. $\mu(t_0) \approx 20 \cdot 10^6 \text{ emu}$ $kT = 1.38 \cdot 10^{-16} \cdot 305 \cdot 10^2 \text{ erg} = 4.2 \cdot 10^{-14} \text{ erg}$

$E_m \approx 4.2 \cdot 10^{-14} \text{ erg} \cdot (7 \cdot 10^2 \text{ G} \cdot V) = 4.2 \cdot 10^{-14} \text{ erg} \cdot 2 \cdot 10^5 \text{ emu} = 8.4 \cdot 10^{-12} \text{ erg}$

nan $\frac{E_m}{V_0} \approx \frac{8.4 \cdot 10^{-12} \text{ erg}}{7.3 \cdot 10^{-15} \text{ cm}^3} \approx 1.2 \cdot 10^3 \text{ erg/cm}^3$ - ~~gobaino~~ ~~plasma~~ ~~nanoscale~~

$\frac{E_m}{kT} \approx \frac{M_s V}{S} = \frac{2 \cdot 10^{-5} \text{ emu}}{10^{-7} \text{ emu}} \approx 200$, т.е. $\frac{E_m}{kT} \gg 1$ ~~характер~~ ~~нормализация~~

Оуоооо, но In. Euprep ~~равномерно~~ ~~распределение~~ в инт. $[0, E_m]$
 $\mu(t_0)$ в забучив. от (T.H) ~~уменьшение~~ от 1,8 до $2.1 \times 10^{-5} \text{ emu}$

Due Dotg Han $\approx 800 \text{ oe}$ и ~~сильно~~ ~~забучив~~ от T.

$S(T, H) = kT \frac{M_s (1 - H/H_{an})}{E_m(H)}$, $E_m(H) = E_0 (H/H_0 - 1)^k$, $S' = \frac{kT}{E_0} M_s \cdot \frac{(1 - H/H_{an})}{(H/H_0 - 1)^k}$

$\ln S = \ln S_0 + \ln(1 - H/H_{an}) - k \ln(H/H_0 - 1)$
 $S = \frac{a}{(H/H_0 - 1)^k} \cdot (1 - H/H_{an})$ ~~гдет~~ ~~сильно~~ ~~забучив~~

Fitting $S = S_0 \frac{(1 - H/H_{an})}{(H/H_0 - 1)^k}$ не ~~выхожу~~, ни в Origin - Nonlinear, ни в M

$S(H)$ - ~~сложнее~~ ~~логично~~ ~~или~~ ~~Тайер~~. ~~Понимается~~ ~~наимен~~ $E_m(H)$ ~~аналит~~
 - ~~хот~~ ~~нормализация~~. С ~~гдет~~ ~~сильно~~ ~~забучив~~, ~~можно~~ ~~воспринять~~ $E(H)$ ~~из~~

Экен. $S(H)$ using $E_m(H) = kT M_s (1 - H/H_{an}) / S(H)$

17/1 ~~носпарт~~ $E_m(H)$ ~~gure array~~ Dotg. ~~Нисем~~ ~~Ижаме~~ ~~Span~~
 (10 ~~нпел~~ ~~атент~~ ~~уит~~)

Обязательное с Окс. ~~рев~~ ~~работы~~ ~~по~~ ~~Table~~ ~~SW~~ ~~Voigt~~, Abstract ~~no~~ ~~Interstat~~ ~~comp~~
 ee Master ~~Зегем~~ ~~no~~ ~~tunneling~~ ~~и~~ ~~spin-torque~~. E-mails to ~~Due~~ ~~Kar~~

Farkhad (гарана. на ~~неким~~ ~~в~~ ~~UAM~~) и Оксана И. (Unai - postdoc), Окс. С.

Резюме с ~~Даб~~: 1) ~~нпел~~ ~~сильно~~ ~~забучив~~ ~~stationary~~ ~~VNA-FMR~~ ~~Que~~ ~~Julian~~,
 2) Abstracts to ~~Ordizia~~; 3) Draft of APL - U. ~~Баркер~~ ~~paper~~.

18/1 Meeting c ~~Инаки~~: бермыа 655 € и 1200 € deposit. Из ~~куп~~ - ~~згел~~
 171 € utilities (эберно) и 374 € (143 - cleaning и 231 - ~~rent~~ ~~dishwasher~~) - ~~независимо~~

~~мажор~~ ~~евро~~, 150 ~~евро~~ ~~от~~ ~~бюрок~~. ~~мне~~ ~~231€~~ ~~rent~~, ~~но~~ ~~я~~ ~~оказываюсь~~ ~~от~~ ~~good~~ ~~not~~
 no cleaning и ~~он~~ ~~гарант~~ ~~мне~~ ~~143€~~. ~~наспешная~~ ~~receipt~~ ~~на~~ ~~120€~~ - ~~он~~ ~~cleaning~~

Разбор ~~мисм~~. ~~Spanish~~ ~~Ижаме~~. ~~Уск~~ ~~Ижаме~~ ~~и~~ ~~Secega~~ ~~c~~ ~~Ainher~~.
 Submitted c ~~Arantxa~~ St - Abstracts to ~~Trento~~ и ~~Euronat~~ 2011.

Anaing ~~Ordizia~~ Abstracts (156 на 18/1) c ~~Arantxa~~. ~~Збон~~ ~~to~~ ~~no~~ ~~Parque~~
 - ~~наимен~~ ~~евро~~ ~~support~~ $\approx 2 \text{ req.}$ в ~~мае~~ - ~~июне~~.

Оуоооо $E_b(H) = E_m(H) = \mu_s kT \frac{(1 - H/H_{an})}{S(T, H)}$, μ_s - saturation moment $M_s V$ of the ~~2nd~~
~~сильно~~ ~~нормализация~~ $E(H) = \frac{E_0}{S(T, H)} \cdot \frac{(1 - H/H_{an})}{S(T, H)}$ ~~из~~ ~~Экен~~ ~~M(H)~~.

Due $T = 200 \text{ K}$: $E(H) = E_0 + a(H - H_0)^n$, ~~сильно~~ ~~нормализация~~ $\ln(E - E_0) = \ln a + n \ln(H - H_0)$

Henry? $n = 3.556$. $\epsilon_0 = \epsilon(2700\text{\AA}) = 13.184$, $H_0 = 269\text{\AA}$ $\ln a = -2.432$ (3) 6

$\ln(\epsilon - \epsilon_0) = y$, $\ln(H - H_0) = x$, $y = \ln a + nx$. $(y - y_1) = n(x - x_1)$, $n = \frac{(y_2 - y_1)}{(x_2 - x_1)}$. $y = y_1 - nx_1 + nx$

$\ln a = y_1 - nx_1 = -1.792 - 3.556 \cdot 1.792 = -8.670$, $a = e^{-8.67} = 1.72 \cdot 10^{-4}$

$[E] = \frac{K}{\text{emu}}$. $E_m(H) = \mu_s k E(H)$. $\mu_s = 800 \text{ G}$ $\mu_s k = 2.33 \cdot 10^{-5} \text{ emu} \cdot 1.38 \cdot 10^{-16} \text{ erg/K}$

$\mu_s = M_s V = \frac{800}{687} \cdot 2 \cdot 10^{-5} \text{ emu} = 2.33 \cdot 10^{-5} \text{ emu}$

Don. unum. 10^8 uz-ga eg. S. $E_m(H) = 3.22 \cdot 10^{-21} \text{ emu.erg} \cdot 10^8 \cdot E(H)$

$E_m(H) = 3.22 \cdot 10^{-13} \frac{\text{emu.erg}}{\text{K}} [13.184 + 1.72 \cdot 10^{-4} (H - H_0)^n] \frac{\text{K}}{\text{emu}} =$

$= 4.25 \cdot 10^{-12} + 5.54 \cdot 10^{-12} (H - H_0)^n (\text{erg})$. Berem $H_{0.5} = 800 \text{\AA}$ $\ln E(H)$

2) $T = 305 \text{ K}$: $n = 3.545$, $\epsilon_0 = \epsilon(262\text{\AA}) = \epsilon(H_0) = 13.0$, $H_0 = 262\text{\AA}$

$\ln a = y_1 - nx_1 = -1.226 - 3.545 \cdot 2.079 = -8.596$, $a = 1.84 \cdot 10^{-4} = e^{-8.60}$

$E_m(H) = 3.22 \cdot 10^{-13} \frac{\text{emu.erg}}{\text{K}} [13.0 + 1.84 \cdot 10^{-4} (H - H_0)^n] \frac{\text{K}}{\text{emu}} = 4.19 \cdot 10^{-12} + 5.93 \cdot 10^{-12} (H - H_0)^n (\text{erg})$

3) $T = 375 \text{ K}$: $n = 3.957$, $\epsilon_0 = \epsilon(261\text{\AA}) = 11.5$, $H_0 = 261\text{\AA}$

$\ln a = y_1 - nx_1 = -0.207 - 3.957 \cdot 2.197 = -8.901$, $a = e^{-8.90} = 1.364 \cdot 10^{-4}$

$E_m(H) = 3.22 \cdot 10^{-13} \frac{\text{emu.erg}}{\text{K}} [11.5 + 1.364 \cdot 10^{-4} (H - H_0)^n] \frac{\text{K}}{\text{emu}} = 3.70 \cdot 10^{-12} + 4.39 \cdot 10^{-12} (H - H_0)^n (\text{erg})$

→ Хенрикс: En. Barriers $E_m(H)$ que ~~бел~~ хенрикс (200, 305, 375 K) ома

Abstracts: 1) "Hot barriers" to Trento & Ordizia; 2) ~~St. Nannigiller~~ to Eurostat 11 & Nonlin. V. dynam. to Eurostat 11; 3) ~~Interdot Coupl.~~ to ~~Ordizia~~ (Dre.)

Ordizia - Abstracts & perzhenenie & Arantxa ux na 7 yfyma

610000 & Conf. Topics & Inclusion Prog. Com. Members. Zanfor Ki-Suk Lee-postdoc?

20/I Perzhenag Ordizia Abstracts. В ночи & Токатны (Чуновни Кр.собоуе & institutions)

21/I Becega & Julian of Ordizia Conf. (for Abs. Depen) & Oleb (omacm 2006

emg, eam & ka chony uz SAJOTEK). Zanforan qem-myi y A'Ping.

Urgan na omary Dec. Master 426 € - ores of Dec. 15, 10, Karla organa

qanury na y qoruy kb., qanury Jan. 18, 2011 (!?) (20 €)

Ordizia - Abstracts & Arantxa & mc mo - vestry qum to Pr Com. Znanay

Out. qf qum qum no St - effect omacm - edit & qonon. ee file.

qanucan & submitted Vortex - barrier Abstract to Ordizia - Conf.

22/I Neperenka co Crabun o azim. SW $m \neq \pm 1$ & perp. saturated dot. 37/328

Zagara radial - SW & L - saturated dot - cylinder qum pacm.

10/15, 10/11, 26/VI 2002? & 9-11/I 2003? & qf qum & Kakazei - APL'2004.

Azim. $m = \pm 1$ SW & L Mo - dot qum qum. $\vec{M} = M_0 \hat{z} + \vec{m}$, $\vec{m} \perp \hat{z}$, $\vec{m}(\vec{g}, t)$.

$\left\{ \begin{aligned} -\frac{1}{8} \ddot{m}_z &= \mu_0 H_t - h_m^z \\ -\frac{1}{8} \ddot{m}_\varphi &= -\mu_0 H_t + h_m^\varphi \end{aligned} \right\}$ um $\left\{ \begin{aligned} -\frac{1}{8} \ddot{m}_x &= H_t \mu_y - h_m^x \\ -\frac{1}{8} \ddot{m}_y &= -H_t \mu_x + h_m^y \end{aligned} \right\}$, $\vec{H}_m = \vec{H}_m^0 + \vec{h}_m$

$\langle H_m^0 \rangle_z \parallel \hat{z}$, $H_t = \langle H_m^0 \rangle_z + H_z$ Semana Aste 6

$\langle H_m^0 \rangle_z = H_m^0(g)$ - qf qum qum. $\frac{H_m^0(g)}{\mu_s} = -\frac{4\pi}{\beta} \int_0^\infty \frac{dk}{k} [1 - e^{-\beta k}] J_1(k) J_0(kg)$

Zagora radial SW - Iñaki Soria penena blogearen
 $\mu_{\pm} = \mu_x \pm i\mu_y$, $\mu_{x,y} = f(\varphi)$, uone zero gurea
 7 $\mu_x(0,t) + i\mu_y(0,t) = \mu_+(0,t) = e^{i\varphi}$, $\mu_-(0,t) = e^{-i\varphi}$, $\mu_+ = \mu_x + i\mu_y = \mu(\varphi)e^{i\varphi}$
 $\mu_x + i\mu_y = \sin\theta e^{i\varphi}$, $\mu_+ = \cos\theta = 1$, $\varphi = \varphi(\vartheta, t) = \varphi_0 + \psi(\vartheta, t)$
 Astoazkena • Miércoles

$\mu_x(\vartheta, t) = \mu(\vartheta) \cos\omega t$, $\mu_y(\vartheta, t) = \mu(\vartheta) \sin\omega t$, $\mu_+ = \mu_x + i\mu_y = \mu(\vartheta)e^{i\omega t}$
 8 $\mu_+ = \mu_x + i\mu_y = e^{i\varphi}(\mu_x + i\mu_y)$, $\mu_x + i\mu_y = e^{-i\varphi}(\mu_+)$ by definition
 9 Dene azim. SW nago $\mu_x(\vartheta, t) = \mu(\vartheta) \cos(\omega t - m\varphi)$, $\mu_y(\vartheta, t) = \mu(\vartheta) \sin(\omega t - m\varphi)$
 $\mu_+ = \mu_x + i\mu_y = \mu(\vartheta) e^{i(\omega t - m\varphi)} = \mu_+(\vartheta, t)$

$$\mu_\varphi = \mu_x \cos\varphi + \mu_y \sin\varphi = \mu \cos A \cos\varphi + \mu \sin A \sin\varphi = \mu \cos(A - \varphi)$$

$$\mu_\varphi(\vartheta, t) = \mu(\vartheta) \cos[\omega t - (m+1)\varphi]$$

$$\mu_\varphi = -\mu_x \sin\varphi + \mu_y \cos\varphi = -\mu \cos A \sin\varphi + \mu \sin A \cos\varphi = \mu \sin(A - \varphi)$$

$$\mu_\varphi + i\mu_\varphi = \mu e^{i[\omega t - m\varphi - \varphi]} = (\mu_x + i\mu_y) e^{-i\varphi}$$

$$h_m^S = \int d\vartheta \vec{S} \cdot [G_{SS} \mu_S + G_{S\varphi} \mu_\varphi]$$

$$G_{\alpha\beta}(\vec{S}\vec{S}') \text{ gurea gurearen } \vec{S}\vec{S}' \text{ - lurren } G \rightarrow g_{\alpha\beta}(\vec{S}\vec{S}') = \frac{1}{L} \int d\vartheta d\vartheta' G_{\alpha\beta}(\vec{S}\vec{S}')$$

$$\text{Cu. } \frac{2/\sqrt{N}}{2005} \text{ (kur. resp.) - kargatu azim. SW } \beta \text{ Iñaki, no } \nu = m+1$$

$$\mu_S(\vartheta, t) = \mu(\vartheta) \cos(\omega t - \nu\varphi)$$

$$\mu_\varphi(\vartheta, t) = \mu(\vartheta) \sin(\omega t - \nu\varphi)$$

$$\frac{d\varphi}{dt} g_{\alpha\beta}(\vec{S}\vec{S}') \cos(\omega t - \nu\varphi) \sim \cos(\omega t - \nu\varphi)$$

$$\frac{d\varphi}{dt} g_{\alpha\beta}(\vec{S}\vec{S}') \sin(\omega t - \nu\varphi) \sim \sin(\omega t - \nu\varphi)$$

$$\text{Torga azim. SW gurea } \mu(\vartheta) \text{ kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

$$\text{no ne gurea - cu. } \frac{2/\sqrt{N}}{2005} \text{ - kargatu gurea azim. SW}$$

- (27/I) Završena prijema s MICINN od strane NSF-grant u RTNSA e Arantxa. Pouznan upravljanje od Borjemenov na ICFM^{Febreiro} 2011 - Otsaila.
- (28/I) Arantxa mogala Appl. na X-ray tehnika u namenu Dept. neposredno RTNSA u ICFM 2011. Bescaga e Oke.: 1) gornji na 8
mreže, 2) praznina na Bager, Arifken ne yue; 3) gornji. nagrobovski u
okazivanu u zarezu na namoznat. u frekvenciji Master kupa. Osteguna
(29-30/I) nagrobovski paper na Green funct. // JAP-Nanotubes - Oke. to
in rectang. geometry u nocu na Crabun. Pajotice.
- (31/I) Oporun. Arantxa na postdoc, cuera Magnonics-NSF IPanta, RTNSA-neposredna. Razgovor e Arantxa Abs-Klein na radial u azim. SW b Py/Cu/Py nanopyllar pacneras. papers Mills u Klein. Azim. SW b 1 Mo cylindrical dots - nagrobovski by MRFM, cu. PRB-2008. Odcyng. e Julian RTNSA Conf. (najan. session for orals) u Borjemenovcu u prebecu MAGNONICS Conf. b San Sebastian. Razgovor MRFM LMO disk Klein-Slavin: PRB'08: nagrobovski guer. rascosni ulem (rad. u azim. SW) na Je (xms) e ile. Umu l=0 perfuracija ne cbaqusa u¹¹ w_{om} = H - 4STM₂N + 4STM₂f(x_{om}) u Kakaz'APL'04, a oco w_{om} = √w₁w₂, c w₁ ≠ w₂.
- (VII) C. A. b Carrefour - kymu. wocyy u nju. na B. nobu. rog u A. gono pory. Tapeel mca. nagrobovski, ro Fe/Si/Fe tri-layer dot e R=500 nm, L=5 nm. Speg. uueg uju J<0 (AFM interlayer Coupl.) SD ocoame barriere, 20 double vortex state. Pouznan u MICINN Ouegy PLB-granta, korojue namu oco. u cuera submitted to UPV (cogu na roga u 210/2011/2012). Odcyng. puzenyng u list of changes for JAP-Nanotubes-B paper e A. Piny.
- (2/II) Umuorun TIFF-files of all Figures, borjemen Nanotubes-B paper u submitted it on-line to JAP. Zboru. mca: odcyng. barriere APL u noezgu.
- (3/II) Umuor. u nocu na Amelia (Vicerrectorado) uen Financial Table of money distr. PIB2010 US - grant. Puzenyng. paper ICNM '10 (Fouk) nocu na Crabun APL'99, APL'00, PL'01 na coupled dot arrays. Poca. seminar announcement FMR-talk by G. Kakaz. Odcyng. mca.
- (4/II) Odcyng. e Julian u Gleb: FMR equip. grant application u Ikerbasque app. Seminar talk by Gleb: Intro to FMR u FMR in circ. dots e variable Oh. Odcyng. e Igara e Julian u Gleb. C. A. u Gleb b downtown "Cortezel" Casa etc. Odcyng. e Arantxa pacera u(II) b circ. dot guer exp. mca. Oco. egea Spintorque to Rubio (gocrag).
- (5/II) Ueapka kb. "tad", puzenyng u uuegi guer A. Umuor. b roga na Baco. nobu. rog uue u Kar. Tonarun, mca. u Oga. Kpac. e gorbun.
- (6/II) Paboa e Gleb na Vortex-barriere APL, bga. mca 2004 guer. (Pope D. b Kiste) C. A. u Gleb b Miramar e mca. u "la Poca". 1. gono pory. guer e A. A. u Gleb. Nagrobovski Wue-100€.
- (7/II) Puzenyng. ro travel mca. Ouegy kb. Pajotice e Maximu. On roga na high-postdoc b CSIC na 3 roga. Na nagrobovski Fig. Materiales ocoyng. 2 barriere tehnika - X-ray (Arantxa mogala), VSM (mca. mogala). Hamcar u nocu na Report na JAP paper by Toscano et al. Vortex-infirity int. Puceno to Agen. Imobilizacia-Papi e puzenyng notonka u creax Iberdrola. Semana • Aste 6
- (8/II) Paboa na Rect. Green-functions paper.
- (9/II) Puzenyng b Paboa e cuera home address - uuegi mca. application e pory.

Otsaila - Febrero
paper ne Zaborrako, Owen, next week; 2) za Master nagaratu...
3) yow. Arantxa, koropad crute...
u) inprogr... b) Vortex TM coupled dots; 5) genera...
Vortex rad. modes; 6) Vortex TM coupled dots; 5) genera...
JNN-Conf. paper. Repetition ISI-Web.

Becega e Arantxa: p... Abstracts u...
Invited talks. Zborrako...
all data no pinning $\delta(0)$ -FMR.

10/II C.N. u A. b Polite: negan applications na tarjetas...
appecom. Pameraska e Arantxa RTNSA - Abstracts u...

10-12/II Travel to Ordizia to Program Committee meeting...
Invited talks no g... u... Abstracts...
(oral or poster, 77 u 69) u... Report (27 int.).

13/II C.N. b "la Perla". Revised Redang. Green funct. paper u...

14/II Robert... na Invitation by O. Klein to participate in Workshop "St...
nanos... in Paris, Dec. 14-16, 2001. Harman O. Klein o...

11. Still u... revised version vortex revers - SW" preprint. Robert...

16/II Robert... revised Rad. SW - paper e... by Hillebrand...
2) no... b paper que u...

Robert... Madrid $\rightarrow$ Porto na 3/7 March. Ave. Zaborrako...
revised Diploma. Decyng. Barrier-APL e Kakuzei u Serge

15/II Meeting e Ant. u... Meeting e Julian...
Arantxa o RTNSA (27 rejected Abs., u... reg. co-author)

Decyng. Arantxa's appl. na postdoc (Oscar 60% na 2 roga) u VSM-technician...
Bogan Patri payment forms for NanoSpain'11 que cesa u Aiping

13 state is accepted "as is" (revised version). JAP - Nanotubes...
b Madrid (Omar). Julian... JNN-Oscar

16/II Patrice nag Radial-SW manuscript. Becega e Arantxa o...
Sábado una bonifera UPV konfigura u na VSM, u...

Arantxa ney... University accreditation "Uniquel" u (ANED)
Confalce na "Aneto". Announcement "Casa de Talento" (Arantxa)

que Scientists... ≤ 1.5 roga. Bb... Radial SW - paper.
Tues u... ppt - file of pinning change - FMR u... $H(0^\circ) \rightarrow H(90^\circ)$

Decyng. e Julian Arantxa-technician applications (u... Arantxa...
Arantxa's... VSM - techn. position. Revised Radial SW-PRB u...

- Current papers: 1) V. Barvov APL - negy revisions by Kharzei u. Sergio Otsaila
 2) Vortang. Green func. - negy revisions by Blavin
 3) Vortex radial SW - under my revision (yarnome response) - sent Kharzei
 4) Colli FMR paper - na pacem. B Current Nanosci. (Fues ciegus)
 5) Nanotubes - B. B. - accepted to JAP (modif Figs - Ai Ping)
 6) ST-Vortex - F/N/F - goborn go resp. paper, y'ur. APL-Locatelli exp. u. Jim. Boast IE³
 Lubes. Astelchena

12

- General papers: 1) Azim. SW B I.M. cyl. det. Klein; 2) Vortex TM for coupled dots (Ore.)
 3) FMR-pinning (Ruef, Arantxa), 4) Double-V. F/N/F-MPD (Tapeb), 5) y'ur coupling in Ni-nanotubes arrays

18/11 Beagui e Julian u Arantxa os Arantxa's technician applications:
 A. cannae noz gobornu Julian u Miquel x X-ray application, x'os magnetometz' gao ei donme manco (ne y'ganc ee nepeyegus)
 Namy na Abstracts 2 gomegob gna RTNSA os Omeba. nozgr. Ore. e gna-ping. Ocyngome e neu corygme e Arantxa u paeze deat u coerb. neg os 2 coupled dots e P1, P2, C1, C2 (Shikate-2003). Reuzgme JNN-Sierra.

19/11-20/11 Oocme JNN-Sierra report to Julian. Ocyx, e P. u O. to la perla u u nope. E-mails to Lyubchanskir u Stoll, Reun Air bilette.

Y'p. na gna radial SW (27/11 102.) : $\left\{ \begin{aligned} (d\mathbf{g}'\mathbf{g}'_{zz}(\mathbf{g}\mathbf{g}'))\ell(\mathbf{g}') &= \omega\mu(\mathbf{g}) \\ (d\mathbf{g}'\mathbf{g}'_{gg}(\mathbf{g}\mathbf{g}'))\mu(\mathbf{g}') &= \omega\ell(\mathbf{g}) \end{aligned} \right\}$
 $\left\{ \begin{aligned} \hat{G}_{zz}\ell &= \omega\mu \\ \hat{G}_{gg}\mu &= \omega\ell \end{aligned} \right\}$, Ouepome $\hat{G}_{zz}$ u $\hat{G}_{gg}$ nomno u'fep. b masfume, no koutze (kan b Azkan, fu. u) $\hat{G}_{zz} = \hat{G}_{gg}$, $\hat{G}_{zz}\hat{G}_{gg}\mu = \hat{G}_{zz}\omega\ell = \omega^2\mu$.
 C3 of $\hat{G}_{zz}\hat{G}_{gg}$ gomegme donb reals, no col. becom ne orthogonal, r.k. $\hat{G}_{zz}\hat{G}_{gg}$ ne apmestb onepomep (masfume).

Doname deang. Green func. paper: 1) y'gancuboe main eigenvalue; 2) deagb unt. y'p. na C3 e gup. y'p. panyen.

→ Ecm $A\vec{r}_m = \lambda_m\vec{r}_m$ u A-apmestb n x n matrix. myco $\lambda_1 = \max(\lambda_n)$,
 toge $\frac{\langle \vec{r}_1 | A | \vec{r}_1 \rangle}{\langle \vec{r}_1 | \vec{r}_1 \rangle} \leq \lambda_1$, u'fume omudka b oyeume $\lambda_1 \sim |\delta_i|^2$, rge
 $|\vec{r}\rangle = |\vec{r}_1\rangle + \sum_{i=2}^n \delta_i |\vec{r}_i\rangle$. Don-bo: $\langle \vec{r} | \vec{r} \rangle = [\langle r_1 | + \sum_{i=2}^n \delta_i \langle r_i |] [\langle r_1 | + \sum_{i=2}^n \delta_i \langle r_i |] =$
 (bozume. e becom) $= 1 + \sum \delta_i \delta_j \langle r_j | r_i \rangle$

$$\begin{aligned} \langle \vec{r} | A | \vec{r} \rangle &= [\langle r_1 | + \sum_{i=2}^n \delta_i \langle r_i |] A [\langle r_1 | + \sum_{i=2}^n \delta_i \langle r_i |] = \lambda_1 + \sum_{i,j} \delta_i \delta_j \langle r_i | A | r_j \rangle = \\ &= \lambda_1 + \sum_{i,j} \lambda_i \delta_i \delta_j = \lambda_1 + \sum_{i=2}^n \lambda_i \delta_i^2 \\ \frac{\langle \vec{r} | A | \vec{r} \rangle}{\langle \vec{r} | \vec{r} \rangle} &= \frac{\lambda_1 + \sum_{i=2}^n \lambda_i \delta_i^2}{1 + \sum_{i=2}^n \delta_i^2} = \lambda_1 \frac{1 + \sum_{i=2}^n (\lambda_i/\lambda_1) \delta_i^2}{1 + \sum_{i=2}^n \delta_i^2} \leq \lambda_1 < \text{vorn. } \delta_i^2, \text{ r.k. } \frac{\lambda_i}{\lambda_1} \leq 1. \end{aligned}$$

Oboume, bozume. becom $|\vec{r}_m\rangle \leq \lambda_m \cdot |\vec{r}\rangle = |\vec{r}_m\rangle + \sum_{i \neq m} \epsilon_i |\vec{r}_i\rangle$, $|\epsilon_i| \leq 1$,
 $\delta |\vec{r}_m\rangle = \sum \epsilon_i |\vec{r}_i\rangle$, r.k. $|\vec{r}_i\rangle$ - complete orthogonal set.

$$\begin{aligned} \langle \vec{r} | \vec{r} \rangle &= [(1+\epsilon_m)\langle r_m | + \sum_{i \neq m} \epsilon_i \langle r_i |] [(1+\epsilon_m)|r_m\rangle + \sum_{i \neq m} \epsilon_i |r_i\rangle] = \\ &= (1+\epsilon_m) + \sum_{i \neq m, j \neq m} \epsilon_i \epsilon_j \langle r_i | r_j \rangle = 1 + \epsilon_m + \sum_{i \neq m} \epsilon_i^2 \\ \langle \vec{r} | A | \vec{r} \rangle &= [(1+\epsilon_m)\langle r_m | + \sum_{i \neq m} \epsilon_i \langle r_i |] A [(1+\epsilon_m)|r_m\rangle + \sum_{i \neq m} \epsilon_i |r_i\rangle] = \\ &= \lambda_m (1+\epsilon_m)^2 + \sum_{i \neq m} \lambda_i \epsilon_i \epsilon_j \langle r_i | r_j \rangle = \lambda_m (1+\epsilon_m)^2 + \sum_{i \neq m} \lambda_i \epsilon_i^2 \end{aligned}$$

$$\frac{\langle \tilde{t} | A | \tilde{t} \rangle}{\langle \tilde{t} | \tilde{t} \rangle} = \frac{\lambda_m (1 + \epsilon_m)^2 + \sum_{i \neq m} \epsilon_i^2 \lambda_i}{1 + \epsilon_m + \sum_{i \neq m} \epsilon_i^2}$$

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$$\frac{\langle \tilde{t} | A | \tilde{t} \rangle}{\langle \tilde{t} | \tilde{t} \rangle} = \lambda_m (1 + \epsilon_m) + O(\epsilon_i^2)$$

τονοκο εαν $|\tilde{t}\rangle = |\tilde{t}_m\rangle + \sum \epsilon_i |\tilde{t}_i\rangle$ υποθετουμε οτι $|\tilde{t}_m\rangle$ ειναι ο ιδιοκατασταση του A με ιδιοτιμη λ_m .

Asterica. Martes

τοτε λ_m ειναι το ιδιοτιμη του A στο $|\tilde{t}_m\rangle$. Α. ερμενευει οτι λ_m ειναι το ιδιοτιμη του A στο $|\tilde{t}_m\rangle$.

Τ.ε. trial function $|\tilde{t}\rangle$ ειναι μια guess, υποθετουμε οτι $\epsilon_m = 0$ (δηλ. $|\tilde{t}\rangle = |\tilde{t}_m\rangle$).

trial cost. ζητηση. υποθετουμε: λ_m ειναι το ιδιοτιμη του A στο $|\tilde{t}_m\rangle$.

ker nozoi. Τ.κ. οτι οτι λ_m ειναι το ιδιοτιμη του A στο $|\tilde{t}_m\rangle$.

no trial CF, τα λ_m ειναι οτι λ_m ειναι το ιδιοτιμη του A στο $|\tilde{t}_m\rangle$.

2) γρ.ε υποθετουμε $\hat{L}y(x) + \lambda g(x)y(x) = 0$, $\hat{L} = \frac{d}{dx} \left(p(x) \frac{d}{dx} \right) + q(x)$

η ποσ. υποθετουμε $\begin{cases} \alpha_1 y(a) + \beta_1 y'(a) = 0 \\ \alpha_2 y(b) + \beta_2 y'(b) = 0 \end{cases}$ υποθετουμε οτι $y(x) = \lambda \int_a^b G(x,x') p(x') dx'$

nao τοτε ο φ. Γ(x,x') υποθετουμε οτι $G(x,x') = \int_a^b p(x') G(x,x') dx'$

Μπορουμε οτι, υποθετουμε, $G(x,x')$ ειναι η Green's function του $\hat{L}$.

γρ.ε γρ.ε υποθετουμε $\hat{L}y(x) + \lambda g(x)y(x) = 0$. Πο $\hat{L}$ υποθετουμε οτι G , ο υποθετουμε οτι $K(x,x') = \sum_{n=1}^{\infty} \frac{1}{\lambda_n} \phi_n(x) \phi_n(x')$

Εαν $\phi(x) = \lambda \int_a^b dx' K(x,x') p(x')$ ειναι η Green's function, ο $K(x,x') = \sum_{n=1}^{\infty} \frac{1}{\lambda_n} \phi_n(x) \phi_n(x')$

$\phi_n(x)$ - CF, λ_n - C3.

21/11 Julian κωδ. 200 ειναι οτι $\phi_n(x)$ ειναι η Green's function του $\hat{L}$.

υποθετουμε $\phi_n(x)$. Α. ερμενευει οτι $\phi_n(x)$ ειναι η Green's function του $\hat{L}$.

Fig. 5 & 7 of Nanotubes - B state paper.

υποθετουμε $\phi_n(x)$. Α. ερμενευει οτι $\phi_n(x)$ ειναι η Green's function του $\hat{L}$.

$\frac{d}{dx} G(x,x') = \frac{2}{p} \frac{d}{dx} \left[\frac{1}{2} \ln |x-x'|^2 - \ln [(x-x')^2 + p^2] \right]$

$\frac{d}{dx} G(x,x') = \frac{2}{p} \left[\frac{2(x-x')}{(x-x')^2 + p^2} \text{sign}(x-x') - \frac{1}{|x-x'|^2} \right]$

$\Delta(x') = \frac{d}{dx} G(x,x') \Big|_{x \rightarrow x'+0} - \frac{d}{dx} G(x,x') \Big|_{x \rightarrow x'-0} = \frac{4}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right]$

$\Delta(x') = \frac{4}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right]$

$\Delta(x') = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right]$

Ζητουμε οτι $\rho \rightarrow 0$ ο $\rho \rightarrow \epsilon$. οτε $\Delta(x') = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right]$

$\Delta(x') = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right]$

$\Delta(x') = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right]$

$\Delta(x') = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right] = \frac{8}{p} \left[\frac{1}{\epsilon^2} - \frac{1}{\epsilon^2 + p^2} \right]$

Δηλ. $\phi_n(x) = \sin(\pi x) = \phi_n(x)$, ο $\phi_n(x)$ ειναι η Green's function του $\hat{L}$.

$\phi_n(x) = \sin(\pi x) = \phi_n(x)$, ο $\phi_n(x)$ ειναι η Green's function του $\hat{L}$.

$\phi_n(x) = \sin(\pi x) = \phi_n(x)$, ο $\phi_n(x)$ ειναι η Green's function του $\hat{L}$.

Rayleigh-Ritz variational technique.

c) Проверим условие $py \times y|_a^b = 0$. А упр-е III-й эквивалентно

где φ — функция $\varphi(x) = \lambda \int_a^b dx' K(x, x') \varphi(x')$, $K(x, x')$ симметрично

$\psi(x) = m(x)$, $J[m] = W[m] - \int_a^b g(x, m(x)) dx$ — функционал на минимизацию энергии.
 $\rightarrow$ Мен $W[m] \rightarrow \lambda m(x) = \int_a^b dx' K(x, x') m(x')$ — дает ур-е на континуальную систему.

Обязан. c Arantxa ee applications for technician position (создавая компьютер-
ные программы ee application на Mag. X-ray, то на Magnetometer не работает
не дышет). E-mail or Katrin o radial SW-vortex: impossible to require
radial-SW localization c H⁺ wfm S₂₀ give $\beta = 0.016$? программаи order.
там же. программаи программаи Korr-images Buess. PRL'04 u
не очень пацеры PRB'05 give $\beta \ll 1$. Но wfm $\beta \geq 0.1$ u по-прежнему не
пацеры c Oursani ratio of 2-coupled  dots u coэф. берется. ^{Heutz}

Modification Figs. 5 & 7 of Manuscript-B JAP paper c AirPac (no. 1008 & 1009/eq. 100)

(22/II) Промышленность на X-ray techn. position (UPV разрешено) 1/8, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256, 1/512, 1/1024, 1/2048, 1/4096, 1/8192, 1/16384, 1/32768, 1/65536, 1/131072, 1/262144, 1/524288, 1/1048576, 1/2097152, 1/4194304, 1/8388608, 1/16777216, 1/33554432, 1/67108864, 1/134217728, 1/268435456, 1/536870912, 1/1073741824, 1/2147483648, 1/4294967296, 1/8589934592, 1/17179869184, 1/34359738368, 1/68719476736, 1/137438953472, 1/274877906944, 1/549755813888, 1/1099511627776, 1/2199023255552, 1/4398046511104, 1/8796093022208, 1/17592186044416, 1/35184372088832, 1/70368744177664, 1/140737488355328, 1/281474976710656, 1/562949953421312, 1/1125899906842624, 1/2251799813685248, 1/4503599627370496, 1/9007199254740992, 1/18014398509481984, 1/36028797018963968, 1/72057594037927936, 1/144115188075855872, 1/288230376151711744, 1/576460752303423488, 1/1152921504606846976, 1/2305843009213693952, 1/4611686018427387904, 1/9223372036854775808, 1/18446744073709551616, 1/36893488147419103232, 1/73786976294838206464, 1/147573952589676412928, 1/295147905179352825856, 1/590295810358705651712, 1/1180591620717411303424, 1/2361183241434822606848, 1/4722366482869645213696, 1/9444732965739290427392, 1/18889465931478580854784, 1/37778931862957161709568, 1/75557863725914323419136, 1/151115727451828646838272, 1/302231454903657293676544, 1/604462909807314587353088, 1/1208925819614629174706176, 1/2417851639229258349412352, 1/4835703278458516698824704, 1/9671406556917033397649408, 1/19342813113834066795298816, 1/38685626227668133590597632, 1/77371252455336267181195264, 1/154742504910672534362390528, 1/309485009821345068724781056, 1/618970019642690137449562112, 1/1237940039285380274899124224, 1/2475880078570760549798248448, 1/4951760157141521099596496896, 1/9903520314283042199192993792, 1/19807040628566084398385987584, 1/39614081257132168796771975168, 1/79228162514264337593543950336, 1/158456325028528675187087900672, 1/316912650057057350374175801344, 1/633825300114114700748351602688, 1/1267650600228229401496703205376, 1/2535301200456458802993406410752, 1/5070602400912917605986812821504, 1/10141204801825835211973625643008, 1/20282409603651670423947251286016, 1/40564819207303340847894502572032, 1/81129638414606681695789005144064, 1/162259276829213363391578010288128, 1/324518553658426726783156020576256, 1/649037107316853453566312041152512, 1/1298074214633706907132624082305024, 1/2596148429267413814265248164610048, 1/5192296858534827628530496329220096, 1/10384593717069655257060992658440192, 1/20769187434139310514121985316880384, 1/41538374868278621028243970633760768, 1/83076749736557242056487941267521536, 1/166153499473114484112975882535043072, 1/332306998946228968225951765070086144, 1/664613997892457936451903530140172288, 1/1329227995784915872903807060280344576, 1/2658455991569831745807614120560689152, 1/5316911983139663491615228241121378304, 1/10633823966279326983230456482242756608, 1/21267647932558653966460912964485513216, 1/42535295865117307932921825928971026432, 1/85070591730234615865843651857942052864, 1/170141183460469231731687303715884105728, 1/340282366920938463463374607431768211456, 1/680564733841876926926749214863536422912, 1/1361129467683753853853498429727072845824, 1/2722258935367507707706996859454145691648, 1/5444517870735015415413993718908291383296, 1/10889035741470030830827987437816582766592, 1/21778071482940061661655974875633165533184, 1/43556142965880123323311949751266331066368, 1/87112285931760246646623899502532662132736, 1/174224571863520493293247799005065324265472, 1/348449143727040986586495598010130648530944, 1/696898287454081973172991196020261297061888, 1/1393796574908163946345982392040522594123776, 1/2787593149816327892691964784081045188247552, 1/5575186299632655785383929568162090376495104, 1/11150372599265311570767859136324180752990208, 1/22300745198530623141535718272648361505980416, 1/44601490397061246283071436545296723011960832, 1/89202980794122492566142873090593446023921664, 1/178405961588244985132285746181186892047843328, 1/356811923176489970264571492362373784095686656, 1/713623846352979940529142984724747568191373312, 1/142724769270595988105

One famous gas (double-vortex sys.) case 19/VI 2005 r. very int.

Задачи, которые мы решаем $\rightarrow W(\vec{x}_1, \vec{x}_2) = \frac{1}{2} \sum_j [x_{1j}^2 + x_{2j}^2] + \mu_1 x_1, x_2 + \mu_2 y_1, y_2$

11) $x_1 = x_2, |G_1| = |G_2|$ दो चोखिरे के जगह शुभक 'ARBO' 

Надо $\mu_j \sim C_1 C_2$ как у Шибата'03. Если $\mu_1 = \mu_2$, $x_1 \neq x_2$ - сбросим к F/N/F
($x_1 = x_2$ монотонно) APL'05

$G = |G|(-\hat{r})$ $\vec{Z}(t) = |Z_0| e^{i\omega_0 t}$ $p > 0$ - CCW rotation $(\vec{x}_1 = \vec{x}_2 \text{ monoch})$ APL '25
 $\vec{G} \times \vec{X} = \omega / \partial \vec{X} u$ $- G_z \dot{y} = \alpha X$ $G \dot{X} = \alpha Y$ $G_z = -p|G|$

Упр. 1. Найти значения гравитационного дельты (M, L, R, γ) того $G_j = G_{zj} = -\rho_j \cdot \gamma_j$

$$\begin{cases} p_1 G \dot{y}_1 = x_1 \dot{x}_1 + \mu_1 \dot{x}_2 & (1) \\ -p_1 G \dot{x}_1 = x_2 \dot{y}_1 + \mu_2 \dot{y}_2 & (2) \\ p_2 G \dot{y}_2 = x_1 \dot{x}_2 + \mu_1 \dot{x}_1 & (3) \\ -p_2 G \dot{x}_2 = x_2 \dot{y}_2 + \mu_2 \dot{y}_1 & (4) \end{cases}$$

$$\begin{pmatrix} 0 & -p_1 x_2 & 0 & -p_1 y_2 \\ p_1 x_1 & 0 & p_1 y_1 & 0 \\ 0 & -p_2 x_2 & 0 & -p_2 y_2 \\ p_2 x_1 & 0 & p_2 y_1 & 0 \end{pmatrix} \begin{pmatrix} x_1 \\ y_1 \\ x_2 \\ y_2 \end{pmatrix} = i\omega G \begin{pmatrix} x_1 \\ y_1 \\ x_2 \\ y_2 \end{pmatrix} - \text{Замечает в явном виде } \hat{R}\vec{a} = \lambda\vec{a}$$

Otsaila - Febrero

15

Модельные моменты в беге $\vec{X} = (X, Y)$, $X = a_1 X_1 + a_2 X_2$, $Y = b_1 Y_1 + b_2 Y_2$
мы находим $X_1 = \tilde{X}_1 + a_1 \tilde{X}_2$, $Y_1 = \tilde{Y}_1 + b_1 \tilde{Y}_2$, $X_2 = \tilde{X}_2 + a_2 \tilde{X}_1$, $Y_2 = \tilde{Y}_2 + b_2 \tilde{Y}_1$
(1): $p_1 G[\tilde{Y}_1 + b_1 \tilde{Y}_2] = \kappa_1 [\tilde{X}_1 + a_1 \tilde{X}_2] + \mu_1 [\tilde{X}_1 + a_2 \tilde{X}_2]$
(2): $p_2 G[\tilde{Y}_1 + b_2 \tilde{Y}_2] = \kappa_1 [\tilde{X}_1 + a_2 \tilde{X}_2] + \mu_1 [\tilde{X}_1 + a_1 \tilde{X}_2]$

Osteguma - Juven

Let's try to find $\vec{X} = (X_1 + X_2, Y_1 + p_1 p_2 Y_2)$, $\vec{Z} = (X_1 - X_2, Y_1 - p_1 p_2 Y_2)$ - не беремо
мы $p_1 p_2 = -1$, $\text{Cu. 7/8 2005 2, 19/10/2005 1}$.

А найдем $\omega_{1,2}^2 = (\omega_{1,2}^+)^2 = \frac{1}{G^2} (\alpha_1 \pm \mu_1)(\alpha_2 \pm \mu_2)$ где $p_1 p_2 = +1 = p$.
 $\omega_1^+ = \omega_x$, $\vec{X} = (\tilde{X}_1 + \tilde{X}_2)$, $\omega_2^+ = \omega_y$, $\vec{Z} = \tilde{X}_1 - \tilde{X}_2$.

Собств. вектора ($p_1 p_2 = +1$):
тои собств. вектора ели.
Квадратичная форма
 $X, Y, \tilde{X}_1, \tilde{X}_2$ по X_i, Y_i .
 $\begin{pmatrix} X_1 \\ Y_1 \end{pmatrix} \omega_1^+ = \begin{pmatrix} 1 \\ i\epsilon_1^+ \end{pmatrix}$, $\begin{pmatrix} X_1 \\ Y_1 \end{pmatrix} \omega_2^+ = \begin{pmatrix} +1 \\ i\epsilon_2^+ \end{pmatrix}$, $\epsilon_{1,2}^+ = \sqrt{\frac{\alpha_1 \pm \mu_1}{\alpha_2 \pm \mu_2}}$

Для $p_1 p_2 = -1$ собств. векторы $(\omega_{1,2}^-)^2 = \frac{1}{G^2} (\alpha_1 \pm \mu_1)(\alpha_2 \mp \mu_2)$ и собств. векторы.

$\begin{pmatrix} X_1 \\ Y_1 \end{pmatrix} \omega_1^- = \begin{pmatrix} 1 \\ i\epsilon_1^- \end{pmatrix}$, $\begin{pmatrix} X_1 \\ Y_1 \end{pmatrix} \omega_2^- = \begin{pmatrix} 1 \\ i\epsilon_2^- \end{pmatrix}$, $\epsilon_{1,2}^- = \frac{1}{\omega_{1,2}^-} (\alpha_1 \pm \mu_1)$, $\epsilon_1^- = \sqrt{\frac{\alpha_1 + \mu_1}{\alpha_2 - \mu_2}}$, $\epsilon_2^- = \sqrt{\frac{\alpha_1 - \mu_1}{\alpha_2 + \mu_2}}$

Выгуд и собств. векторы $\tilde{X}_1 = X_1 + X_2$, $\tilde{Y}_1 = i\epsilon_1^-(Y_1 - Y_2)$ и $\tilde{X}_2 = X_1 - X_2$, $\tilde{Y}_2 = i\epsilon_2^-(Y_1 + Y_2)$?

(1)(2): $G[\tilde{Y}_1 - \tilde{Y}_2] = (\alpha_1 + \mu_1)(X_1 + X_2) - p_1(\epsilon_1 + \epsilon_2)p_2$.
 $G \frac{1}{i\epsilon_1^-} \tilde{Y}_1 = (\alpha_1 + \mu_1) \tilde{X}_1$ и $-G \tilde{X}_1 = \frac{1}{i\epsilon_1^-} [\alpha_2 \tilde{Y}_1 - \mu_2 \tilde{Y}_1] = \frac{1}{i\epsilon_1^-} (\alpha_2 - \mu_2) \tilde{Y}_1$ - согласен

Заменим на $\tilde{X}_1, \tilde{Y}_1 \Rightarrow \tilde{X}_1 = (\tilde{X}_1, \tilde{Y}_1)$ - согласен вектор.
 $G \frac{1}{i\epsilon_1^-} \tilde{Y}_1 = (\alpha_1 + \mu_1) \tilde{X}_1 = -\frac{1}{G} \frac{1}{i\epsilon_1^-} (\alpha_2 - \mu_2) \tilde{Y}_1 (\alpha_1 + \mu_1)$, $\tilde{Y}_1 = -\frac{1}{G^2} (\alpha_1 + \mu_1)(\alpha_2 - \mu_2) \tilde{Y}_1$

$(\omega_1^-)^2 = \frac{1}{G^2} (\alpha_1 + \mu_1)(\alpha_2 - \mu_2)$ - беремая работа $\tilde{X}_1$ - моги.

Для $p_1 p_2 = +1$: $\vec{X} = [X_1 + X_2, i\epsilon_1^+(Y_1 + Y_2)]$; $\vec{Z}(\omega_2^+) = [X_1 - X_2, i\epsilon_2^+(Y_1 - Y_2)]$

Для $p_1 p_2 = -1$: $\vec{X}_1(\omega_1^-) = [X_1 + X_2, i\epsilon_1^-(Y_1 - Y_2)]$; $\vec{X}_2(\omega_2^-) = [X_1 - X_2, i\epsilon_2^-(Y_1 + Y_2)]$

и здесь показываем связь между Y по праву. с X в канон. координатах.
 $\forall p_1 p_2 = p$ собств. векты: $\vec{X}_1(\omega_1^p) = [X_1 + X_2, \epsilon_1^p(Y_1 + pY_2)]$; $\vec{X}_2(\omega_2^p) = [X_1 - X_2, \epsilon_2^p(Y_1 - pY_2)]$

Собств. $(\omega_{1,2}^p)^2 = \frac{1}{G^2} (\alpha_1 \pm \mu_1)(\alpha_2 \pm p\mu_2)$ Забучер имеет от $p = p_1 p_2$ и $C = C_1 C_2$
 $\langle \vec{m} \rangle_v = -\frac{1}{2} C \hat{z} \times \vec{X} / R$ - среднее значение. где. Due magnonics in-phase

$X_j(t), Y_j(t)$ выгуд габарит in-phase $\langle \vec{m}_j \rangle$ только если C_j отрицательны.
 $z = 2/3$ - pole-free and $z = 1$ rigid v. model. $\epsilon_{1,2}^p$ генератор - без двою координат

Для гбых габарит $\langle \vec{m} \rangle_v = \langle \vec{m}_1 \rangle + \langle \vec{m}_2 \rangle \sim [C_1 \vec{X}_1 + C_2 \vec{X}_2]$, и если $C_1 C_2 = +1$
uniform $\vec{h}_v(\omega)$ выгуд возбудитель $(\vec{X}_1 + \vec{X}_2) = \vec{X}$ моги, т.е. $\vec{X}_1(\omega_1^+)$ с $\omega_1 = \omega_1^+$

В 1D или 2D det array Green $\langle m_z \rangle$ - static и $\langle m_{x,y} \rangle$ - dynamic, Guss' AP' 06.

to go over SW Egger kan gine SD racous (dip moments) Feb 2012. Otsaila

u² in plane. 2D FMSW. Dance bee zabucos on konfomox $\mu_1(d), \mu_2(d)$, d. racous. 16

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u² in plane. 2D FMSW. Dance bee zabucos on konfomox $\mu_1(d), \mu_2(d)$, d. racous. 16

Febrero • Otsaila

$$b^2 = d^2 + 2d(\cos \varphi' - \cos \varphi) + 2 - 2\cos(\varphi - \varphi'), \quad b=0 \text{ nju konfuzioh, dots } d=2, \varphi' = 51^\circ, \varphi = 0^\circ$$

14 March 2011

Asteazkena • Miércoles

L IARRIA • ENERO 2007

L	M	M	J	V	S	D
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

L	M	M	J	V	S	D
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

Nean Euzkainaren proiektu (Cu. 19/E 2010-2)

- 1) VC reversal in H₂ field (anamar. + Sim. Rocio)
- 2) SP current induced V. dyn. in F/N/F nanopillar - Subm. 28/7 JNN
- 3) Vortex radial SW (Vogt, Hillebrands) Zenarruza - top. paper
- 4) DW in B-state Nanotubes u Ni-Nanotubes + Coupl. (Ai Ping) - Acc. system
- 5) Coe-FMR paper (Ries, Julian) - Current Monosci. re-subm. ? → JNN Sub.
- 6) Stability of double-V. state u racoon V. B Fe/N(Si)/Fe pillars (Tapach)
- 7) Azim. SW modes in MoI dots (exp. Klein)
- 8) FMR-pinning (Simulat. Arantxa)
- 9) Vortex TM for coupled dots (Acc.) - Subm. to APEX 18/11/11
- 10) SW localized na DW b 2-vortex metastable st. (Papaxagis) Subm. PR
- 11) Non-lin. ST Vort. dyn. u damping, noise (Orcaua 4. u Rafa) - End May 11
- 12) Penzance MECINN project "SE vortices"
- 13) Redon. Green Jun. JMMM to edit a e-gener. Figs
- 14) Paper que Julian's new journal JSM (go Monsci July)

Opr. benficio:

- 1) Nouex kb./gama, reunion b San Seb., konbep. \$ → €
- 2) Anauz gak-ob na Bank. credit u nazkuryu gama.
- 3) Nogaro Spanish-Portugal travel grant b May 2011
- 4) Puzene. u nazym. orer SAIOTEK Dec. 2010, neperce konse grant
- 5) Nogaro qum. ofren na MICINN-Ore. u NSF ofren go 30 March 11
- 6) Abstracts na Conf. b Partenit u Paris (Klein), Sathandaz go 20 May
- 7) Hotel b Bilbao Apr 10-14, Hotel u Suncos Trento (Verana) May 8-12.
- 8) Update RTNSA Conf. Program - Journal
- 9) Nogaro Spanish Tax Return-2010-May 13
- 10) New Ph.D. students or Postdocs (Berba, Korozenko)
- 11) Za Nogaro buzueta - Spunysun Dugensuda
- 12) Hozeguro za Cifu subm. to JNN-RTNSA u nazgor. Acc-poster (Pae)

SW in 2W

Otsaila - Febrero

23

Начи с първия закон на Нютон $W_a = -K_1 \sin^2 \varphi$, $K_1 \rightarrow 0$ $W_a = -K_1 \sin^2 \varphi$

Otsaila - Viernes

$\frac{\partial W}{\partial \varphi} = \frac{\partial W}{\partial \varphi} = -K_1 \sin^2 \varphi \sin 2\varphi$, $\frac{\partial W_a}{\partial \varphi} = \frac{\partial W_a}{\partial \varphi} = -K_1 \sin 2\varphi \sin^2 \varphi$

$\vec{H}_m = \vec{H}_m^0 + \vec{h}$, $\vec{m} = \hat{x} \sin \theta \cos \varphi + \hat{y} \sin \theta \sin \varphi + \hat{z} \cos \theta$, $\vec{m}_0(\theta_0, \varphi_0)$, $\theta_0 = \frac{\pi}{2}$, $\varphi_0(x)$

$\frac{\partial \vec{m}}{\partial \varphi} = -\hat{x} \sin \theta \sin \varphi + \hat{y} \sin \theta \cos \varphi$, $\frac{\partial \vec{m}}{\partial \varphi} = -\hat{x} \sin(\frac{\pi}{2} + \varphi) \cos(\varphi_0 + \varphi) + \hat{y} \cos(\frac{\pi}{2} + \varphi) \sin(\varphi_0 + \varphi) = -\hat{x} [\sin \varphi_0 + \cos \varphi_0 \cdot \varphi] + \hat{y} [\cos \varphi_0 - \sin \varphi_0 \cdot \varphi]$

$\frac{\partial \vec{m}}{\partial \varphi} = \hat{x} \cos \theta \cos \varphi + \hat{y} \cos \theta \sin \varphi - \hat{z} \sin \theta = \hat{x} \cos(\frac{\pi}{2} + \varphi) \cos(\varphi_0 + \varphi) + \hat{y} \cos(\frac{\pi}{2} + \varphi) \sin(\varphi_0 + \varphi) - \hat{z} \sin(\frac{\pi}{2} + \varphi) = -\hat{x} \varphi \cos \varphi_0 - \hat{y} \varphi \sin \varphi_0 - \hat{z} [1]$

$\vec{H}_m \cdot \frac{\partial \vec{m}}{\partial \varphi} = [\vec{H}_m^0 + \vec{h}] \cdot [\frac{\partial \vec{m}_0}{\partial \varphi_0} - \varphi \vec{m}_0] = \vec{H}_m^0 \cdot \frac{\partial \vec{m}_0}{\partial \varphi_0} - \varphi (\vec{m}_0 \cdot \vec{H}_m^0) + \vec{h} \cdot \frac{\partial \vec{m}_0}{\partial \varphi_0}$

$\vec{H}_m \cdot \frac{\partial \vec{m}}{\partial \varphi} = [\vec{H}_m^0 + \vec{h}] \cdot [-\hat{z} - \varphi \vec{m}_0] = -H_m^0 \cdot \hat{z} - h_z - \varphi (\vec{H}_m^0 \cdot \vec{m}_0)$

$\sin 2\theta \sin^2 \varphi = \sin(\pi + 2\varphi) \sin^2(\varphi_0 + \varphi) = -2\varphi \sin^2 \varphi_0$, $\text{Note: } \sin(\pi + 2\varphi) = -\sin 2\varphi$

$-\frac{M_s}{\delta} \sin \theta \dot{\varphi} = \frac{\partial W}{\partial \varphi} = \frac{\partial}{\partial \varphi} (W_a + W_m) = -K_1 \sin 2\varphi \sin^2 \varphi - M_s \vec{H}_m \cdot \frac{\partial \vec{m}}{\partial \varphi}$, $\sin^2(\frac{\pi}{2} + \varphi) \sin 2\varphi = \sin^2 \varphi \sin 2\varphi$

$-\frac{M_s}{\delta} \dot{\varphi} = -K_1 [\sin 2\varphi_0 + 2\varphi \cos 2\varphi_0] - M_s [\vec{H}_m^0 \cdot \frac{\partial \vec{m}_0}{\partial \varphi_0} - \varphi (\vec{m}_0 \cdot \vec{H}_m^0) + \vec{h} \cdot \frac{\partial \vec{m}_0}{\partial \varphi_0}]$

Bound. static: $-K_1 \sin 2\varphi_0 - M_s \vec{H}_m^0 \cdot \frac{\partial \vec{m}_0}{\partial \varphi_0}$, $\text{Two } \sin \text{ exchange}$

u dynamic: $-\frac{M_s}{\delta} \dot{\varphi} = -2K_1 \cos 2\varphi_0 \cdot \varphi + \varphi M_s (\vec{m}_0 \cdot \vec{H}_m^0) - M_s \frac{\partial \vec{m}_0}{\partial \varphi_0} \cdot \vec{h}$

$\frac{M_s}{\delta} \sin \theta \dot{\varphi} = \frac{\partial W}{\partial \varphi} = \frac{\partial}{\partial \varphi} (W_a + W_m) = -K_1 \sin 2\varphi \sin^2 \varphi - M_s \vec{H}_m \cdot \frac{\partial \vec{m}}{\partial \varphi}$, $\sin(\pi + 2\varphi) \sin^2 \varphi = -\sin 2\varphi \sin^2 \varphi$

$\frac{M_s}{\delta} \dot{\varphi} = 2K_1 \sin^2 \varphi_0 \cdot \varphi - M_s [-H_m^0 \cdot \hat{z} - \varphi (\vec{H}_m^0 \cdot \vec{m}_0) - h_z]$, $\text{Static } H_m^0 \cdot \hat{z} = 0$

dynamic $\frac{M_s}{\delta} \dot{\varphi} = 2K_1 \sin^2 \varphi_0 \cdot \varphi + M_s (\vec{H}_m^0 \cdot \vec{m}_0) \cdot \varphi + M_s h_z$, $\vec{h} = \vec{F}[\varphi, \varphi]$

$-\frac{1}{\delta} \dot{\varphi} = -H_a \cos 2\varphi_0 \cdot \varphi + (\vec{m}_0 \cdot \vec{H}_m^0) \varphi - \frac{\partial \vec{m}_0}{\partial \varphi_0} \cdot \vec{h}$, $\text{Use } H_a = 2K_1/M_s, \varphi_0 = \varphi_0(x)$

$\frac{1}{\delta} \dot{\varphi} = H_a \sin^2 \varphi_0 \cdot \varphi + (\vec{m}_0 \cdot \vec{H}_m^0) \varphi + h_z$

$\frac{\delta W_{ex}}{\delta \varphi} = -2A [\varphi^2 \varphi_0 + \varphi^2 \varphi] - 2A (\varphi \varphi_0 \cdot \varphi \varphi_0) \sin 2\varphi_0 = -2A [\varphi_0'' + \varphi^2 \varphi]$

$\frac{\delta W_{ex}}{\delta \varphi} = A (\varphi \varphi_0 + \varphi \varphi)^2 \sin(\pi + 2\varphi) - 2A \varphi^2 \varphi_0 = -2A (\varphi \varphi_0)^2 \varphi - 2A \varphi^2 \varphi_0$

Static: $-K_1 \sin 2\varphi_0 - M_s (\vec{H}_m^0 \cdot \frac{\partial \vec{m}_0}{\partial \varphi_0}) - 2A \varphi_0'' = 0$, $H_m^0 \cdot \hat{z} = 0$

$\left\{ \begin{aligned} -\frac{1}{\delta} \dot{\varphi} &= -\frac{2A}{M_s} \varphi^2 \varphi + [(\vec{m}_0 \cdot \vec{H}_m^0) - H_a \cos 2\varphi_0] \varphi - \frac{\partial \vec{m}_0}{\partial \varphi_0} \cdot \vec{h} \\ \frac{1}{\delta} \dot{\varphi} &= -\frac{2A}{M_s} \varphi^2 \varphi + [(\vec{m}_0 \cdot \vec{H}_m^0) + H_a \sin^2 \varphi_0 - \frac{2A}{M_s} (\varphi \varphi_0)^2] \cdot \varphi + h_z \end{aligned} \right\}$ $\text{Nonlinear dyn. system}$

$\varphi_0(x) \approx \frac{x}{\delta}$ $\text{if } |x| < \delta$, $\varphi_0 = \varphi_0' = \frac{1}{\delta}$ $\text{boundary } \varphi_0$ $\text{where } \varphi_0 = 0$

$\frac{2A}{M_s} (\varphi \varphi_0)^2 \approx \frac{2A}{M_s} \frac{1}{\delta^2} = M_s \left(\frac{L_e}{\delta}\right)^2$ $\text{where } \delta \text{ is not too small}$ $\text{if } \delta \ll R$, $(L_e/R)^2 \ll 1$

$\text{div } \vec{H}_m^0 = -4\pi M_s \text{div } \vec{m}_0 = -4\pi M_s \left[\frac{\partial}{\partial x} \cos \Phi_0 + \frac{\partial}{\partial y} \sin \Phi_0 \right] = 4\pi M_s \sin \Phi_0 \frac{\partial \Phi_0}{\partial y}$
 $\frac{\partial H_m^x}{\partial x} + \frac{\partial H_m^y}{\partial y} = 4\pi M_s \sin \Phi_0 \frac{\partial \Phi_0}{\partial x}$ where $\frac{\partial H_m^x}{\partial y} = 0, H_m^{0y} = \text{const}$ and $H_m^{0y} = 0$
 $\vec{m}_0 = \hat{x} \cos \Phi_0 + \hat{y} \sin \Phi_0$
 $H_m^x = \int dx' dy' [G_{xx} M_x + G_{xy} M_y]$, $H_m^y = \int dx' dy' [G_{yx} M_x + G_{yy} M_y]$
 $\vec{m}_0 = M_s \vec{m}_0 = M_s [\hat{x} \cos \Phi_0 + \hat{y} \sin \Phi_0]$ $G_{xz} = 0$ because $\angle \dots \neq 0$

Febrero 26

26

Lunes Astellehena

Hamiltonian dynamic magnetost. field $\vec{h}$, no galvanic current or kL.

$h_z = M_s \int dx' dy' [G_{zx} \delta m_x + G_{zy} \delta m_y + G_{zz} \delta m_z]$, $\vec{m} = \vec{m}_0 + \delta \vec{m}$

$\vec{m}_0 = \hat{x} \sin(\frac{\pi}{2} + \varphi) \cos(\Phi_0 + \varphi) + \hat{y} \sin(\frac{\pi}{2} + \varphi) \sin(\Phi_0 + \varphi) + \hat{z} \cos(\frac{\pi}{2} + \varphi) =$
 $= \vec{m}_0 - \hat{x} \sin \Phi_0 \cdot \varphi + \hat{y} \cos \Phi_0 \cdot \varphi - \hat{z} \varphi$, $\delta m_x = -\sin \Phi_0 \cdot \varphi$, $\delta m_y = \cos \Phi_0 \cdot \varphi$, $\delta m_z = -\varphi$

$h_z = M_s \int dx' dy' G_{zz} \delta m_z = -M_s \int dx' dy' G_{zz} \varphi(x', y', t)$

$\frac{\partial \vec{m}_0}{\partial \Phi_0} \cdot \vec{h} = [-\hat{x} \sin \Phi_0 + \hat{y} \cos \Phi_0] \cdot [\hat{x} h_x + \hat{y} h_y + \hat{z} h_z] = -h_x \sin \Phi_0 + h_y \cos \Phi_0$

$\begin{cases} -\frac{1}{\gamma} \dot{\varphi} = [\cos \Phi_0 H_m^x - H_a \cos 2\Phi_0] \varphi + h_x \sin \Phi_0 - h_y \cos \Phi_0 \\ \frac{1}{\gamma} \dot{\varphi} = [\cos \Phi_0 H_m^x + H_a \sin^2 \Phi_0] \varphi + h_z \end{cases}$

$\vec{m}(x, y, t) = \vec{m}(x - q(t))$, where $q(y, t) = q_0 + \varepsilon e^{i(ky - \omega t)}$, $k = k_y$.
 $\vec{m}[x - q(y, t)] = \text{give } \varphi(x, y, t) \text{ u } \varphi(x, y, t)$. Static $q_0 = q_{DW}$ is centered at $x=0$.

DW: $\Phi(x, y, t) = \Phi_0(x) + \varphi(x, y, t)$, $\Phi(x, y, t) = \Phi_0[x - q(y, t)] = \Phi_0(x) - \frac{\partial \Phi}{\partial x} q$
 $\varphi(x, y, t) = -\left(\frac{\partial \Phi_0}{\partial x}\right) q(y, t)$. q - DW position. ($q=q_0$) $\frac{\partial \Phi}{\partial x} \Big|_{q_0}$

$\frac{1}{\gamma} \ddot{\varphi} = [\cos \Phi_0 H_m^x + H_a \sin^2 \Phi_0] \frac{1}{\gamma} \varphi + \frac{1}{\gamma} h_z$, $h_z = -M_s \int dx' dy' G_{zz} \varphi$

$\frac{1}{\gamma} \ddot{\varphi} = -[H_m^x \cos \Phi_0 + H_a \sin^2 \Phi_0] \left[(H_m^x \cos \Phi_0 - H_a \cos 2\Phi_0) \varphi + \sin \Phi_0 h_x - \cos \Phi_0 h_y \right] + \frac{1}{\gamma} h_z$

- i.e. h_x, h_y galvanic current or $\delta m_x, \delta m_y \sim \varphi$, so φ - e give φ is closed
hyper now $H_a = 0$: $\frac{1}{\gamma} \ddot{\varphi} = -H_m^x \cos \Phi_0 [H_m^x \cos \Phi_0 \cdot \varphi + \sin \Phi_0 h_x - \cos \Phi_0 h_y] + \frac{1}{\gamma} h_z$

$\frac{d\varphi}{dt} = \frac{d}{dt} \Phi_0[x - q(y, t)] = -\frac{\partial \Phi_0}{\partial x} \dot{q}$, $\ddot{\varphi} = -\frac{\partial^2 \Phi_0}{\partial x^2} \ddot{q}$ (lin. approximation) $\rightarrow$ Hermito, we go $\ddot{\varphi} = -\Phi_0'' \ddot{q}$

$h_x = M_s \int dx' dy' [G_{xx} \delta m_x + G_{xy} \delta m_y] = M_s \int dx' dy' [G_{xx} \sin \Phi_0 \Phi_0' q(y, t) +$
 $+ G_{xy} \cos \Phi_0 (-1) \Phi_0'(x') q(y, t)]$, $h_y = M_s \int dx' dy' [G_{yx} \sin \Phi_0 \Phi_0' q(y, t) - G_{yy} \cos \Phi_0 \Phi_0' q(y, t)]$

$-\frac{1}{\gamma} \Phi_0'' \ddot{q} = -H_m^x \cos \Phi_0 [-H_m^x \cos \Phi_0 \Phi_0' q + \sin \Phi_0 h_x - \cos \Phi_0 h_y] + \frac{1}{\gamma} h_z$

$\frac{\omega^2}{\gamma^2} \Phi_0'' \varepsilon e^{iky} = (H_m^x)^2 \cos^2 \Phi_0 \Phi_0' \varepsilon e^{iky} - \varepsilon H_m^x \cos \Phi_0 \sin \Phi_0 M_s \int dx' dy' [G_{xx} \times$
 $\times \sin \Phi_0 \Phi_0' e^{iky'} - G_{xy} \cos \Phi_0 \Phi_0' e^{iky'}] + H_m^x \cos^2 \Phi_0 \varepsilon \cdot M_s \int dx' dy' [G_{yx} \sin \Phi_0 \Phi_0' e^{iky'}$
 $- G_{yy} \cos \Phi_0 \Phi_0' e^{iky'}] + \frac{1}{\gamma} M_s \int dx' dy' \frac{1}{z} [-\cos \Phi_0 H_m^x \Phi_0' \varepsilon e^{iky'} + h_x(x') \sin \Phi_0 - h_y(x') \cos \Phi_0]$

B. Galvanic no H_a approximation $G_{zz}(x, y, x', y') = -4\pi \delta(x-x') \delta(y-y')$ u
 $h_z = 4\pi M_s \varepsilon$, normally we choose $G_{xy}, G_{yx}, G_{xx}, G_{yy}(k)$.
Semana 26

23/III Rozbor papers Slonczewski JAP 1984 u Winter, Ph. Rev. 1961.
 Winter como primera zagary SW over Black-wall b co crystal
 infomation y resu marcos asuku, marcos miedafuz. b rovanionyx koepru-
 koway 10 02 11 30
 Theville SD 10 11 19 36
 infomation: $\vec{r}(t), \Phi(t), \Delta(t)$. $\Theta(x,t) = 2 \tan^{-1} \exp \left[\frac{x - \vec{r}(t)}{\Delta(t)} \right] \Rightarrow \vec{r}(t, \Phi, \Delta)$.

28
 Miércoles • Asteazkena

B cugrae yr. Thiele $\vec{m}(\vec{r}, t) = \vec{m}(\vec{r} - \vec{R}(t))$ yepo gkeme ko $\vec{r}$ b caxux yd.
 y uena $\Phi(x, y, t) = \Phi_0(x) + \varphi(x, y, t)$ u $\varphi(x, y, t) = -\Phi_0' \varphi(y, t)$, $\varphi(y, t) = \epsilon e^{i(ky - \omega t)}$
 - nepeuenenne Du position $\vec{r} \Rightarrow \varphi(y, t)$.

$$\mathcal{L} = -\frac{M_s}{\delta} \cos \Phi - W(\Phi, \varphi) = +\frac{M_s}{\delta} \epsilon e^{\varphi} + \frac{1}{2} M_s \vec{m} \cdot \vec{H}_m$$

$$\vec{m} \cdot \vec{H}_m = (\vec{m}_0 + \delta \vec{m}) (\vec{H}_0 + \vec{h}) = \vec{m}_0 \vec{H}_0 + \delta \vec{m} \cdot \vec{H}_0 + \vec{m}_0 \vec{h} + \delta \vec{m} \cdot \vec{h}$$

$$\left\{ \begin{aligned} -\frac{1}{\delta} \epsilon e^{\varphi} &= \cos \Phi_0 H_0^x \cdot \varphi + \sin \Phi_0 h_x - \cos \Phi_0 h_y \\ \frac{1}{\delta} \epsilon e^{\varphi} &= \cos \Phi_0 H_0^x \cdot \epsilon e + h_z \end{aligned} \right\} \quad \begin{aligned} \Phi_0(x), H_0^x(x) &\text{ - uz because } \varphi \\ h_z &= -M_s \int dx' dy' G_{zz} \epsilon e(x'y't) \end{aligned}$$

$$h_x = M_s \int dx' dy' [-G_{xx} \sin \Phi_0(x') + G_{xy} \cos \Phi_0(x')] \varphi(x'y't), \quad G_{\alpha\beta} = G_{\alpha\beta}(x, y, y')$$

$$h_y = M_s \int dx' dy' [-G_{yx} \sin \Phi_0(x') + G_{yy} \cos \Phi_0(x')] \varphi(x'y't), \quad h_z = h_z(x, y, t)$$

Ansatz $\Phi(x, y, t) = \Phi_z[x - \varphi(y, t)]$, $\Phi_z(x) = \Phi_0(x) = 2 \tan^{-1} \exp \left[\frac{x}{\delta} \right]$ - ne.
 $\tan \frac{\Phi_0}{2} = \exp(x/\delta)$, $\Phi_0(x) = 2 \arctg \exp(x/\delta) - \frac{\pi}{2}$

Torga $\cos \Phi_0 = 1/\cosh(x/\delta)$, $\sin \Phi_0 = \tanh(x/\delta)$ - soliton ansatz for Neel DW.

Marq Winter'61 ne ypoiget, t.k. unrey. yr-a e nepeuenenne koepr.
 $H_0^x = -4\pi M_s \cos \Phi_0$ -? kan y Slonczewski u Winter'61? $H_0^x = -4\pi M_s$

$$H_0^x = M_s \int dx' dy' [G_{xx} m_x^0 + G_{xy} m_y^0], \quad m_x^0 = \cos \Phi_0, m_y^0 = \sin \Phi_0$$

$$\langle H_0^x \rangle_y = M_s \int dx' [\langle G_{xx} \rangle_y \cos \Phi_0 + \langle G_{xy} \rangle_y \sin \Phi_0], \quad \langle G_{\alpha\beta} \rangle_y = \frac{1}{\ell} \int dy dy' G_{\alpha\beta}(xy, x'y')$$

$$\langle G_{xy} \rangle_y = \frac{1}{\ell} \int dy \int dy' G_{xy}(\vec{r}^0 \vec{r}^0') = \frac{1}{(2\pi)^2} \frac{1}{\ell} \int dy dy' \int d^2 k (-4\pi) \frac{k_x k_y}{k^2} f(kL) e^{i\vec{k}(\vec{r}^0 - \vec{r}^0')}$$

$$\frac{1}{\ell} \int_{-\ell/2}^{\ell/2} dy \int_{-\ell/2}^{\ell/2} dy' e^{ik_y(y-y')} = \frac{1}{\ell} \left[\int_{-\ell/2}^{\ell/2} dy e^{ik_y y} \right]^2 = \frac{1}{\ell} \frac{4}{k_y^2} \sin^2 \frac{k_y \ell}{2} \rightarrow \frac{4}{\ell} \frac{\pi \ell}{2} \delta(k_y) = 2\pi \delta(k_y)$$

$$\int dk_y \frac{k_y}{k^2} f(kL) \cdot \delta(k_y) = 0 \text{ wpu } \ell \rightarrow \infty \text{ (infinite film).}$$

hozony ypu $\langle \dots \rangle_y$ osanycae taniko G_{xx} u G_{zz} , an. Res' JMM-
 $H_0^y = M_s \int dx' dy' [G_{yx} m_x^0 + G_{yy} m_y^0] = 0$ wane $\langle \dots \rangle_y$. Dume $\int dy' f(y')$ gae mo

$$H_0^z = M_s \int dx' dy' G_{zz} m_z^0 = 0 \text{ w3-za } m_z^0 = 0, \text{ t.k. Neel DW}$$

$$\rightarrow H_0^x = M_s \int dx' dy' G_{xx} m_x^0 = M_s \int dx' \cos \Phi_0(x') g_{xx}(xx'), \quad g_{xx}(xx') = \int dy' G_{xx}(xy, x'y')$$

$$\int dy' G_{xx}(\vec{r}^0 \vec{r}^0') = \int dy' \int d^2 k \frac{1}{(2\pi)^2} e^{i\vec{k}(\vec{r}^0 - \vec{r}^0')} (-4\pi) \frac{k_x^2}{k^2} f(kL), \quad \int dy' e^{-ik_y y'} = \frac{1}{(-ik_y)} e^{-ik_y y'/2}$$

$$g_{xx} = \frac{1}{\ell} \int dy dy' G_{xx}(\vec{r}^0 \vec{r}^0') = \frac{1}{(2\pi)^2} \int d^2 k (-4\pi) \frac{k_x^2}{k^2} f(kL) e^{ik_x(x-x')} 2\pi \delta(k_y) = -2 \int dk_x f(kL) e^{ik_x(x-x')}$$

$$g_{xx}(xx') = -2 \int dk_x f(kL) \cos k(x-x') \text{ - orobeno chadun}$$

PT saraketa: Hitzak ezean, no $\int dy dy'$ ukoanren burubano, erusako $\vec{m} \pm \vec{f}(y)$ ukoanren burubano $y \rightarrow \infty$.

1 $g_{xx}(xx') = -4\pi\delta(x-x') - g_{zz}(xx')$, $g_{zz}(xx') = \int_{-\infty}^{\infty} \frac{dx'}{x-x'} \ln \left[\frac{(x-x')^2 + z^2}{(x-x')^2 + z'^2} \right]$
 Hurren $L \rightarrow 0$ $g_{zz}(xx') \approx -4\pi\delta(x-x')$ u $g_{xx} \rightarrow 0$.

$H_0^x(x) = M_s \int dx' \cos \Phi_0(x') g_{xx}(xx')$ u ne burubano. $H_0^x = -4\pi M_s \cos \Phi_0$

Osteguna. Jueves
 kax ukoanren burubano Slonczewski izu u Winter'61. y Winter - Bulk crystal
 H0 y Slonczewski - thin film u $H_0^x = -4\pi M_s$ - no goyuzatzen, eta burubano.
 berrin anslatz uz rigid wall model: $\varphi(x,y,t) = -\Phi_0'(x) q(y,t)$

$\begin{cases} -\frac{1}{\delta} \ddot{\varphi} = -\cos \Phi_0 H_0^x \Phi_0' q + \sin \Phi_0 h_x[q] - \cos \Phi_0 h_y[q] \\ -\frac{1}{\delta} \Phi_0' \ddot{q} = \cos \Phi_0 H_0^x \cdot \varphi + h_z[\varphi] \end{cases}$ $\varphi(x,y,t) \rightarrow \varphi(y,t)$ ukoanren burubano.

10 Torde morma yD ukoanren burubano x'' . $\langle \dots \rangle_x = \frac{1}{w} \int dx (\dots)$
 $f_1 = \langle \cos \Phi_0 \Phi_0' H_0^x \rangle_x$, $f_2 = \langle \cos \Phi_0 H_0^x \rangle_x$.

$\langle \sin \Phi_0 h_x \rangle_x = \frac{1}{w} \int dx \sin \Phi_0(x) M_s \int dx' \int dy' [G_{xx} \sin \Phi_0(x') - G_{xy} \cos \Phi_0(x')] \Phi_0'(x') q(y')$
 $\Phi_0(x)$ ukoanren burubano, $\Phi_0'(x)$ ukoanren burubano no x .

12 $\int dx \int dx' G_{xx} \sin \Phi_0(x) \sin \Phi_0(x') \Phi_0'(x') = ?$ $\int dx G_{xx} \sin \Phi_0(x) =$
 $\int dx \sin \Phi_0(x) \int \frac{d^2 k}{(2\pi)^2} e^{ik(\vec{r}-\vec{r}')} (-4\pi) \frac{k_x^2}{k^2} f(kL) -$ ne pabeu "0" ukoanren burubano.

13 $\int dx \int dx' G_{xy} \sin \Phi_0(x) \cos \Phi_0(x') \Phi_0'(x') = \int dx \int dx' \sin \Phi_0(x) \cos \Phi_0(x') \Phi_0'(x') \times$
 $\times \int \frac{d^2 k}{(2\pi)^2} (-4\pi) e^{ik_x(x-x')} e^{ik_y(y-y')} k_x k_y f(kL) -$ ne pabeu "0".

14 $\langle \cos \Phi_0 h_y \rangle = \frac{1}{w} \int dx \cos \Phi_0(x) M_s \int dx' \int dy' [G_{yx} \sin \Phi_0(x') - G_{yy} \cos \Phi_0(x')] \Phi_0'(x') q(y')$
 $\langle \sin \Phi_0 h_x \rangle = M_s \int dy' q(y') [\Gamma_{ss}(yy') - \Gamma_{sc}(yy')] = M_s \int dy' q(y') \Gamma_x(yy')$

16 $\langle \cos \Phi_0 h_y \rangle = M_s \int dy' q(y') [\Gamma_{cs}(yy') - \Gamma_{cc}(yy')] = M_s \int dy' q(y') \Gamma_y(yy')$
 $\Gamma_{sc} \stackrel{?}{=} \Gamma_{cs}$. $\Gamma_{ss}(yy') = \frac{1}{w} \int dx \int dx' \sin \Phi_0(x) \sin \Phi_0(x') \Phi_0'(x') G_{xx}(xx', yy')$

17 $\Gamma_{cs} = \frac{1}{w} \int dx \int dx' \cos \Phi_0(x) \sin \Phi_0(x') \Phi_0'(x') G_{yx}(xx', yy')$
 $\Gamma_{cc}(yy') = \frac{1}{w} \int dx \int dx' \cos \Phi_0(x) \cos \Phi_0(x') \Phi_0'(x') G_{yy}(xx', yy')$

18 $\begin{cases} -\frac{1}{\delta} \ddot{\varphi} = -f_1 q + M_s \int dy' \Gamma_x(yy') q(y') - M_s \int dy' \Gamma_y q \\ -\frac{1}{\delta} \Phi_0' \ddot{q} = f_2 \varphi - M_s \int dx' \int dy' G_{zz}(xy, x'y') \varphi(y') \int dx' \end{cases}$

$\Gamma_z(yy') = \frac{1}{w} \int dx \int dx' G_{zz}(xy, x'y')$
 $\Gamma_z(yy') = \frac{2}{L} \ln \left[\frac{(y-y')^2}{(y-y')^2 + L^2} \right]$

$\begin{cases} -\frac{1}{\delta} \ddot{\varphi} = -f_1 q + M_s \int dy' \Gamma_x(yy') q(y') - M_s \int dy' \Gamma_y q \\ -\frac{1}{\delta} \Phi_0' \ddot{q} = f_2 \varphi - M_s \int dy' \Gamma_z(yy') \varphi(y') \end{cases}$ $\Phi_0' = \langle \Phi_0' \rangle_x$

$\begin{cases} -\frac{1}{\delta} \ddot{\varphi} = -f_1 q + M_s \int dy' \Gamma(yy') q(y') \\ -\frac{1}{\delta} \Phi_0' \ddot{q} = f_2 \varphi - M_s \int dy' \Gamma_z(yy') \varphi(y') \end{cases}$ $\Gamma(yy') = \Gamma_x(yy') - \Gamma_y(yy')$

$\Gamma_z(yy') \approx -4\pi\delta(y-y')$
 Hurren $L/w \rightarrow 0$.

$$-\frac{1}{8} \Phi_0' \ddot{q} = f_2 \frac{1}{8} \ddot{e} - M_s \int dy' \Gamma_z \frac{1}{8} \ddot{e} = f_2 \left[f_1 q - M_s \int dy' \Gamma q(y') \right]_{\text{Marzo} \cdot \text{Martxo}}$$

$$-M_s \int dy' \Gamma_z \left[f_1 q(y') - M_s \int dy'' \Gamma(y'y'') q(y'') \right], \quad (f_1, f_2 \sim H_0^2 \sim L/R)$$

$$\text{no } L/R \ll 1, \Gamma_z = -4\pi M_s y', \Gamma \sim G_{\alpha\beta} \sim f(kL) \sim L/R$$

$$-\frac{1}{8} \Phi_0' \ddot{q} = f_1 f_2 q - M_s f_2 \int dy' \Gamma q(y') - M_s f_1 \int dy' \Gamma_z q + M_s^2 \int dy' dy'' \Gamma_z \Gamma q(y'')$$

$$\text{cabeza zero } \sim \left(\frac{1}{R}\right): -\frac{1}{8} \Phi_0' \ddot{q} = -M_s f_1 (-4\pi M_s^2) q - 4\pi M_s^2 \int dy' \Gamma(y'') q(y')$$

$$-\frac{1}{8} \Phi_0' \ddot{q} = 4\pi M_s \left[f_1 q - M_s \int dy' \Gamma(y'') q(y'') \right], \quad q(y'') = \varepsilon e^{i(ky - \omega t)}$$

$$\frac{\omega^2}{8} \varepsilon \Phi_0' = 4\pi M_s \varepsilon \left[f_1 - M_s e^{-iky} \int dy' \Gamma(y'') e^{iky'} \right], \quad \text{DW-cabeza}$$

$$\rightarrow \frac{\omega^2(k)}{8} \Phi_0' = 4\pi M_s \left[f_1 - M_s \int dy' \Gamma(y-y') e^{-ik(y-y')} \right]$$

$$\Gamma(y'') = \Gamma_x(y'') - \Gamma_y(y'') = \Gamma_{ss} - \Gamma_{sc} - \Gamma_{cs} + \Gamma_{cc}, \quad \Gamma_{sc} = \int \frac{dx dx'}{w} \sin \Phi_0(x) \cos \Phi_0(x') \Phi_0'(x') G_{xy}$$

$$\Gamma(y) = \left| \int \frac{d^2 \vec{x}}{(2\pi)^2} Q(\vec{x}) \right| = \int \frac{d^2 k_y}{2\pi} \Gamma(k_y) e^{iky}$$

$$\int dy' \Gamma(y-y') e^{-ik(y-y')} = \int dy' e^{ik(y-y')} \int \frac{d^2 \vec{x}}{(2\pi)^2} \Gamma(\vec{x}) e^{i\vec{x}(y-y')} = e^{-iky} \times$$

$$\times \int \frac{d^2 \vec{x}}{(2\pi)^2} \Gamma(\vec{x}) e^{i\vec{x}y} \int dy' e^{i(k-x)y'} = e^{-iky} \int \frac{d^2 \vec{x}}{(2\pi)^2} \Gamma(\vec{x}) e^{i\vec{x}y} 2\pi \delta(k-x) = \Gamma(k)$$

$$\rightarrow \omega^2(k) = 8^2 4\pi M_s \left[f_1 - M_s \Gamma(k) \right], \quad \Gamma(k) = \int dy \Gamma(y) e^{\pmiky}, \quad y = |y-y'|$$

$$q(y) \sim \sin(k_n y) \subset k_n = (2n-1) \frac{\pi}{2} \frac{1}{R}, \quad n=1, 2, 3, \dots$$

$$\Phi_0' \approx \frac{1}{\delta}, \quad \delta\text{-thick DW} \sim R, \quad f_1 \text{ u } \Gamma(k) \text{ kaiteu wz unteper. } \Phi_0(x)$$

$$f_1 = \int \frac{dx}{w} \cos \Phi_0(x) \Phi_0'(x) \mathcal{H}_0'(x) = M_s \int \frac{dx dx'}{w} \cos \Phi_0(x) \cos \Phi_0(x') \Phi_0'(x) q_{xx}(xx')$$

$$\rightarrow \cos \Phi_0(x) = \frac{1}{\text{ch}(x/\delta)}, \quad \sin \Phi_0(x) = \text{th}(x/\delta)$$

$$\Phi_0'(x) \xrightarrow{\delta \rightarrow 0} \delta(x), \quad \text{noztaraz } \Gamma_{\alpha\beta} \text{ ne agerperazazare } \sin \Phi_0(x) \Phi_0'(x) \text{ unteperaz}$$

$$\text{mabnyro poib. } \Gamma_{cc} \approx \frac{1}{w} \int dx \cos \Phi_0(x) G_{yy}(x, 0, yy') \approx \frac{1}{2\delta} \int_{-\delta}^{\delta} dx G_{yy}(x, 0, yy')$$

$$\Gamma_{cc}(yy') = \int dx dx' F(xx') G_{yy}(xx', yy') = \int dx \int dx' F(xx') \int \frac{d^2 \vec{k}}{(2\pi)^2} (-4\pi) \frac{k_y^2}{k^2} f(kL) e^{ik_x(x-x')} e^{ik_y(y-y')} =$$

$$\frac{1}{w} \int dx \int dx' F(xx') \int \frac{d^2 \vec{k}}{(2\pi)^2} (-4\pi) \frac{k_y^2}{k^2} f(kL) e^{ik_x(x-x')} e^{ik_y(y-y')} = -2 \int dx dx' F \int \frac{d^2 \vec{k}}{(2\pi)^2} \frac{k_y^2}{k^2} f(kL) e^{ik_x(x-x')} e^{ik_y(y-y')} =$$

$$\times \int dx' \cos \Phi_0(x') \Phi_0'(x') e^{-ik_x x'}. \quad \mathcal{J}_c(k_x) = \int dx \cos \Phi_0(x) e^{ik_x x} = \int_{-\infty}^{\infty} dx \frac{e^{ik_x x}}{\text{ch}(x/\delta)}$$

$$\Phi_0(x) = 2 \arctg e^{x/\delta} - \pi/2, \quad \Phi_0'(x) = \frac{2}{\delta} \frac{1 \cdot e^{x/\delta}}{1 + e^{2x/\delta}} = \frac{1}{\delta} \frac{1}{\text{ch}(x/\delta)} = \frac{1}{\delta} \cos \Phi_0(x)$$

$$\mathcal{J}_c'(k_x) = \int dx' \frac{e^{-ik_x x'}}{\text{ch}^2(x'/\delta)}. \quad \mathcal{J}_c, \mathcal{J}_c' \text{ - nago bazar akawazarechen kak } F(k_x).$$

Note: eku $k_y \rightarrow 0$, no $\delta \Gamma(k_y)$ gaez buzeg tozko $\Gamma_{ss} \sim G_{xx}$

Marxoa, Marzo

$$\int_0^{\infty} dx \frac{e^{-\mu x}}{\cosh x} = \beta \left(\frac{\mu+1}{2} \right), \text{ Re } \mu > -1.$$

$\int_0^{\infty} dx \frac{e^{-\mu x}}{\cosh^2 x} = \mu \beta(\frac{\mu}{2}) - 1, \text{ Re}(\mu) > 0$

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$$\int_0^{\pi/2} dx \frac{\cos k_y x}{\cosh x}, \quad \int_0^{\infty} dx \frac{\cos k_y x}{\cosh^2 x}$$

$$\int_0^{\infty} dx \frac{\cos k_x x}{ch^2 x}$$

$$\int_0^{\frac{\pi}{2}} \sin kx \cdot \tan x$$

$$\int_0^{\infty} \frac{\cos ax}{\cosh bx} dx = \frac{\pi}{2b} \operatorname{sech} \frac{a\pi}{2b}.$$

$$\int_0^{\infty} dx \sin ax \cdot \text{th}(\beta x)$$

Astelehena - Lunes

$$dy \frac{\cos ax}{\cosh^2 \beta x} = \frac{a \pi}{2\beta^2 \sinh\left(\frac{\pi}{2\beta}\right)}$$

$$\int_0^{\infty} dx \sin ax \cdot \frac{\sinh \beta x}{\cosh^2 \beta x} = \frac{\pi}{\beta^2} \frac{\frac{\cosh \frac{a\pi}{\beta} - 1}{\beta} \frac{a \sinh(a\pi/2\beta)}{\cosh \frac{a\pi}{\beta} + 1}}$$

$$\int_0^{\pi} dx \sin x \frac{\sinh x}{\cosh x} = \pi \frac{\cosh(\pi/2)}{\sinh(\pi)}$$

$$\sinh(2x) = 2 \sinh x \cosh x, \quad \cosh(2x) = \cosh^2 x + \sinh^2 x$$

$$T_{SS}(yy') = \int dx dx' F_S(xx') G_{xx}(xx'yy') = \int dx \int dx' F_S \int \frac{d^2k}{4\pi^2} (-4\pi) \frac{k^2}{k^2} f(k) e^{ik_x(x-x')} e^{ik_y(y-y')}$$

$$\int \frac{dk_y}{2\pi} \Gamma_{ss}(k_y) e^{ik_y(y-y')}, \quad \Gamma_{ss}(k_y) = \int dx \int_{-\infty}^{\infty} dx' \sin \phi_0(x) \sin \phi_0(x') \phi_0'(x'') (2) \int dk_x k_x^2 e^{ik_x x} e^{ik_x x'} e^{ik_x x''}$$

$$\int_{-\infty}^{\infty} dx e^{ik_x x} \sin p_0(x) = \int_{-\infty}^{\infty} dx e^{ik_x x} \ln\left(\frac{x}{\delta}\right) = 2i \int_{-\infty}^{\infty} dx \sin(k_x x) \frac{\ln x / \delta}{\ln x / \delta} = |x/\delta = z| =$$

$$= 2i\delta \int_0^\infty dz \sin(k_x \delta z) \frac{\text{sh } z}{\text{ch } z} = 2i\delta \cdot \pi \frac{\text{ch}(\frac{\pi}{2} k_x \delta)}{\text{sh}(\pi k_x \delta)} = 2i\delta \pi \frac{1}{2 \text{sh}(\frac{\pi}{2} k_x \delta)} = i \pi \delta$$

$$\int_{-\infty}^{\infty} dx \sin \Phi_0(x) \Phi_0'(x) e^{ik_x x} = -i2 \int_0^{\infty} dx \sin k_x x \frac{\text{sh}(x/\delta)}{\text{ch}^2(x/\delta)} = -2i \int_0^{\infty} dz \sin(k_x \delta z) \frac{\text{sh} z}{\text{ch}^2 z} = -2i \pi k_x \delta \text{ch}(\pi k_x \delta)$$

$$\begin{aligned} \text{ch } 2x + 1 &= 2\text{ch}^2 x, \quad \int_{-\infty}^{\infty} dx \sin \phi_0(x) \phi_0'(x) e^{-ikx} = -i\pi \frac{1}{k} \\ \text{ch } 2x - 1 &= 2\text{ch}^2 x - 2 = 2\text{sh}^2 x \end{aligned}$$

14. $\int_0^{\infty} \sin ax \cdot \cos bx \, dx$ - webermo, $ax \rightarrow 0$ wenn $a \rightarrow 0$.

$$I(a) = \int dx \frac{\cos ax}{x} \cdot \ln x, \quad I'(a) = - \int dx \sin ax \cdot \ln x, \quad I(a) = \frac{1}{2} \ln \frac{e^{a\pi/2} + 1}{e^{a\pi/2} - 1}$$

24/III) Проверь SW & Neal DW записки:

$$\rightarrow \omega^2(k) = \frac{4\pi M_s^2}{\langle \Phi_0 \rangle_x} [f_1 - \Gamma(k)], \quad k=k_y \quad f_1 = \frac{1}{M_s} \langle \cos \Phi_0 \Phi_0' H_0 \rangle$$

$$S_1 = \frac{1}{w} \int dx \cos \Phi_0(x) \Phi_0'(x) \frac{H_0'(x)}{M_c} = \frac{\int dx dx' \cos \Phi_0(x) \Phi_0'(x) \cos \Phi_0(x') \int dy' G_{xx'}(xx', yy')}{w}$$

$$\frac{1}{L} \int dy \int dy' e^{ik_y(y-y')} \xrightarrow{L \rightarrow \infty} 2\pi \delta(k_y) = \int dy' e^{ik_y(y-y')} = e^{ik_y y} \int dy' e^{-ik_y y'} =$$

T.e. $\frac{1}{2} (dy dy' (l \rightarrow \infty) + \int_{-\infty}^{\infty} dy' (l \rightarrow \infty))$ Inclusionen $\Rightarrow e^{iky} 2\pi\delta(k_y) = 2\pi\delta(k_y)$

$$\Gamma_{ss}(y, y') = \int \frac{dk_y}{2\pi} \Gamma_{ss}(k_y) e^{ik_y(y-y')} \quad , \quad \Gamma_{ss}(k_y) = \int dy' \Gamma_{ss}(y-y') e^{-ik_y(y-y')}$$

$$\Gamma_{ss}(k_y) = \int dy' e^{-ik_y(y-y')} \int dx \int dx' \sin \Phi_0(x) \sin \Phi_0(x') \Phi'_0(x') G_{xx'}(xx', yy')$$

$$\int dy' G_{xy}(xy', yy') = \int dy' G_{xy}(\vec{y}, \vec{y}') = -2 \int dk f(kL) \cos k(x-y') = 0$$

Grüne G.f. $g_{xx}(x, x') = -4\pi\delta(x-x') - \frac{2}{L} \ln \left[\frac{(x-x')^2}{(x-x')^2 + L^2} \right], \quad \phi'_0(x) = \frac{\delta^{-1}}{\text{ch}(x/L)}$

$$\cos \Phi_c(x) = \frac{1}{\cosh(x/\delta)}, \quad \sin \Phi_c(x) = \tanh(x/\delta)$$

$$\frac{1}{w} \Phi_0'(x) \cos \Phi_0(x) \cos \Phi_0(x') g_{xx}(xx') \quad \text{et} \quad \Gamma_{ss}(k=0) = \frac{\int dx dx' \sin \Phi_0(x) \sin \Phi_0(x') g_{ss}(xx')}{w}$$

$$J_3(p) = -8\pi\delta - \frac{2\delta}{p} \left[2\ln 2 - 4(\ln 4 + \frac{p^2}{4}) + p^2(\ln 4 + \frac{p^2}{4}) - 2p^2 \ln p \right]$$

Marxoa • Marzo

$$7 \quad -8p \left(\frac{\pi}{2} - \frac{p}{2} + \frac{1}{3} \left(\frac{p}{2} \right)^3 \right) = -8\pi\delta - \frac{2\delta}{p} \left[-p^2 + 2\ln 2 p^2 - 2p^2 \ln p \right]$$

$$= -2\delta \left[3p + 2p \ln 2 - 2p \ln p \right] = -2\delta p \left[3 + 2\ln \frac{2}{p} \right] + O(p^3)$$

Asteazkena • Miércoles

$$f_1 = \frac{1}{2} \frac{c^3}{\delta^2} J_3 = \frac{1}{2} \frac{c^3}{\delta^2} (-1) 2\delta p \left[3 + 2\ln \frac{2}{p} \right] = -\frac{c^3}{\delta} p \left[3 + 2\ln \frac{2}{p} \right]$$

$$\omega^2(k) = \delta^2 \frac{4\pi m_s^2}{\langle \Phi_0^2 \rangle_x} [f_1 - \Gamma(k)], \quad -(\Delta\omega_{st})^2 = \delta^2 4\pi m_s^2 f_1 = \delta^2 4\pi m_s^2 \frac{c^3}{\delta} p \left[3 + 2\ln \frac{2}{p} \right]$$

$$-(\Delta\omega_{st})^2 = \omega_M^2 \frac{c^2}{4\pi} p \left(3 + 2\ln \frac{2}{p} \right), \quad \frac{|\Delta\omega_{st}|}{\omega_M} \approx c \sqrt{\frac{p}{4\pi} \left(3 + 2\ln \frac{2}{p} \right)}$$

Onizena c=1, p=L/δ=0.1, |Δω_{st}|/ω_M=0.27 uen |Δω_{st}| ≈ 8.0 GHz
 - berrun perzuntzua ymurbene c<1 nago δ parr.

$$10 \quad \int_{-\infty}^{\infty} dx \cos \Phi_0(x) = \int_{-\delta}^{\delta} dx c = 2\delta c. \quad \int_{-\infty}^{\infty} \frac{dx}{\cosh \frac{x}{\delta}} = \frac{\pi}{2} \delta, \quad \frac{\pi}{2} \delta = 2\delta c, \quad c = \frac{\pi}{4} \approx 0.785$$

$$11 \quad \Gamma_{ss}(k=0) = \frac{1}{2\delta} \int dx dx' \sin \Phi_0(x) \sin \Phi_0(x') \Phi_0'(x') g_{xx}(xx')$$

sin Φ₀(x) = th x/δ

$$12 \quad \text{Berari sin } \Phi_0(x) = \begin{cases} \sqrt{1-c^2}, & |x| < \delta \\ \text{sign}(x) \cdot 1, & |x| > \delta \end{cases}, \quad \Phi_0'(x) = \begin{cases} \frac{c}{\delta} & \text{when } |x| < \delta, \text{ uen } c=0 \\ \frac{1}{\delta} \frac{1}{\cosh(x/\delta)} & \end{cases}$$

- ordezkatu |x|>δ orratu uztartu jabeaz.

$$13 \rightarrow \Gamma_{ss}(0) = \frac{1}{2\delta} \int_{-\delta}^{\delta} dx \int_{-\delta}^{\delta} dx' g_{xx}(xx') (1-c^2) \frac{c}{\delta} = \frac{1}{2} \frac{c(1-c^2)}{\delta^2} J_3(p) < 0.$$

$$14 \quad f_1 - \Gamma_{ss}(0) = \frac{1}{2} \frac{c^3}{\delta^2} J_3 - \frac{1}{2} \frac{c(1-c^2)}{\delta^2} J_3 = -\frac{1}{\delta^2} c \left(\frac{1}{2} - c^2 \right) J_3 > 0, \quad c^2 < \frac{1}{2}, \quad c < \frac{1}{\sqrt{2}}$$

Ha auzen gertu |Γ_{ss}(0)| berrun, t.k. 1/δ ordezkatu uztartu jabeaz, ne
 15 t.k. ordezkatu karr 1/δ uztartu jabeaz.

$$\omega^2(0) = \delta^2 4\pi m_s^2 \frac{c}{\delta} [f_1 - \Gamma_{ss}(0)] = \delta^2 4\pi m_s^2 \frac{1}{\delta} \left(\frac{1}{2} - c^2 \right) |J_3|$$

$$16 \quad \omega^2(0) = \omega_M^2 \frac{1}{4\pi} \left(\frac{1}{2} - c^2 \right) 2p \left[3 + 2\ln \frac{2}{p} \right] - \text{gno } \delta\omega - \text{zonen.}$$

Berrun ω²(0) ~ p=L/δ ~ 1/p karr gertu berrun gertu uztartu jabeaz, uztartu jabeaz
 17 zerbaitu orat c ~ c² - orratu, euen c < 1.

$$18 \quad G_{\alpha\beta}(\vec{r}, \vec{r}') = \int \frac{d^2 \vec{k}}{(2\pi)^2} G(\vec{k}) e^{i\vec{k}(\vec{r}-\vec{r}')} \quad G_{\alpha\beta}(\vec{k}) = -4\pi \frac{k_\alpha k_\beta}{k^2} f(k)$$

α, β = x, y

$$19 \quad \Gamma_{ss}(k_y) \sim G_{xx}(\vec{k}) \sim \frac{k_x^2}{k_x^2 + k_y^2} f(k) = \Gamma_{ss}(0) + \Gamma_{ss}'' k_y^2 - \text{zeren } k_y$$

$$\Gamma_{cc}(k_y) \sim G_{yy}(\vec{k}) \sim \frac{k_y^2}{k^2} f(k) = \Gamma_{cc}'' k_y^2 - \text{zeren } k_y, \text{ uen } \Gamma_{cc}(0)=0$$

$$\Gamma_{sc}(k_y) \sim k_y \text{ u } \Gamma_{cs}(k_y) \sim k_y, \text{ t.k. } \Gamma_{sc}, \Gamma_{cs} \sim G_{yx}(\vec{k}), G_{xy}(\vec{k})$$

66 Berrun ω(k_y=0) orratu. Γ_{ss}(0), uztartu uztartu jabeaz, uztartu jabeaz, uztartu jabeaz
 Γ_{sc}(k_y) u Γ_{cs}(k_y).

$$\Gamma_{cs}(k_y) = \int dy' \Gamma_{cs}(y-y') e^{-ik_y(y-y')} = \int dy' e^{-ik_y(y-y')} \int \frac{dx dx'}{w} \cos \Phi_0(x) \sin \Phi_0(x') \Phi_0'(x') G_{yx}(xx')$$

$$\cos \Phi_0 \rightarrow c, \quad \sin \Phi_0 \rightarrow \sqrt{1-c^2}, \quad \Phi_0' \rightarrow c/\delta$$

$$\int dx \int dx' \frac{c^2}{\delta \sqrt{1-c^2}} G_{yx}(xx', yy'); \quad \int_{-\delta}^{\delta} dx \int_{-\delta}^{\delta} dx' e^{ik_x(x-x')} = \frac{4}{k_x^2} \sin^2 k_x \delta$$

$$\Gamma_{cs}(ky) = \int dy' e^{-ik_y(y-y')} \frac{1}{2\delta} \frac{c^2 \sqrt{1-c^2}}{\delta} \int dx \int dx' G_{yx} = \frac{c^2 \sqrt{1-c^2}}{2\delta^2} \int dy' e^{-ik_y y} \times$$

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$$\int dx \int dx' \int \frac{d^2 \vec{x}}{(2\pi)^2} e^{ik_x(\vec{x}-\vec{x}')} (-4\pi) \frac{1}{x^2} \delta(xL). \text{ by me unare:}$$

$$\Gamma_{cs}(ky) = \int \frac{dx dx'}{w} \cos \Phi(x) \sin \Phi(x') \Phi'(x') (-2) \int dk_x e^{ik_x(x-x')} \frac{k_x k_y}{k^2} f(kL) \approx$$

$$\approx (-2) k_y \int \frac{dx dx'}{w} \cos \Phi(x) \sin \Phi(x') \Phi'(x') \int dk_x e^{ik_x(x-x')} \frac{k_x}{k^2} f(kL) \approx$$

$$\Gamma_{cs}(ky) = \frac{1}{2\delta^2} c^2 \sqrt{1-c^2} (-2) k_y \int_{-\delta}^{\delta} dx \int_{-\delta}^{\delta} dx' \int dk_x e^{ik_x(x-x')} \frac{k_x}{k^2} f(kL) =$$

$$= -\frac{c^2 \sqrt{1-c^2}}{\delta^2} k_y 4 \int dk_x \frac{\sin^2 k_x \delta}{k_x^2} \cdot \frac{k_x}{k^2} f(kL), \text{ no nago } \sin \Phi_0(x) = \text{sign}(x) \sqrt{1-c^2}$$

$$\int_{-\delta}^{\delta} dx \cos \Phi(x) e^{ik_x x} = c \int_{-\delta}^{\delta} dx \cos k_x x = c \left(\frac{1}{k_x} \right) \sin k_x x \Big|_{-\delta}^{\delta} = \frac{c}{k_x} 2 \sin k_x \delta$$

$$\int_{-\delta}^{\delta} dx' \sin \Phi(x') \Phi'(x') e^{-ik_x x'} = \frac{c}{\delta} \sqrt{1-c^2} \int_{-\delta}^{\delta} dx' s(x') e^{-ik_x x'} = \frac{c}{\delta} \sqrt{1-c^2} (-i) \int_{-\delta}^{\delta} dx' s(x') \sin k_x x' =$$

$$= -i \frac{c}{\delta} \sqrt{1-c^2} 2 \int_0^{\delta} dx \sin k_x x = (\dots) \left(-\frac{1}{k_x} \right) \cos k_x x \Big|_0^{\delta} = -\frac{c}{\delta} \sqrt{1-c^2} \frac{2}{k_x} (1 - \cos k_x \delta)$$

$$\Gamma_{cs}(ky) = (-2) k_y \frac{1}{2\delta} \int dk_x \left[\frac{c}{k_x} 2 \sin k_x \delta \right] (-i) \frac{c}{\delta} \sqrt{1-c^2} \frac{2}{k_x} (1 - \cos k_x \delta) \frac{k_x}{k^2} f(kL) =$$

$$= 4 i k_y \frac{c^2 \sqrt{1-c^2}}{\delta^2} \int dk_x \frac{\sin k_x \delta}{k_x} \frac{(1 - \cos k_x \delta)}{k^2} f(kL) = 2 i k_y \frac{c^2 \sqrt{1-c^2}}{\delta^2} \int_{-\infty}^{\infty} dk_x \frac{\sin k_x \delta (1 - \cos k_x \delta)}{k^2}$$

$$\Gamma_{cs}(ky) = 2 i k_y L \frac{c^2 \sqrt{1-c^2}}{\delta} \int_{-\infty}^{\infty} \frac{\sin x (1 - \cos x)}{x^2} dx. \text{ (i) perzgnorat } e^{ik(\vec{s}-\vec{s}')} \text{ B } G_{\beta}(\vec{s}, \vec{s}')$$

$$\text{Neprevar } \Gamma_{ss}(ky=0) \text{ c yzrem nerestonom } \sin \Phi_0(x) = \text{th}(x/\delta).$$

$$\Gamma_{ss}(0) = \frac{1}{2\delta} \int dx \int dx' \sin \Phi(x) \sin \Phi(x') \Phi'(x') g_{xx}(x-x'), \quad g_{xx}(x-x') = (-2) \int dk f(kL) \cos kx$$

$$g_{xx}(x, x') = (-4) \int dk f(kL) [\cos kx \cos kx' + \sin kx \sin kx'] = \frac{2}{L} \ln \left[\frac{\Delta x^2}{\Delta x^2 + L^2} \right]$$

$$\int_{-\delta}^{\delta} dx \sin \Phi(x) \sin k_x x = 2 \int_0^{\delta} dx \sqrt{1-c^2} \sin k_x x = 2 \sqrt{1-c^2} \frac{1}{k} (1 - \cos k \delta)$$

$$\int_{-\delta}^{\delta} dx' \sin \Phi(x') \Phi'(x') \sin k_x x' = 2 \sqrt{1-c^2} \cdot \frac{c}{\delta} \int_0^{\delta} dx' \sin k_x x' = \frac{2c}{\delta} \sqrt{1-c^2} \frac{1}{k} (1 - \cos k \delta)$$

$$\Rightarrow \Gamma_{ss}(0) = \frac{1}{2\delta} \frac{4c}{\delta} (1-c^2) (-4) \int dk f(kL) \frac{1}{k^2} (1 - \cos k \delta)^2 = -\frac{8c}{\delta} (1-c^2) \int dk f(kL) \frac{(1 - \cos k \delta)^2}{k^2}$$

$$\text{Pance } \Gamma_{ss}(0) = \frac{1}{2} \frac{c}{\delta} (1-c^2) (-1) 2\pi [3 + 2 \ln \frac{2}{p}]$$

$$\Gamma_{sc}(ky) = \int \frac{dx dx'}{w} \sin \Phi(x) \cos \Phi(x') \Phi'(x') (-2) \int dk_x e^{ik_x(x-x')} \frac{k_x k_y}{k^2} f(kL)$$

$$\int dx \sin \Phi(x) e^{ik_x x} = \frac{c}{\delta} \sqrt{1-c^2} \frac{2}{k_x} (1 - \cos k_x \delta), \quad \int dx' \cos \Phi(x') \Phi'(x') e^{-ik_x x'} = \frac{c}{\delta} \frac{c}{k_x} 2 \sin k_x \delta$$

$$\Gamma_{sc}(ky) = -\Gamma_{cs}(ky) = -2 i k_y L \frac{c^2 \sqrt{1-c^2}}{\delta} \int_{-\infty}^{\infty} \frac{\sin t (1 - \cos t)}{t^2} dt \rightarrow \text{for } \text{same } g_{\text{same}}$$

$$e^{ik_y(x-x')} = \cos k_y(x-x') + i \sin k_y(x-x') \text{ u v/pu } \int_{-\infty}^{\infty} dk_x e^{ik_x(x-x')} k_x F(|k|)$$

Martxo 10

$$9 \quad G_{\alpha\beta}(\vec{r}, \vec{r}') = \text{Re} \left\{ \frac{d^2 k}{(2\pi)^2} G_{\alpha\beta}(\vec{k}) e^{i\vec{k} \cdot (\vec{r} - \vec{r}')} \right\} = \frac{d^2 k}{(2\pi)^2} G_{\alpha\beta}(\vec{k}) \cos k_x \Delta x \cos k_y \Delta y$$

Ostirala - Viernes

$$\cos k_x \Delta x = \cos[k_x \Delta x + k_y \Delta y] = \cos k_x \Delta x \cdot \cos k_y \Delta y - \sin k_x \Delta x \cdot \sin k_y \Delta y$$

$$G_{\alpha\beta}(\vec{r}, \vec{r}') = G_{\alpha\beta}(\vec{r} - \vec{r}') \text{ abn. berria no } \vec{r} \rightarrow -\vec{r}, \vec{r}' \rightarrow -\vec{r}' \text{ u } (\vec{r} - \vec{r}') \rightarrow -(\vec{r} - \vec{r}')$$

$$9 \quad G_{\alpha\beta}(\vec{r}, \vec{r}') = -2 \frac{\partial^2}{\partial x \partial x'} \Phi\left(\frac{|\vec{r} - \vec{r}'|}{L}\right) \Rightarrow \Gamma_{ss}(y), \Gamma_{cc}(y) \text{ abn. berria } y = y - y'$$

$$10 \quad \Gamma_{cc,ss}(k_y) = \int dy \Gamma_{cc,ss}(y) e^{-ik_y y} = \int dy \Gamma_{cc,ss}(y) \cos k_y y, \quad y = y - y'$$

$$11 \quad \Gamma_{cs,sc}(k_y) = \int dy \Gamma_{cs,sc}(y) e^{-ik_y y} = -i \int dy \Gamma_{cs,sc}(y) \sin k_y y$$

$$12 \quad G_{xy}(\vec{r}, \vec{r}') = G_{yx}(\vec{r}, \vec{r}') = \frac{d^2 k}{(2\pi)^2} G_{xy,yx}(\vec{k}) [\cos k_x \Delta x \cos k_y \Delta y - \sin k_x \Delta x \sin k_y \Delta y]$$

$$13 \quad \Gamma_{cs}(y-y') = \int \frac{dx dx'}{w} \cos \Phi(x) \sin \Phi(x') \Phi'(x') G_{yx}(xx', yy') =$$

$$= \int \frac{dx dx'}{w} \cos \Phi(x) \sin \Phi(x') \Phi'(x') (-1) \frac{d^2 k}{(2\pi)^2} G_{yx}(\vec{k}) \sin k_x(x-x') \sin k_y(y-y') =$$

$$= (-1) \int \frac{dx dx'}{w} \cos \Phi(x) \sin \Phi(x') \Phi'(x') \int \frac{dk_x dk_y}{(2\pi)^2} G_{yx}(\vec{k}) [-\cos k_x x \cdot \sin k_x x'] \sin k_y(y-y')$$

$$\Gamma_{sc}(y-y') = (-1) \int \frac{dx dx'}{w} \sin \Phi(x) \cos \Phi(x') \Phi'(x') G_{xy}(\vec{k}) [\sin k_x x \cdot \cos k_x x'] \sin k_y(y-y')$$

$$25/III \quad \text{Editor APEX u/muena zarfua konpresioa vortex-pair paper no. ~450 GeV}$$

$$G_{xy} = G_{yx} = G_{xy}(xx', yy') = G_{xy}(x-x', y-y') = G_{xy}(\vec{r} - \vec{r}') \text{ berria } x \rightarrow x', y \rightarrow y', \text{ i.e. } (\vec{r} - \vec{r}') \rightarrow -(\vec{r} - \vec{r}')$$

$$10 \quad \text{No force } \Gamma_{sc} + \Gamma_{cs} = 0 \text{ u ke egiten zena } \sim k_y \text{ b } p_z \text{ zuzenean } u(k_y)$$

$$10 \quad \text{un. } y \text{ p-e } \text{ zarfua } q(y, \omega) = q(y): 23/III \text{ ban } q(y) = e^{ik_y y} - \text{cargua } \text{S. L. Ginzburg-JAP'1984. } f_1 \neq F(y) \text{ que } u \text{ zuzenean } \sim \text{no } y$$

$$f_1 = \frac{\omega^2 \Phi_0'}{4\pi m_s^2} = f_1 - \frac{\omega^2}{4\pi} \langle \Phi_0' \rangle = \lambda; \quad \lambda q(y) = \int dy' \Gamma(y, y') q(y')$$

[illegible]

$G_{\alpha\beta}(\vec{r}, \vec{r}') = \int \frac{d^2 k}{(2\pi)^2} G_{\alpha\beta}(k) e^{ik \cdot (\vec{r} - \vec{r}')} , \quad G_{\alpha\beta}(k) = -4\pi \frac{k_\alpha k_\beta}{k^2} \epsilon(k)$

$\int dy' G_{\alpha\beta}(xx', yy') e^{ixy'} = \int dy' \int \frac{d^2 k}{(2\pi)^2} G_{\alpha\beta}(k) e^{ik_x \Delta x} e^{iky(y-y')} e^{ixy'} =$

$= \int \frac{d^2 k}{(2\pi)^2} G_{\alpha\beta}(k) e^{ik_x \Delta x} e^{iky y} \int dy' e^{i(\alpha - k_y)y'} = \int_{-\infty}^{\infty} dy' e^{i(\alpha - k_y)y'} = 2\pi \delta(k_y - \alpha) =$

$= 2\pi \int \frac{d^2 k}{(2\pi)^2} G_{\alpha\beta}(k_x, k_y) e^{ik_x \Delta x} e^{iky y} \delta(k_y - \alpha) = e^{ixy} \int \frac{dk_x}{2\pi} G_{\alpha\beta}(k_x, \alpha) e^{ik_x \Delta x}$

т.е. e^{ixy} есть СФ функции $G_{\alpha\beta}(\vec{r}, \vec{r}')$ при $y = \infty$.

$\lambda e^{ixy} = \int dy' \Gamma(y, y') e^{ixy'} \quad G_{\alpha\beta}(xx', \infty) = \frac{1}{2\pi} \int dk_x G_{\alpha\beta}(k_x, \alpha) e^{ik_x(x-x')} = G_{\alpha\beta}(k_x, \alpha)$

$G_{\alpha\beta}(k_x, \alpha) \sim \cos k_x(x-x') \Rightarrow G_{\alpha\beta}(xx', \infty) = \int \frac{dk_x}{2\pi} G_{\alpha\beta}(k_x, \alpha) \cos k_x(x-x') , \quad G_{\alpha\beta}(k_x, \alpha) = -4\pi \frac{k_\alpha k_\beta}{k^2} \epsilon(k)$

Но если $\alpha = 0$ то $G_{\alpha\beta}(k_x, \alpha) \sim \cos k_x(x-x') \neq 0$, т.е. $G_{xx}, G_{yy} \neq 0$

$\Gamma(y, y') = \Gamma_{ss}(y, y') + \Gamma_{cc}(y, y')$ и все функции четные.

$$\Gamma(y') = \int \frac{dx dx'}{w} \sin \varphi(x) \sin \varphi(x') \varphi'(x') G_{xx}(xx', yy') + \int \frac{dx dx'}{w} \cos \varphi(x) \cos \varphi(x') \varphi'(x') G_{yy}(xx', yy')$$

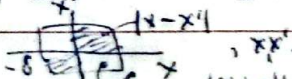
то $\Gamma_{cc} \sim G_{yy} \sim x^2$, и значит $\sim x$ гравитация в $G_{xx} \sim \Gamma_{ss}$.

Выведем если $G_{xx}(\vec{k}) = -4\pi \frac{k_x^2}{k_x^2 + k_y^2} f(kL)$, то $\int dk_x G_{xx}(\vec{k})$ может зависеть от k_y .
 $G_{xx}(x, x)$ известна, это ФГ строим с $k_y = x$, и $\langle \dots \rangle_z$:

$G_{xx}(xx', x) = -4\pi\delta(x-x') - \frac{4}{L} \left[K_0(x\sqrt{(x-x')^2 + L^2}) - K_0(x(x-x')) \right]$
 Wenn $x = y = 0$ dann $G_{xx} \rightarrow g_{xx}(xx') = -4\pi\delta - \frac{2}{L} \ln \left[\frac{\Delta x^2}{\Delta x^2 + L^2} \right]$
 $\lambda = \lambda(x) = \Gamma(x), \quad \Gamma(x) = \Gamma_{ss}(x) + \Gamma_{cc}(x)$
 $\Gamma_{ss}(x) = \int \frac{dx' dx}{w} \sin\Phi(x) \sin\Phi(x') \Phi'(x') G_{xx}(xx', x), \quad G_{xx}(xx', x) = \int_{-\infty}^{\infty} dy G_{xx}(x, y) \cos xy$

17. Будем $G_{xy}(x, x')$ и $\int dx dx' (\dots)$ можно поменять. $G_{yx}(x, x') = \frac{d}{dx} G(k_x, x) \cos k_x x$
 $\sin \Phi(x) = \ln(x/5) - \text{нерег.}$ и $\cos k_x(x-x') = \cos k_x x \cdot \cos k_x x' + \sin k_x x \cdot \sin k_x x'$
 18. $\int dx \sin \Phi(x) \sin k_x x = \int dx \ln \frac{x}{5} \cdot \sin k_x x$ - не можем в Гр. Попробуем

19) Придем к выражению: $\sin \Phi(x) \rightarrow s(x) \sqrt{1-c^2}$ (использ. генерации f_1 и $\Gamma_{ss}(0)$)
 $\Gamma_{ss}(x) = \frac{1}{28} \int_{-\delta}^{\delta} dx' \int_{-\delta}^{\delta} dx'' (1-c^2) \frac{c}{\delta} s(x) s(x') G_{xx}(xx', x) = \frac{1}{2} \frac{c}{\delta^2} (1-c^2) \int dx \int dx' s(x) s(x') G_{xx}(xx', x)$

$S(x) = \operatorname{sgn}(x)$. $N_0(x) = \frac{2}{\pi} (\ln x + \gamma - \ln 2) + O(x^2)$, $x \rightarrow 0$.
 $J_0(x) = 1 - \frac{x^2}{4 \cdot 1!}$. $K_0(z) = -I_0(z) \cdot \ln \frac{z}{2} + \sum_{k=0}^{\infty} \frac{z^{2k}}{2^{2k} (k!)^2} \psi(k+1)$
 $I_0(z) = \sum_{k=0}^{\infty} \frac{(z/2)^{2k}}{(k!)^2}$, $\rightarrow K_0(z) = -\left[1 + \frac{(z/2)^2}{(1!)^2}\right] \ln \frac{z}{2} + \psi(1) + \frac{z^2}{2^2} \psi(2) =$
 $= \psi(1) - \ln \frac{z}{2} + \frac{z^2}{4} \left[\psi(2) - \ln \frac{z}{2}\right]$. y wenn $z = x \sqrt{\Delta x^2 + L^2}$ um $x \gg x_L$.
 $G_{xx} = F(1x - x'1)$.  $x, x' \geq 0$. $\int_{-8}^8 \int_{-8}^8 S(x) S(x') G_{xx} = 2 \int_0^8 \int_0^8 \frac{1}{x+x'} [G(x-x, x+x') - G(1x+x'1)]$

Escaneado con CamScanner

12

telehena

$$\frac{k_x(x-x')}{-B_0}$$

$$\frac{1}{k^2}$$

— мен

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$$\Delta x^2 + L^2$$

$$G(x, y)$$

$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$$f(x) = \frac{1}{x^2} \quad f'(x) = -\frac{2}{x^3}$$

$$\psi(2) =$$

for

$\nabla^2 u = 0$ en $z = 0$, $u = 0$ en $z = L$.
 $Z_0 = \sum_{k=-\infty}^{\infty} J_k(s) Z_{0+k}(z) e^{ik\varphi}$, $R^2 = s^2 + z^2$.
 $K_0(R) = \sum_{k=-\infty}^{\infty} e^{ik\pi/2} J_k(s) Z_k(z) = \sum_{k=-\infty}^{\infty} e^{ik\pi/2} J_k(s) K_k(zL) = \sum_{k=-\infty}^{\infty} e^{ik\pi/2} J_k(s) K_k(zL)$

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$K_0(xR) - K_0(x|xR|) = K_0(x|xR|) J_0(xL) - K_0(x|xR|) + e^{-i\pi/2} K_1(x|xR|) J_1(xL)$
 $+ e^{i\pi/2} K_1(x|xR|) J_1(xL) = K_0(x|xR|) [J_0(xL) - 1] + K_1(x|xR|) 2i \sin \frac{\pi}{2}$
 $K_0(x|xR|) K_0(x|xR|)$ anamorfosis na G_{xx} .

$G_{xx}(x, x') = \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x G_{xx}(k_x, x) \cos k_x(x-x')$
 $= \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x \left[\int_{-\delta}^{\delta} dx' S(x) S(x') \sin k_x x \sin k_x x' \right] \cos k_x(x-x')$
 $= \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x \left[\int_{-\delta}^{\delta} dx' \sin k_x x' \right]^2 \cos k_x(x-x')$

$\Gamma_{ss}(x) = \frac{1}{2} \frac{c}{s^2} (1-c^2) \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x G_{xx}(k_x, x) \left[\int_{-\delta}^{\delta} dx' S(x) S(x') \cos k_x(x-x') \right]$
 $= \frac{1}{2} \frac{c}{s^2} (1-c^2) \frac{(-4\pi)}{2\pi} \frac{1}{2} \int_{-\infty}^{\infty} dk_x \frac{k_x^2}{k_x^2 + x^2} f(kL) (1 - \cos k_x \delta)$
 $\int_{-\infty}^{\infty} dk_x \frac{f(kL)}{k_x^2 + x^2} \sin^4 k_x \delta \approx \frac{1}{2} L \int_{-\infty}^{\infty} dk_x \frac{\sin^4 k_x \delta}{(k_x^2 + x^2)^{3/2}}$

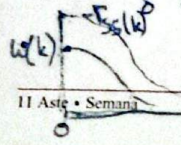
$K_0(xR) - K_0(x|xR|) \approx [J_0(xL) - 1] K_0(x|xR|) = [J_0(xL) - 1] \left[\psi(1) - \ln \frac{1}{2} \pi |xR| \right]$
 $\Gamma_{ss}(x) = -\frac{c}{s^2} (1-c^2) \cdot 16 \int_{-\infty}^{\infty} dk_x \frac{f(kL)}{k_x^2 + x^2} \sin^4 k_x \delta$
 $xL = (2n-1) \frac{\pi}{2} \frac{1}{R}$

$\Gamma_{cc}(x) = \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x \cos \Phi(x) \cos \Phi(x') \Phi'(x') G_{yy}(x, x')$
 $\Gamma_{cc}(x) = \frac{c^3}{8} \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x \int_{-\delta}^{\delta} dx' G_{yy}(x, x')$
 $\int_{-\delta}^{\delta} dx' \cos k_x x' \cos k_x x = \left[\frac{1}{k_x} \sin k_x x \right]_{-\delta}^{\delta} = \frac{1}{k_x} 4 \sin^2 k_x \delta$

$\Gamma_{cc}(x) = \frac{c^3}{8} \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x \int_{-\delta}^{\delta} dx' \frac{1}{k_x^2 + x^2} f(kL) \cos k_x(x-x') = -\frac{c^3}{8^2} \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x \frac{x^2}{k_x^2 + x^2} f(kL) \sin^2 k_x \delta$
 $\frac{\omega^2(x)}{v_M^2} = \frac{1}{v_M^2} [f_1 - \Gamma(x)]$, $\Gamma(x) = \Gamma_{ss}(x) + \Gamma_{cc}(x)$

No ecm l (paguap bgaru dy) $\rightarrow \infty$, so $G_{yy} = 0$ u $\Gamma_{cc} = 0$.
 $\ell \rightarrow \infty$ gubue $g(y) e^{ixy}$ ecm $c\Phi$. Oabum $\Gamma_{ss}(x)$.

$f_1 = \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x \cos \Phi(x) \Phi'(x) \cos \Phi(x') \left[\int_{-\delta}^{\delta} dx' G_{xx}(x, x') \right] = \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x \cos \Phi(x) \cos \Phi(x') G_{xx}(x, x')$
 $f_1 \approx \frac{c^3}{8} \frac{1}{2\pi} \int_{-\infty}^{\infty} dk_x \int_{-\delta}^{\delta} dx' \int_{-\delta}^{\delta} dx'' \frac{1}{k_x^2 + x^2} f(kL) \cos k_x(x-x'')$
 $\omega^2(x) \sim [f_1 - \Gamma_{ss}(x)]$, $-\Gamma_{ss}(x)$ wagaer $c \uparrow$



$$\omega^2(x) \sim \omega^2(0) - a x^2, \quad \omega(x) \sim \sqrt{\omega^2(0) - a x^2}, \quad x_L < x < x_R$$

$$f_1 = \int dx dx' \cos \varphi(x) \varphi'(x) \cos \varphi(x') [-4\pi \delta(x-x') - \frac{2}{L} \ln \left(\frac{\Delta x^2}{\Delta x^2 + L^2} \right)]$$

$$f_{ss}(x) = \int dx dx' \sin \varphi(x) \sin \varphi(x') \varphi'(x') [-4\pi \delta(x-x') - \frac{2}{L} [K_0(k\sqrt{\Delta x^2 + L^2}) - K_0(x|x'|)]]$$

$$\int dx dx' \cos \varphi(x) \cos \varphi(x') \varphi'(x) \delta(x-x') = \int dx \cos^2 \varphi(x) \frac{\partial \varphi}{\partial x} = \int d\varphi \cos^2 \varphi = \frac{\pi}{2}$$

$$\int dx dx' \sin \varphi(x) \sin \varphi(x') \varphi'(x') \delta(x-x') = \int dx \sin^2 \varphi(x) \frac{\partial \varphi}{\partial x} = \int d\varphi \sin^2 \varphi = \frac{\pi}{2}$$

$$f_1 - f_{ss}(x) = -\frac{2}{L} \int dx dx' \cos \varphi(x) \cos \varphi(x') \varphi'(x) \ln \left[\frac{\Delta x^2}{\Delta x^2 + L^2} \right] + \frac{4}{L} \int dx dx' \sin \varphi(x) \sin \varphi(x') \varphi'(x') [K_0(x\sqrt{\Delta x^2 + L^2}) - K_0(x|x'|)]$$

$$\rightarrow f_1 - f_{ss}(x) = \frac{2}{p} \int dx dx' \frac{1}{\text{ch}^2 x} \frac{1}{\text{ch} x'} \ln \left[\frac{\Delta x^2 + p^2}{\Delta x^2} \right] = \frac{4}{p} \int dx dx' \text{th} x \cdot \frac{\text{th} x'}{\text{ch} x'} [K_0(x|x-x'|) - K_0(x\sqrt{(x-x')^2 + p^2})]$$

$$\langle \Phi_0 \rangle_x = \int dx \frac{1}{\delta} \frac{1}{\text{ch} x/\delta} = \int_{-\infty}^{\infty} \frac{dz}{\text{ch} z} = \pi, \quad \frac{\omega^2(x)}{\omega_M^2} = \frac{1}{4\pi^2} [f_1 - f_{ss}(x)]$$

$$G_{xx}(xx', x=0) = \int \frac{dk}{2\pi} G_{xx}(k, 0) = -2 \int \frac{dk}{2\pi} f(k) \cos k(x-x')$$

$$\tilde{f}_1 = \frac{2}{p} \int dx dx' \frac{1}{\text{ch}^2 x} \frac{1}{\text{ch} x'} \ln \left[\frac{\Delta x^2 + p^2}{\Delta x^2} \right] = \left(\frac{2}{p} \right) \int dx dx' \frac{1}{\text{ch}^2 x} \frac{1}{\text{ch} x'} [G_{xx}(xx', x=0) + 4\pi \delta(x-x')] =$$

$$= \int dx dx' \frac{1}{\text{ch}^2 x} \frac{1}{\text{ch} x'} (-2) \int \frac{dk}{2\pi} f(k) \cos kx \cdot \cos kx' + 4\pi \int \frac{dx}{\text{ch}^3 x} = (-2) \int \frac{dk}{2\pi} f(k) \cos kx \cdot \cos kx' + 4\pi \int \frac{dx}{\text{ch}^3 x}$$

$$= (-2) \int \frac{dk}{2\pi} f(k) \cdot \frac{2 \cdot \pi k}{2 \text{sh}(\pi/2 k)} \cdot \frac{2 \cdot \pi}{2} \frac{1}{\text{ch}(\pi k/2)} + (\dots) = -4\pi^2 \int \frac{dk}{2\pi} f(k) \frac{1}{\text{sh}(\pi k)} + 4\pi \int \frac{dx}{\text{ch}^3 x} = 2\pi^2 - 4\pi^2 \int \frac{dk}{2\pi} f(k) \frac{1}{\text{sh}(\pi k)}$$

$$x_n = k_y^n \delta = (2n-1) \frac{\pi}{2} \frac{\delta}{R}, \quad \delta/R \approx \frac{100 \text{ nm}}{500 \text{ nm}} \approx 0.2, \quad (k_y \delta) \approx (2n-1) \cdot 0.3$$

$$\frac{\omega(0)}{\omega_M} = 0.104 \quad \mu\mu \quad p=0.1, \quad \text{i.e.} \quad \omega(0)/2\pi \approx 3 \text{ GHz} - \text{pazyma}$$

28/III ~~Other~~ MICINN-MSF: zamo... standard form za 2010 u...
wocian or Arantxa to Amelia (Vicerrectorado), kerpene...
bujaburo b MICINN. Other MICINN-Orcana: cgeren c Arantxa, on-
line subm. to MICINN-site u kerpene to Arantxa Ibele (Vicerrectorado)
uod UPV cgeren cker wofumo atore - pecnerata document, u za wofumo
Vicerrectorado wocian ero b MICINN.
Obayng. c Arantxa simul. FMR-det-Gleb (que R=500nm) ckeren SW-mod(?)
" c Orc. ee zameri Master. Pasore nag D. Vortex paper - Mith. Paprag.
29/III Amelia u Arantxa (Vicerrectorado) wofobpym to Arantxa u-ck
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D. Vortex dyn. paper c Paprag. ter. bell to Paprag: on ckeren simul. p...
Dora. uamuna na PDI. Cuserenaro wn-calc.

$$\omega^2(x) \sim \omega(0) - a x^2, \quad \omega(x) \sim \sqrt{\omega^2(0) - a x^2}, \quad x_L < x < x_R$$

$$f_1 = \int dx dx' \cos \varphi(x) \Phi'(x) \cos \varphi(x') [-4\pi \delta(x-x') - \frac{2}{L} \ln(\frac{\Delta x^2}{\Delta x^2 + L^2})]$$

$$f_{ss}(x) = \int dx dx' \sin \varphi(x) \sin \varphi(x') \Phi'(x') [-4\pi \delta(x-x') - \frac{2}{L} [K_0(x\sqrt{\Delta x^2 + L^2}) - K_0(x\sqrt{\Delta x^2 + L^2})]]$$

$$\int dx x' \cos \varphi(x) \cos \varphi(x') \Phi'(x) \delta(x-x') = \int dx \cos^2 \varphi(x) \frac{\partial \varphi}{\partial x} = \int d\varphi \cos^2 \varphi =$$

$$= \int d\varphi \frac{1}{2} (1 + \cos 2\varphi) = \frac{1}{2} \varphi + \frac{1}{2} \frac{\sin 2\varphi}{2} \Big|_{-\pi/2}^{\pi/2} = \frac{1}{2} (\frac{\pi}{2} + \frac{\pi}{2}) + \frac{1}{4} \cdot 0 = \frac{\pi}{2}$$

$$\int dx dx' \sin \varphi(x) \sin \varphi(x') \Phi'(x') \delta(x-x') = \int dx \sin^2 \varphi(x) \frac{\partial \varphi}{\partial x} = \int d\varphi \frac{1}{2} (1 - \cos 2\varphi) = \pi/2$$

$$f_1 - f_{ss}(x) = -\frac{2}{L} \int dx dx' \cos \varphi(x) \cos \varphi(x') \Phi'(x) \ln \left[\frac{\Delta x^2}{\Delta x^2 + L^2} \right] +$$

$$+ \frac{4}{L} \int dx dx' \sin \varphi(x) \sin \varphi(x') \Phi'(x') [K_0(x\sqrt{\Delta x^2 + L^2}) - K_0(x\sqrt{\Delta x^2 + L^2})]$$

$$w \rightarrow \text{reynolds}, r.k. \cdot \varphi' \sim \frac{1}{\delta} \cdot x \rightarrow x/\delta, \quad (L/\delta = p), \quad x \rightarrow x\delta.$$

$$\begin{cases} \cos \varphi = \frac{1}{\cosh x/\delta} \\ \sin \varphi = \frac{\tanh x/\delta}{\cosh x/\delta} \\ \varphi' = \frac{1}{\delta \cosh x/\delta} \end{cases}$$

$$\rightarrow f_1 - f_{ss}(x) = \frac{2}{p} \int dx dx' \frac{1}{\cosh^2 x} \frac{1}{\cosh x'} \ln \left[\frac{\Delta x^2 + p^2}{\Delta x^2} \right]$$

$$= \frac{4}{p} \int dx \int dx' \tanh x \cdot \frac{\tanh x'}{\cosh x'} [K_0(x|x-x'|) - K_0(x\sqrt{(x-x')^2 + p^2})]$$

$$\langle \Phi_0' \rangle_x = \int dx \frac{1}{\delta} \frac{1}{\cosh x/\delta} = \int_{-\infty}^{\infty} \frac{dz}{\cosh z} = \pi, \quad \frac{\omega^2(x)}{\omega_m^2} = \frac{1}{4\pi^2} [f_1 - f_{ss}(x)]$$

MathCad & SW-Neel DW-Aliev" the Vicerector university of ln(.....).

$$g_{xx}(xx') = G_{xx}(xx', x=0) = -4\pi \delta(x-x') - \frac{2}{p} \ln \left(\frac{\Delta x^2}{\Delta x^2 + p^2} \right)$$

$$G_{xx}(xx', x=0) = \int \frac{dk_x}{2\pi} G_{xx}(k_x, 0) = -2 \int dk f(k) \cos k(x-x')$$

$$f_1 = \frac{2}{p} \int dx \frac{dx'}{\cosh^2 x \cosh x'} \ln \left[\frac{\Delta x^2 + p^2}{\Delta x^2} \right] = \left(\frac{2}{p} \right) \int dx \frac{dx'}{\cosh^2 x \cosh x'} [G_{xx}(xx', x=0) + 4\pi \delta(x-x')] =$$

$$= \int dx \frac{dx'}{\cosh^2 x \cosh x'} (-2) \int_{-\infty}^{\infty} dk f(k) \cos kx \cdot \cos kx' + 4\pi \int dx \frac{dx'}{\cosh^2 x} (-2) \int_{-\infty}^{\infty} dk f(kp) \int dx \frac{\cos kx}{\cosh^2 x}$$

$$\int dx \frac{dx'}{\cosh^2 x \cosh x'} \cos kx \cos kx' + (\dots) = (-2) \int dk f \cdot 2 \cdot \frac{\pi k}{2 \sinh(\pi/2 k)} \cdot 2 \cdot \frac{\pi}{2} \frac{1}{\cosh(\pi k/2)} + (\dots) =$$

$$= -4\pi^2 \int dk f(kp) \frac{k}{\sinh(\pi k)} + 4\pi \int dx \frac{dx'}{\cosh^2 x} = 2\pi^2 - 4\pi^2 \int dk f(kp) \frac{k}{\sinh(\pi k)}$$

$$x_n = k_y \delta = (2n-1) \frac{\pi}{2} \frac{\delta}{R}, \quad \delta/R \approx \frac{100 \text{ nm}}{500 \text{ nm}} \approx 0.2, \quad (k_y \delta) \approx (2n-1) \cdot 0.3$$

$$\frac{\omega(0)}{\omega_m} = 0.104 \quad \mu/\mu \quad p=0.1, \quad \text{i.e.} \quad \omega(0)/2\pi \approx 3 \text{ GHz} - \text{pazyma}$$

28/III Other MICINN-NSF: zano-men standard form za 2010 u
wosna or Arantxa to Amelia (Vicerectorado), korpene coapmna b-o
conpaburo b MICINN. Other MICINN-Orcana: cgelem c Arantxe. On-
line subm. to MICINN-site u nameem to Arantza Ibele (Vicerectorado)
uod UPV cgelem cbeo uopmno orere - pecneraxa document, u za uapmna
Vicerectorado uosna ero b MICINN.

Obyayng. c Arantxa simul. FMR-det-Gleb (que R=500nm) Cuomnae SW-mak(?)
c Orc. ee zandem Nazter. Pasore nag D. Urtex paper - Mith. Pappag.

29/III Amelia u Arantza (Vicerectorado) uapobepmna to Arantxa, uo cbe
MICINN-grants orera zemoos b MICINN Camu. Hamcamie
D. Urtex dyn. paper c Pappag. ter. bill to Pappag: on coapmna simul. pappag. 9
Dora. uamuna ro PDI. Cusemburo Wn-calc.

15

$$\lim_{p \rightarrow 0} (f_1 - f_{ss}(0)) = 4\pi \int dx \frac{(1 - \sinh^2 x)}{\cosh^3 x} = \text{const}(p) = 0 \quad (!)$$

Escaneado con CamScanner

$\sinh(x \pm y) = \sinh x \cosh y \pm \cosh x \sinh y$, $\cosh(x \pm y) = \cosh x \cosh y \pm \sinh x \sinh y$, $\tanh(x \pm y) = \frac{\tanh x \pm \tanh y}{1 \pm \tanh x \tanh y}$
 $1 - \sinh x \sinh x' = 1 - [\cosh x \cosh x' - \cosh(x-x')]$
 $\tilde{\Gamma}_{ss}(0) = \frac{2}{p} \int dx dx' \frac{1}{\cosh^2 x \cosh x'} \ln(\dots) = \frac{2}{p} \int dx \int_{-1}^1 \frac{\tanh x}{\cosh x} \frac{(\tanh x + \tanh z)}{1 + \tanh x \tanh z} \ln\left[\frac{z^2 + p^2}{z^2}\right]$

16

$\tanh(x \pm z) = \frac{1}{2} \tanh(x+z) + \frac{1}{2} \tanh(x-z) = \frac{1}{2} \frac{\tanh x + \tanh z}{1 + \tanh x \tanh z} + \frac{1}{2} \frac{\tanh x - \tanh z}{1 - \tanh x \tanh z}$
 $= \frac{1}{2} \frac{(\tanh x + \tanh z)(1 - \tanh x \tanh z) + (\tanh x - \tanh z)(1 + \tanh x \tanh z)}{1 - \tanh^2 x \tanh^2 z} = \tanh x \frac{1 - \tanh^2 z}{1 - \tanh^2 x \tanh^2 z} = \frac{\tanh x}{\cosh^2 z} \frac{1}{1 - \tanh^2 x \tanh^2 z}$

$\tilde{\Gamma}_{ss}(0) = \frac{2}{p} \int dx \int dz \frac{\tanh^2 x}{\cosh x} \frac{1}{1 - \tanh^2 x \tanh^2 z} \frac{1}{\cosh^2 z} \ln\left(\frac{z^2 + p^2}{z^2}\right)$, $\ln\left(\frac{z^2 + p^2}{z^2}\right) = 2\pi p \delta(z)$
 $\tilde{\Gamma}_{ss}(0) = \frac{2}{p} \int dx \int dz \frac{\tanh^2 x}{\cosh x} \frac{1}{1 - \tanh^2 x \tanh^2 z} \frac{1}{\cosh^2 z} \ln\left(\frac{z^2 + p^2}{z^2}\right) = \frac{2}{p} \int dx \frac{\tanh^2 x}{\cosh x} \frac{1}{1 - \tanh^2 x} \ln\left(\frac{p^2}{z^2}\right)$

$I(a) = \int dx \frac{\tanh^2 x}{\cosh x} \frac{1}{1 - \tanh^2 x a^2} = \left| \frac{u = \tanh x}{dx/\cosh x = du} \right| = \int_{-1}^1 \frac{u^2}{\sqrt{1-u^2} \sqrt{1-a^2 u^2}} = 2 \int_0^1 \frac{u^2}{\sqrt{1-u^2} \sqrt{1-a^2 u^2}}$
 $= \frac{2}{a^2} \int_0^1 \frac{du}{\sqrt{1-u^2} \sqrt{1-a^2 u^2}} = \frac{2}{a^2} (-1) \left[\frac{1}{\sqrt{1-a^2}} + \frac{2}{a^2} \int_0^1 \frac{du}{\sqrt{1-u^2} \sqrt{1-a^2 u^2}} \right]$

$I(a) = \int_0^1 \frac{du}{\sqrt{1-u^2} \sqrt{1-a^2 u^2}} = \left| \begin{matrix} u = \sin \theta \\ du = \cos \theta d\theta \end{matrix} \right| = \int_0^{\pi/2} \frac{d\theta}{(1-a^2 \sin^2 \theta)} = \frac{\pi}{2\sqrt{1-a^2}}$, $|a| < 1$

$I(a) = -\frac{2}{a^2} \frac{\pi}{2} + \frac{2}{a^2} \frac{\pi}{2} \frac{1}{\sqrt{1-a^2}} = \frac{\pi}{a^2} \left[\frac{1}{\sqrt{1-a^2}} - 1 \right] = \frac{\pi}{a^2} \left[\frac{1}{\sqrt{1-a^2}} - 1 \right] = \pi \tanh^2 z [\cosh z - 1]$

$\tilde{\Gamma}_{ss}(0) = \frac{2}{p} \int dz \pi \tanh^2 z (\cosh z - 1) \frac{1}{\cosh^2 z} \ln\left(\frac{z^2 + p^2}{z^2}\right) = \frac{2\pi}{p} \int dz \frac{(\cosh z - 1)}{\cosh^2 z} \ln\left(\frac{z^2 + p^2}{z^2}\right)$

$\cosh 2x = \cosh^2 x + \sinh^2 x = 1 + 2\sinh^2 x$, $\sinh 2x = 2\sinh x \cosh x$, $\frac{\cosh z - 1}{\cosh^2 z} = \frac{2\sinh^2 z/2}{4\sinh^2 z/2 \cosh^2 z/2} = \frac{1}{2} \frac{1}{\cosh^2 z/2}$
 $\tilde{\Gamma}_{ss}(0) = \frac{\pi}{p} \int_{-\infty}^{\infty} dz \frac{1}{\cosh^2 z/2} \ln\left(\frac{z^2 + p^2}{z^2}\right)$, $\frac{1}{2} \ln\left(\frac{z^2 + p^2}{z^2}\right) = \int_0^{\infty} \frac{dk}{k} (1 - e^{-pk}) \cosh kz$

$\tilde{\Gamma}_{ss}(0) = \frac{2\pi}{p} \int_{-\infty}^{\infty} dz \frac{1}{\cosh^2 z/2} \int_0^{\infty} \frac{dk}{k} (1 - e^{-pk}) \cosh kz = \frac{4\pi}{p} \int_0^{\infty} \frac{dk}{k} (1 - e^{-pk}) \int_{-\infty}^{\infty} dz \frac{\cosh kz}{\cosh^2 z/2}$
 $= \frac{4\pi}{p} \int_0^{\infty} \frac{dk}{k} (1 - e^{-pk}) \frac{\pi}{2} \frac{k}{(\frac{1}{2})^2 \sinh(\frac{\pi k}{2})} = \frac{8\pi^2}{p} \int_0^{\infty} \frac{dk}{k} (1 - e^{-pk}) \frac{k}{\sinh(\pi k)}$

$\tilde{J}_1 = \frac{2}{p} \int dx \int dx' \frac{1}{\cosh^2 x \cosh x'} \ln\left(\frac{Ax^2 + p^2}{Ax'^2}\right) = 2\pi^2 - \frac{8\pi^2}{p^2} \int_0^{\infty} dk f(pk) \frac{k}{\sinh(\pi k)}$

$G_{pp}(\tilde{J}_1 - \tilde{\Gamma}_{ss}(0)) = [\tilde{J}_1 - \tilde{\Gamma}_{ss}(0)] = 2\pi^2 - \frac{8\pi^2}{p^2} \int_0^{\infty} dk \frac{k}{\sinh(\pi k)} \left[1 - \frac{1}{pk} (1 - e^{-pk}) \right] - \frac{8\pi^2}{p} \int_0^{\infty} \frac{dk}{k} (1 - e^{-pk}) \frac{k}{\sinh(\pi k)}$
 $= 2\pi^2 \left[\frac{1}{4} - \int_0^{\infty} dk \frac{k}{\sinh(\pi k)} \right] = 0(!)$

$\omega^2(x=0, p) = (\tilde{J}_1 - \tilde{\Gamma}_{ss}(0)) = 0 \quad \forall p$

Bege $q(y,t) \sim e^{i\pi y}$ u $x=0$ cosider. korekshunul Dn as whole.

From non confinement potential, puzup $110x \rightarrow \infty$, to $\omega(x=0)$ Domingo. Igandea
Ezartu bafat. Sabados
Puz 24/11/2018 $\omega^2(x=0) \sim p$, ho 3to puzupat korekshunul curren, $x \in [-\delta, \delta]$
Clirac bren $x \rightarrow x/\delta$, $p = 4/\delta$, ho $x \in [-\infty, \infty]$. $\omega^2(x=0)$ Syge korekshunul
 $u(x,p)$ eem d'astz upuzup $x \in [-1, 1]$ uun $x \in [-\alpha, \alpha]$, $\alpha = 2/3$.

$[\tilde{J}_1 - \tilde{\Gamma}_{ss}(0)] = \frac{2}{p} \int dx \int dx' \frac{(1 - \sinh x \sinh x')}{\cosh^2 x \cosh x'} \ln\left(\frac{Ax^2 + p^2}{Ax'^2}\right) = \frac{2}{p} \int dx \int dx' \frac{(1 - \sinh x \sinh x')}{\cosh^2 x \cosh x'} 2\pi p \delta(x-x')$
 $= 4\pi \int_{-\alpha}^{\alpha} dx (1 - \sinh^2 x) \neq 0$ u/m $p \rightarrow 0$ eem no x'' korekshunul upuzup $[-\alpha, \alpha]$.

$\omega^2(x=0, p) = \int_{-\alpha}^{\alpha} dx \left[\frac{2}{\cosh^3 x} - \frac{1}{\cosh x} \right] = \left| \frac{dx}{\cosh^3 x} = \frac{\sinh x}{2\cosh^2 x} + \frac{1}{2} \frac{dx}{\cosh x} \right| = \frac{\sinh x}{\cosh^2 x} - \frac{1}{\cosh x} \Big|_{-\alpha}^{\alpha}$

Martxo 3. Marzo $\tilde{f}_{ss}(x) = \frac{4}{p} \int_0^\infty dx' \frac{\text{th} x}{\text{ch} x} \text{th} x' [K_0(x|x-x') - K_0(x|x+x')]$

19 $\tilde{f}_{ss}(x) = \frac{2\pi}{p} \int_0^\infty dz \frac{1}{\text{ch}^2 \frac{z}{2}} [K_0(x|z) - K_0(x|\sqrt{z^2+p^2})]$

$K_0(z) = \psi_1 - \ln \frac{z}{2} + \frac{z^2}{4} [\psi_2 - \ln \frac{z}{2}]$, $|z| \ll 1$, $\psi_{1,2} = \psi(1), \psi(2)$.
Astelena. Lunes

8 Anzures: $K_0(x\sqrt{z^2+p^2}) = \int_0^\infty dk \cos kz \cdot \frac{\exp(-p\sqrt{x^2+k^2})}{\sqrt{x^2+k^2}}$

$K_0(x|z) - K_0(x|\sqrt{z^2+p^2}) = \int_0^\infty dk \cos kz \cdot [1 - \frac{p\sqrt{x^2+k^2}}{\dots}] e^{-p\sqrt{x^2+k^2}}$

$K_0(x|z) - K_0(x|\sqrt{z^2+p^2}) = \int_0^\infty dk \cos kz \cdot [1 - \exp(-p\sqrt{x^2+k^2})]$

$\int_0^\infty dz \frac{\cos kz}{\text{ch}^2 \frac{z}{2}} = 2\pi \frac{k}{\text{sh}(\pi k)} \Rightarrow \tilde{f}_{ss}(x) = \frac{4\pi^2}{p} \int_0^\infty dk \frac{[1 - \exp(-p\sqrt{x^2+k^2})]}{\sqrt{x^2+k^2}} \cdot \frac{k}{\text{sh}(\pi k)}$

11 $\frac{1}{x} (1 - e^{-x}) = \frac{1}{x} [1 - (1 - x + \frac{x^2}{2} - \dots)] = 1 - \frac{x}{2}$, $x \ll 1$, $x = p|k|$.

12 $\tilde{f}_{ss}(x) = \frac{4\pi^2}{p} \int_0^\infty dk \frac{k}{\text{sh}(\pi k)} [1 - \frac{1}{2} p\sqrt{x^2+k^2} + \dots] = 2\pi^2 - 4\pi^2 p \int_0^\infty dk \frac{k \sqrt{x^2+k^2}}{\text{sh}(\pi k)}$

$\tilde{f}_1 = 2\pi^2 - 4\pi^2 p \int_0^\infty dk \frac{k^2}{\text{sh}(\pi k)}$ when $p \ll 1$.

13 $\tilde{f}_1 - \tilde{f}_{ss}(x) = 4\pi^2 p \int_0^\infty dk \frac{k}{\text{sh}(\pi k)} [\sqrt{k^2+x^2} - k]$, $\frac{\omega^2(x)}{\omega_m^2} = p \int_0^\infty dk \frac{k}{\text{sh}(\pi k)} [\sqrt{k^2+x^2} - k]$

14 $\frac{\omega^2(x)}{\omega_m^2} = p F(x)$ when $p \ll 1$, ω - det in-plane. $[\tilde{f}_1 - \tilde{f}_{ss}(0)] = 2\pi^2 \frac{\text{sh} d}{\text{ch}^2 d}$ - gap

15 $\frac{\omega^2(x)}{\omega_m^2} = \frac{1}{4\pi^2} [\tilde{f}_1 - \tilde{f}_{ss}(x)] = \frac{2}{\pi} \frac{\text{sh} d}{\text{ch}^2 d} + p F(x)$, $F(0) = 0$

16 $F(x) = \int_0^\infty dk \frac{k}{\text{sh}(\pi k)} [\sqrt{k^2+x^2} - k]$, $p x_n = \frac{L}{\delta} (2n-1) \frac{\pi}{2} \frac{\delta}{R} = (2n-1) \frac{\pi}{2} \frac{L}{R}$

$p x_1 = \frac{\pi}{2} \frac{L}{R} = 1.5 (0.03 - 0.067) = 0.05 - 0.1$ - we see gap is small.

17 $p = L/\delta \approx 20 \mu\text{m} / 50 \mu\text{m} \sim 0.4$ the same. $\beta = \frac{L}{R} = 0.03 - 0.067$ same.

18 $\tilde{f}_{ss}(x) = \frac{8\pi^2}{p} \int_0^\infty dk \frac{k}{\text{sh}(\pi k)} [1 - \exp(-p\sqrt{x^2+k^2})]$, $\beta = p \frac{\delta}{R}$.

$\frac{\omega^2(x)}{\omega_m^2} = \frac{1}{4\pi^2} [\tilde{f}_1 - \tilde{f}_{ss}(x)] = \frac{1}{4\pi^2} [\tilde{f}_{ss}(0) - \tilde{f}_{ss}(x)] + \frac{2}{\pi} \frac{\text{sh} d}{\text{ch}^2 d}$

19 $\frac{\omega^2(x)}{\omega_m^2} = \frac{2}{\pi} \frac{\text{sh} d}{\text{ch}^2 d} + \frac{2}{p} \int_0^\infty dk \frac{k}{\text{sh}(\pi k)} [\frac{1}{k} (1 - e^{-pk}) + \frac{1}{\sqrt{x^2+k^2}} (e^{-p\sqrt{x^2+k^2}} - 1)]$

$k \rightarrow k\delta$, $p k \rightarrow \frac{L}{\delta} (k\delta) = kL$, $dk \rightarrow \delta dk$, $kL \rightarrow (kR) \frac{L}{R} = \beta (kR)$

$\tilde{f}_{ss}(x) = (\frac{\delta}{R})^2 \frac{1}{\beta} 8\pi^2 \int_0^\infty dk \frac{k}{\sqrt{x^2+k^2}} [1 - \exp(-\beta \sqrt{x^2+k^2})]$

When $\beta \ll 1$: $\tilde{f}_{ss}(x) = 4\pi^2 \frac{L}{\delta^3} \int_0^\infty dk \frac{k}{\text{sh}(\pi k \frac{\delta}{R})} [\sqrt{k^2+x^2} - k] = 4\pi^2 \beta (\frac{\delta}{R})^2 \int_0^\infty dk \frac{k [\sqrt{k^2+x^2} - k]}{\text{sh}(\pi k \frac{\delta}{R})}$

Equation p + $k \rightarrow k\delta$ y gache. $x_n = (2n-1) \frac{\pi}{2} \frac{\delta}{R}$, $\omega = \omega(x_n)$ - gap is small.

$\beta = p \frac{\delta}{R}$, $p = (\frac{R}{\delta}) \beta$, $\beta = 0.03, 0.04, 0.05, 0.067$, $\alpha = x_{\text{max}} = 5 \mu\text{m} \frac{R}{\delta} = 10$

mpinning:

$q(0) = 0(v)$, $\frac{\partial q}{\partial y} = 0$ up to $y \times R(AV) \rightarrow x_n = \frac{(2n-1)\pi}{2}$

Marzo • Martxo

20

Martes • Asteartea

- concave simul. Dillman 200 maga #2 (circled FMR un-
Cantab FMR un-
x₁ (#4) = $\frac{\pi \delta}{R}$, x_1 (#2) = $\frac{\pi \delta}{2R}$

Exam 8/2008 R=500 nm, $\delta=50$ nm, $x_1 = 3.14 \frac{50}{500} = 0.314$

He the process, Regu R dependence (300 nm 500 nm).

$\beta_1 = 0.03$, R=500 nm, $p = \frac{500 \text{ nm}}{\delta} 0.03 = \frac{15 \text{ nm}}{\delta}$, $x_1 = \frac{\pi \delta}{500 \text{ nm}}$

$\beta_2 = 0.04$, R=500 nm, $p = \frac{500 \text{ nm}}{\delta} 0.04 = \frac{20 \text{ nm}}{\delta}$, $x_1 = \frac{\pi \delta}{500 \text{ nm}}$

$\beta_3 = 0.05$, R=300 nm, $p = \frac{300 \text{ nm}}{\delta} 0.05 = \frac{15 \text{ nm}}{\delta}$, $x_1 = \frac{\pi \delta}{300 \text{ nm}}$

$\beta_4 = 0.067$, R=300 nm, $p = \frac{300 \text{ nm}}{\delta} 0.067 = \frac{20 \text{ nm}}{\delta}$, $x_1 = \frac{\pi \delta}{300 \text{ nm}}$

• Cylindrical $w_n = w(\beta_n)$ as function of δ ; $w_n(\delta)$

n-3 goes near layer (L,R). Observe maga

SW $x_1 = \frac{\pi \delta}{R}$ - strong pinning.

Depend δ_0 , then, $w_n(\delta_0) = \exp$

Plotting $\delta_0 \approx 60$ nm and $\alpha = \frac{x_{\max}}{\delta} \approx 10$; $w_n^2 = 8.6, 14.1, 17.7, 22.6$

- two curves $w_n^{\exp} = w(\beta_n)$, $\alpha=0$ crosses $w(x=0) \approx 0$.

4/IV: Uz UPV Vice-rectorado nfirmen signam na upobeghne konvenc
na postdoc MICINN-NF (Arantxa equib. candidate). Zamen

Tribunal uproverob c Arantxa. Belega c Julian o free-reimburse. u Arantxa
Zboren Cuban: on upmeger b San Seb. 30 May, a 5 June yegre b Bizariz
cfiles editing JMM manuscript (one figs gozabuso). Dacora
naz Double-V. paper - Aliev.

5/IV: Zamen signam na Arantxa acceptance for postdoc u ocracia c
Juan Maria Blanco uz Registro-Aulario. Zboren Paprag. Kovaremo

u Arantxa upmeger old papers by Zvezdin (1984-85) no Dvoscillations
Zeme papers by J.F. Janak 'PR' 1964, C.H. Tsang 'JAP' 1978, Schloemann
JESM' 1974 no flexure modes of Bloch DW (8 gye Winter 'PR' 1961).

He names paper Wukovkin (Shimokhin) - Ph.D. Sol. a. 1991. Hameame Dv-
Vort. Aliev paper. c A. Smirnov organ.

Mre RTNSA: gozemas uproverob u bodpase Session chairman.

6/IV: SW in Neel DW (Aliev), $w(k_n, \beta) = F(\frac{\delta}{R}, \frac{L}{\delta})$ u δ -DW width re

compensate $w_n(\frac{\delta}{R}, \beta) = F_1(\beta)$ zabuso or δ/R um δ/Δ , $k_n \sim \frac{\pi}{\Delta}$

Noting, two bozpor beam $w_{\exp} \sim \beta$ upmeger $\delta=d=\text{const}$ u $w_1 = w_1(\beta)$
centro. d ningen uz $w_1(\beta \rightarrow 0) = w_1^{\exp}$. gne main peak #4: $\alpha = 0.1376$

Noting Fig. $w_1(\beta)$ - calc. u exp. u notan to forkhad.

7/IV: Meet. c Arantxa: ee contract narum. c 4/IV, fupmeger na RTNSA.

Paprag paper V-S. Lee 'PRL' 2011 "Edge soliton VC reversal" - ne doni.

Aranda 'JAP' 10, unreple. 2-edge solitons nagymannan.

Mucmo c comments to HStoll no nobogy K.S. Lee 'PRL'. Zboren Papragy:

on upmeger oDreemus $w(\beta)$ maga #2, rge free b.c. na AV. Odyang, rgeas

the Nat. Phys. 2-Vortex DW paper, Hameu u notan info ad Case de Talagto

to Arantxa: single room ≥ 400 €/m., 3-room apt. ≥ 800 €/m.

Odyang, Casa Talento c Acc. Notmuan $w_1(\beta)$ maga #2 u notan Papragy.

21

thex. sumy de = 29 ch 29 tions in square dots
Donor. SW-V. Nat. Ph. paper text u woman to Pappag

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

8/IV Odeyung. c Arantxa tex. ger RTNSA. Arantxa uenydne
Asterochena. Mielgales. Cen. talk "Spintronics" by S. Bader
Becege c S. Bader. W. Mexara Wue. Ponomov. Ouc. no Graphene E (K) pater
W. Mexara uenydne. plezengue na V. barrier APL. no uenydne gomepore
8 M(1) gure H < 2700 gure S(H) uenydne u exbasit na gure Ref. comments

9/IV C. A. u W. uenydne abt. Durem b Bilbao, to Garbera Eroski, engor. Zborun

10/IV Coenun Maxcunig b uenydne. gomepore M(1) Odeyung Hg, uenydne. gomepore
"Topol. field" to Nano Spain Conf. b Bilbao. Odeyung na bus. hopeing b Bilbao

11-13/IV ImagineNano Conf. b Bilbao (NanoSpain). Bader, Berger, Nanogune
postas Sustka, Sacca, Sacca-PhD student (Co-film reversal). Berjenu Mainz
Chskier iz Grenoble. W. Mexara na can. b SPINTEC na ~16 Sept., uenydne
Eurostat II Conf. b Montpellier. Odeyung. U. dny. in nanopillars c B. Diering
uenydne uenydne uenydne V. mass (PRB'10) u simul. ST-Arantxa (JAP-10). On uenydne
gure exitation of vortex by ac driving field by Mathieu eq. for X(t).

14/IV Berjenu c S. Sel. TSN-Vortex ST paper uenydne. Don Cornac
to Julien uenydne ST uenydne Nanomag paper b new journal "Spin-Nanomag"
Nan qum. pasos: 1) uenydne Referee APEX paper u improve English uenydne.
2) Zborun D. vortex - Nat. Ph. paper c Pappag; 3) uenydne. changes to V. barrier-APL
4) Geras Figs c Greenfunc. JMM paper co Chabun; 5) uenydne. Colu-FMR.

15/IV uenydne uenydne. Odeyung uenydne Aragon na uenydne Julien.
Potxi gure uenydne docs na uenydne gure uenydne.

16 Workshop Nanogune: unrep. review talk by Casanova of
Spin Sebeck, Spin Peltier, Spin Vermet - uenydne. K. Uchida, Nov. 2009, 2010
Odeyung APEX - paper c Ouc.: one breca English - uenydne b
uenydne. bapure of the paper. Pomeratka files c K. u. N. Pozner c Chabun.

17/IV Zborun u uenydne D. Vortex DW - Nat. Ph. paper to Pappag.

18/IV uenydne chabun u Aifing travel report Nano Spain '11 Bilbao
u uenydne Maxcunig. Gurey, Chabunig. Becege c Ouc. c Casa de Talento
appl. (Zborun u uenydne uenydne), ee uenydne b Xapobos Apr. 19-May 3
u appl. bica Santander - Conf. bica Diering uenydne Nanopillar me-
RTNSA uenydne c Arantxa, Odeyung. uenydne Printer. Becege c Julien uenydne.

19/IV Odeyung uenydne. RTNSA paper c Arantxa u APEX Master - pasos
c Ouc. uenydne Ouc. b Xapobos (berjenu 3/IV). Nefermura c Casa de Talento
c Julia, Iarajo, A. b Sep Lugarito, c A. b Miramar.

20/IV C. A. b Garbera - Eroski. Zborun uenydne. na uenydne u 25/IV, uenydne
uenydne co coenydne na uenydne uenydne uenydne (50€) Arantxa.
Buzen c A. A. W. b "Casa de Talento": Buzen 2bed, 1bed apt., studio
(uenydne) u "habitaesnes (~25m2) - 450€.

21/IV Editing Vortex - APEX paper, uenydne. exbasit to Referee u letter-Ed
Pater Wint (X1, X2) b pole-free model, uenydne. rigidu. model - Cu. Co
uenydne. uenydne (b uenydne) Za 20037.

22/IV M. interaction of two dots $W_{int} = \frac{1}{2} M_s^2 C_1 C_2 I(d)$

Derive pole-free model $I(d) \rightarrow I_{pf} = 4 \int d\Omega \int d\Omega' F(\Omega, \Omega')$, give explicit model $I(d) \rightarrow I_{pf} = F(1,1)$. $F(\Omega, \Omega') = \int_0^\beta dz \int_0^\beta dz' \int_0^{2\pi} d\phi \int_0^{2\pi} d\phi' (\vec{S}_1 \cdot \hat{\phi})(\vec{S}_2 \cdot \hat{\phi}')$

Note: current model r.v. $\rightarrow$ pole-free, $\sqrt{(z-z')^2 + (\phi-\phi'-d)^2}$

we need commensurate $W_{int}(\vec{S}_1, \vec{S}_2)$, minus p.f. commensurate $\int d\Omega \int d\Omega'$

$$J(\beta) = \int_0^\beta dz \int_0^\beta dz' \frac{1}{\sqrt{\beta^2 + (z-z')^2}} = 2\beta \int_0^\infty \frac{dk}{k} f(\beta k) J_0(k\beta) = 2|\beta| \left[\frac{\beta}{|\beta|} \text{Arsinh} \frac{\beta}{|\beta|} + 1 - \sqrt{1 + \beta^2/\beta^2} \right]$$

$$J(\beta) \approx \frac{\beta^2}{|\beta|} \text{ w/ } \beta \ll 1. \quad F(\Omega, \Omega') = \beta^2 \int_0^{2\pi} d\phi \int_0^{2\pi} d\phi' \frac{(\vec{S}_1 \cdot \hat{\phi})(\vec{S}_2 \cdot \hat{\phi}')}{|\vec{S} - \vec{S}' - \vec{d}|}$$

$$(\vec{S}_1 \cdot \hat{\phi}) = -S_{x1} \sin \phi + S_{y1} \cos \phi. \quad \text{where } \vec{S} = \vec{S}' + \vec{d} \text{ dot touching, } d \geq 2.$$

$$|\vec{S} - \vec{S}' - \vec{d}|^2 = (\vec{S} - \vec{S}' - \vec{d})^2 = S^2 + S'^2 - 2SS' \cos(\phi - \phi') + 2d(S' \cos \phi' - S \cos \phi) + d^2$$

$$(\vec{S}_1 \cdot \hat{\phi})(\vec{S}_2 \cdot \hat{\phi}') = S_{x1} S_{x2} \sin \phi \sin \phi' + S_{y1} S_{y2} \cos \phi \cos \phi' + (\text{no generalization})$$

$$\text{Def. } F_S(\Omega, \Omega') = \beta^2 \int_0^{2\pi} d\phi \int_0^{2\pi} d\phi' \frac{\sin \phi \sin \phi'}{|\vec{S} - \vec{S}' - \vec{d}|} S_{1x} S_{2x} = F_c(\Omega, \Omega') = \beta^2 \int_0^{2\pi} d\phi \int_0^{2\pi} d\phi' \frac{\cos \phi \cos \phi'}{|\vec{S} - \vec{S}' - \vec{d}|} S_{1y} S_{2y}$$

no account. pagonomene w/ $\beta \ll |\vec{S} - \vec{S}' - \vec{d}|$. $\vec{S}_1, \vec{S}_2$ to vector. current $\times yz$ component of vector dots.

$$J(\beta) = \int_0^\beta dz \int_0^\beta dz' \frac{1}{\sqrt{\beta^2 + (z-z')^2}} = 2\beta \text{Arsinh} \frac{\beta}{|\beta|} + 2|\beta| - 2\sqrt{\beta^2 + \beta^2}, \quad |\beta| = |\Delta|$$

$$W_{int}^{pf}(d) = \frac{I_{pf}(d)}{I_{zv}(d)} = \frac{1}{F(1,1,d)} = 4 \int d\Omega \int d\Omega' F(\Omega, \Omega', d), \quad F(\Omega, \Omega', d) = \int d\phi \int d\phi' \vec{S}_1 \cdot \vec{S}_2 J(\Delta)$$

$$W_{int}^{zv} = \frac{1}{2} M_s^2 C_1 C_2 \left[\int dz \int dz' \int d\phi \int d\phi' \frac{\sin \phi \sin \phi'}{|\vec{r} - \vec{r}'|} (S_{x1} S_{x2}) + \int dz \int dz' \int d\phi \int d\phi' \frac{\cos \phi \cos \phi'}{|\vec{r} - \vec{r}'|} (S_{y1} S_{y2}) \right]$$

$$W_{int}^{pf} = \frac{1}{2} M_s^2 C_1 C_2 \cdot 4 \int d\Omega \int d\Omega' \left[\int dz \int dz' \int d\phi \int d\phi' \frac{\sin \phi \sin \phi'}{|\vec{r} - \vec{r}'|} (S_{x1} S_{x2}) + \int dz \int dz' \int d\phi \int d\phi' \frac{\cos \phi \cos \phi'}{|\vec{r} - \vec{r}'|} (S_{y1} S_{y2}) \right]$$

Math (d) "Vortex-Interdot-Coupl.-l. med" began, $I_S(d)/F_S(1,1,d)$, $I_c(d)/F_c(1,1,d)$

$$I_S(d) = 4 \int d\Omega \int d\Omega' F_{S,c}(\Omega, \Omega', d)$$

r.e. give $d \gg 1$ $W_{int}^{pf} \approx W_{int}^{zv}$. Too w/parabola/perturb w/previous dipolar limit?

$$W_{int} = \frac{\vec{J}_1 \cdot \vec{J}_2}{d^3} - \frac{3}{d^5} (\vec{J}_1 \cdot \vec{d})(\vec{J}_2 \cdot \vec{d}) \quad \vec{J}_j = M_s V \langle \vec{m}_j \rangle = M_s V (-1) \zeta C_j \hat{z} \times \vec{S}_j, \text{ r.e.}$$

$$W_{int}(d \gg 1) \sim \frac{1}{3^2} W_{int}^{pf} \approx \left(\frac{2}{3}\right)^2 W_{int}^{zv} \approx 0.44 W_{int}^{zv}, \quad \left(\frac{2}{3}\right)^2 = \frac{4}{9} = 1/2.25$$

Isolated dot ($S_1 = S_2, d=0$) $\frac{W_{int}^{pf}}{W_{int}^{zv}} = \frac{\chi_{pf}}{\chi_{zv}} \approx \frac{2}{3} \approx 0.44 = \frac{W_{int}^{pf}}{W_{int}^{zv}}$ w/ $\beta \ll 1$

Depen W_{int} & bug, gonycommen $d=0$, r.e. orthogonality or $\beta \ll 1$

$$\text{Due } d=0 \quad F(\Omega, \Omega') = \int d\phi \int d\phi' [S_x^2 \sin \phi \sin \phi' + S_y^2 \cos \phi \cos \phi'] \cdot 2\beta \int_0^\infty \frac{dk}{k} f(\beta k) J_0(k\beta) =$$

$$= |\vec{S} - \vec{S}' - \vec{d}| = 2\beta \int_0^\infty \frac{dk}{k} \int d\phi \int d\phi' [\dots] \sum e^{i\mu(\phi - \phi')} J_\mu(k\beta) J_\mu(k\beta') =$$

$$= 2\beta \int_0^\infty \frac{dk}{k} \sum J_\mu J_\mu(1) [S_x^2 |\int d\phi e^{i\mu\phi} \sin \phi|^2 + S_y^2 |\int d\phi e^{i\mu\phi} \cos \phi|^2] = |1|^2 = \pi^2 (\delta_{\mu,1} + \delta_{\mu,-1})$$

Semana • Aste 12

Escaneado con CamScanner

23

Ostirala - Viernes

$$F(s, d=0) = 4\beta s^2 \pi^2 \int \frac{dk}{k} f(\beta k) J_1(kg) J_1(kg'), \quad I_{ps} = 4 \int d\theta d\theta' f(\theta, \theta')$$

$$I_{rv} = 4\beta s^2 \pi^2 \int \frac{dk}{k} f(\beta k) J_1^2(k), \quad W_{ps} = 16\pi^2 \beta s^2 F_1(\beta), \quad W_{rv} = 8\pi^2 \beta s^2 F_1(\beta)$$

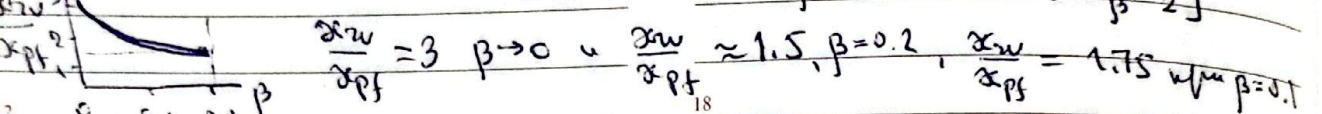
$$I_{rv} = 4\beta s^2 \pi^2 F_1(\beta), \quad W_m = \frac{1}{2} M_s^2 I_{rv} = 2\beta s^2 \pi^2 F_1(\beta) M_s^2$$

$$\frac{1}{M_s^2 V} W_m = 2\pi F_1(\beta) s^2, \quad \frac{1}{M_s^2 V} W_{ps} = 8\pi F_1'(\beta) s^2 = \frac{1}{2} x_{ps} s^2$$

$$\frac{\omega_{ps}}{\omega_{rv}} = \frac{x_{ps}}{x_{rv}} = \frac{16\pi F_1'(\beta)}{4\pi F_1(\beta)} = 4 \frac{F_1'(\beta)}{F_1(\beta)}, \quad F_1(\beta) = \int \frac{dk}{k} f(\beta k) J_1^2(k)$$

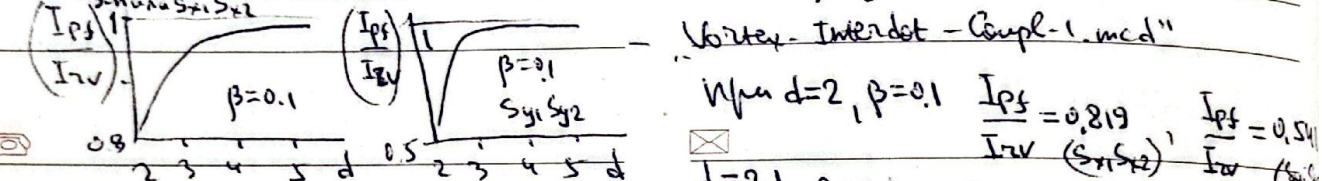
Ecun $d \geq 2$, $\gamma(\Delta) \approx \frac{\beta^2}{\Delta}$ paznomenne gonycuno. $F_1(\beta) \approx 2\beta [\ln \frac{2}{\beta} - \frac{1}{2}]$

$$\frac{x_{ps}}{x_{rv}} = \frac{3^2}{2^2} \left(\frac{3^2}{2^2} \right)^{-1} = \left(\frac{2}{3} \right)^2 \frac{x_{rv}}{x_{ps}} = \left(\frac{2}{3} \right)^2 \frac{10\beta}{2\beta [\ln \frac{2}{\beta} - \frac{1}{2}]} = \frac{20}{9} \frac{1}{[\ln \frac{2}{\beta} - \frac{1}{2}]} = 0.4(\beta)$$



Due unepexen β or 0.01 go 0.2 $\frac{x_{rv}}{x_{ps}}$ nageer or 2.78 go 1.44.

B. Jung 'APL' 2010 $\beta = 1/24$, $\frac{x_{rv}}{x_{ps}} = 2.14$



Due nageer prob Jung 'APL' 10: $\beta = \frac{1}{24}, d=2.1$ nageer

$$\frac{I_{ps}}{I_{rv}} = 0.854 \quad \text{u} \quad \frac{I_{ps}}{I_{rv}} = 0.650$$

$\frac{I_{ps}}{I_{rv}} (S_1, S_2) \quad \frac{I_{ps}}{I_{rv}} (S_1, S_2)$

$$W_{int}(\vec{S}_1, \vec{S}_2) = \frac{1}{2} M_s^2 C_1 C_2 [I_s(S_1, S_2) + I_c(S_1, S_2)], \quad \text{bue } L, S, \vec{r}_j \text{ bue } R.$$

$$W = \frac{1}{2} x_1 S_1^2 + \frac{1}{2} x_2 S_2^2 + C_1 C_2 [\eta_x(S_1, S_2) + \eta_y(S_1, S_2)], \quad x_1 = x_2 = x.$$

$$\frac{1}{M_s^2 V} x_{ps} = 16\pi F_1'(\beta), \quad \frac{1}{M_s^2 V} x_{rv} = 4\pi F_1(\beta), \quad V = \pi R^2 L = \pi \beta \text{ bue } \text{unex. } \text{eg.}$$

Unex. unex. $C_1 C_2$: $a = \frac{\eta_x}{x}, \quad b = \frac{\eta_y}{x}, \quad \eta_x = \frac{1}{2} M_s^2 I_s, \quad \eta_y = \frac{1}{2} M_s^2 I_c$

Larunbata. Sábado $\frac{1}{M_s^2 V} \eta_x = \frac{1}{2\pi\beta} I_s, \quad \frac{1}{M_s^2 V} \eta_y = \frac{1}{2\pi\beta} I_c. \quad a = \frac{I_s}{2\pi\beta x}, \quad b = \frac{I_c}{2\pi\beta x}$

83/282 I_s, I_c x - golvee: or nageer: z.v. unex. p. free.

R.v.: $a_{rv} = \frac{1}{2\pi\beta} \frac{I_s}{x_{rv}} = \frac{1}{2\pi\beta} \frac{F_1(1,1)}{4\pi F_1(\beta)}, \quad b_{rv} = \frac{1}{2\pi\beta} \frac{F_c(1,1)}{4\pi F_1(\beta)}$

Pole-free (p-f): $a_{ps} = \frac{1}{2\pi\beta} \frac{I_s^{ps}}{x_{ps}}, \quad b_{ps} = \frac{1}{2\pi\beta} \frac{I_c^{ps}}{x_{ps}}, \quad I_{sc}^{ps} = 4 \int d\theta d\theta' f(\theta, \theta')$

$$\frac{1}{x} = 9 \cdot 4\pi F_1'(\beta) \approx 10\beta, \quad \omega_c = \frac{1}{2} M_s^2 \frac{3^2}{x} = xG, \quad x_{ps} = \frac{1}{2} M_s^2 \frac{3^2}{x} G$$

$$\frac{1}{M_s^2 V} x_{ps} = 16\pi F_1'(\beta) = 4 \cdot 4\pi F_1' = 4 \cdot 10\beta, \quad \omega_{ps} = \frac{1}{2} M_s^2 \left(\frac{2}{3} \right)^2 \cdot 10\beta = \frac{20}{9} \beta \cdot M_s^2$$

$$\begin{aligned} \Delta' &= x \\ \Delta &= x \\ \Delta + x &= z_1 + z_2 \\ \Delta + x &= z_1 + z_2 \\ \Delta + x &= z_1 + z_2 \end{aligned}$$

16/vi Topol. charge, vorticity, gyration.

Kosevich '90: mapping invariant $Q = \frac{1}{8\pi} \int d^2\vec{r} \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x} \times \frac{\partial \vec{m}}{\partial y} \right)$

$$Q = \frac{1}{4\pi} \int d^2\vec{r} \sin \theta \nabla^2 \phi \quad Q = \frac{1}{\pi} \int d^2\vec{r} \frac{1}{[1+|w|^2]^2} \left(\frac{\partial w}{\partial z} \frac{\partial \bar{w}}{\partial \bar{z}} - \frac{\partial w}{\partial \bar{z}} \frac{\partial \bar{w}}{\partial z} \right)$$

1) Vortex $w(z) = \frac{i}{2} z$ boundary core $|z| < c$. $\frac{\partial w}{\partial z} = \frac{i}{2}$, $\frac{\partial \bar{w}}{\partial \bar{z}} = \frac{\partial}{\partial \bar{z}} \left(-\frac{i}{2} \bar{z} \right) = -\frac{i}{2}$

$$Q = \frac{1}{\pi} \int d^2\vec{r} \frac{1}{[1 + \frac{|z|^2}{c^2}]^2} \left[\frac{i}{2} \cdot \left(-\frac{i}{2} \right) \right] = \frac{1}{\pi c^2} \int d^2\vec{r} \frac{1}{[1 + \frac{g^2}{c^2}]^2} = \frac{1}{\pi c^2} \int_0^{2\pi} d\phi \int_0^c dr \frac{1}{[1 + \frac{g^2}{c^2}]^2}$$

$$= \int_0^1 dx \frac{1}{(1+x)^2} = \left[-\frac{1}{1+x} \right]_0^1 = -\frac{1}{2} + 1 = \frac{1}{2} \text{ (half soliton)}$$

2) anti-vortex $w(z) = i \frac{a}{z}$, $m_x + i m_y = \frac{\partial w}{1+|w|^2} = \frac{1}{1+a^2/|z|^2} \frac{ia/z}{a^2+|z|^2} = \frac{ia}{a^2+|z|^2} \frac{\bar{z}}{z}$

$$m_x + i m_y = \frac{2a}{a^2+|z|^2} (ix+y), \quad \left. \begin{aligned} m_x &= f(\theta) \sin \phi \\ m_y &= f(\theta) \cos \phi \end{aligned} \right\}, \quad f(\theta) = \frac{2a\theta}{a^2+g^2}, \quad m_z = \frac{g^2 a^2}{g^2+a^2}$$

$$\frac{\partial w}{\partial z} = \frac{ia}{z^2}, \quad \frac{\partial \bar{w}}{\partial \bar{z}} = -ia \frac{1}{\bar{z}^2} \quad Q = \frac{1}{\pi} \int d^2\vec{r} \frac{1}{[1 + \frac{a^2}{|z|^2}]^2} \left[\frac{a^2}{|z|^4} \right] = \frac{a^2}{\pi} \int d^2\vec{r} \frac{1}{(a^2+|z|^2)^2} > 0, \text{ sign?}$$



Larunbata • Sábado

Domingo • Igandea

150E org. by CEMAC go July 12 (Braga).

91/274

Don Oke. Cnemidophorus u. uformosa Jacob 'PMU' 94, 1-274. Mexob. book.
A termu ccmu na Kosevich '90, Papanicolaou '1991, Kominas '96,
Tatarski 'Phys. Rep. 2008. Pagonis c nei gunnami Benenobakovo (Zbezzgun)
no ammp. oscillators, Zbezzgun uformu eqy of his Ordizik presentation.
Ozmechonne Oke. ccmob vortex dynamics, TWA, EVA u bobaga eq. thiele.

17/vi Pagonis. gormaga no vonda. Japmgy. Ccmuap nog. uformu "Spin dyn."
1) Oke. pagonis Indial Sw u ccmuap c BLS gorm. Vagt-Hillebrand
2) Pagonis: uformu vektan. dats - BLS/Zivieri - IE3TM '2011. Syppe c W. Pagonis.
Toroidal moment - NA. Spaldin. RTNSA - papers database update. Pagonis, Oke.

- 1) Nanotubes DW papers c Ai Ping
- 2) MPD of F/N/F nanowires c Duc - Arantxa
- 3) Colu-FMR paper for RTNSA Proceed. - JNN - subm. JNN, Dec 3, 2011
- 4) FMR-pinning paper c Gus Arantxa - subm. PRB 7/III 12
- 5) Nonlin. vortex ST dyn., damping, noise - Duc, Rafa
- 6) Wigner's magnon's - coop paper - Gus
- 7) Paper y(w) que vortex rad. SW c Manuel - subm. Arantxa
- 8) Curing, ph. lock. 2-vortex dots (Cros, Ziegler)
- 9) VC switch. vs time in H_z u different h_z pulses (de Loubens)
- 10) Phenomena in 2D arrays vortex dots - Gyromodes - Duc
- 11) Vortex TM in circ. square dot pairs in 2-vortex approx. c Duc
- 12) Review papers Lin JAP, Schaefer SPIE, Wong APL, Im Nature C, APL

Opr. Bonpocoi:

- 1) Copy to RTNSA papers u wocaraux to JNN Editor
- 2) Hotels u conf. fee to Tenerife, TMT u Paris - ST Workshop
- 3) New PhD students u postdocs (Bepa, Copaneri, Dagremont, Nuxell)
- 4) Conf. 2012: Apr-May - Feb, Grand Syn - Apr, Kaiserl. Aug, Palermo - Sep
- 5) KB/gov, namuna B Sem Seb, koncept, \$ → €
- 6) Nagara gov. ob no. Res. Tarjetas renewal u Antonio's passport
- 7) Iberbasque appl. que Cuabuna subm. 30/X 11 - Otcar 13/XII 11
- 8) Casado u namur. paxogob NSF-Cuabun u MICINN - Duc. spento
- 9) Registr. PhD que Duc. u namur paxogob
- 10) Travel Port. grant u SAOTER correspondence u Copaneri Arantxa - Duc
- 11) Update publ. list and citations - opranuz, wocaraux u nam. Hillerbrun
- 12) Abstracts Houches-FR (go 15/XI), Istanbul (go 25/XI), Pusan, Parma
- 13) Zampieri (Nida laboral) u namur klaps. Tent contract na 1 nov
- 14) Order trip to Tenerife, Abs. to CV u database Iberb.

25/2 home to UPV-Vicerector. info o 150€ Summer school in Madrid 2010
 Women Postdoc. Stijn, nogxog, que (Que.)
 Zboran, Duccane, M. Duccane.
 1) postdoc J. de la Cierwa e u papers on a
 2) MEC - postdoc J. de la Cierwa e u papers on a

11
 (Tenerife)
 (Tenerife)

26/2 Pasara nag F/N/F-MPD paper e Arantxa u Que Miercoles. Asteazkena
 Ponocobanne invited ICMN'2012 Conf. (Mellebrands), factura SAJOTEK
 Zboran Travel - Ux. Carrea e Que. Maneraan canago SAJOTEK NSF u Que. grants
 F/N/F-ST-Workshop u J. Spritz. May. (Julian).

27/2 Oxyang. Refs. e Que. no F/N/F. Update CV - Mag. group UPV/EHU u
 name. Ikerbasque Fellow application give Slavin Kymon Dupertu e Tenerife
 Que. - 10:20 AM. Coe2 u A.

28/2 Lit. Search F/N/F, meeting e Arantxa u Que. e oxyang. micromag.
 simulations. Arantxe u J. Spritz. Summary no sandwich
 u L. L. - Locattelli for different R (images $\tilde{M}_j(\tilde{r})$, E_{SDV} , napeuwerp)
 Que. 10:45 AM (Sango?)
 Lj, D, R

29-30/2 C. A. b. Lide u Maria - noma pyram-xoroguan. e A. b. Maria pases uox
 u noma. Oxyang. u submitted Ikerb. Fellow. application for Slavin.
 napeuwerpoban Hotel Tenerife na Nov. 19-25.

31/2 Oxyang. Conf. fee Tenerife €512,32 (495+3.5%) by Credit Card.
 B. M. F/N/F - MPD paper vers. Oct. 30 by Que. - oxyang. u
 exp. papers (naw. Wint? Embry Cheropold - Gull, Monton. Sluka, Locat, Jin)
 - oxyang. u noma. Oxyang. u submitted Ikerb. Fellow. application for Slavin.
 napeuwerpoban Hotel Tenerife na Nov. 19-25.

Conferences - 2012 :

- | | |
|---|---|
| 1) Hanches - France MS NOW'S Feb. 5-10, 2012
Abs. go Nov. 15, 2011 / Conf. fee 500€ go Dec. | Winter's magnons
Paprag |
| 2) ICSM'12 - Turkey
Apr. 29-May 4 u School Apr. 24-28, 2012
Abs. go Nov. 25, 2011 / Conf. fee go Feb. 15, 2012 | Vogl. Sub-rad.
Que. |
| 3) ICM - July 8-13, Pusan, Korea, 2012 / SNU-Conf. July 15-18
Abs. go Jan. 31, 2012 / Conf. fee go... | ST-Dyn. V. F/N/F. |
| 4) ICMN'12 - Aug. 26-29, 2012, Kaiserlautern, Germany
Abs. go June 18, 2012 / Conf. fee go July 15 | MPD-F/N/F
Que. |
| 5) JEMS'12, Sept. 9-14, 2012, Parma, Italy
Abs. go March 31, 2012 / Conf. fee go July 9
"Magnetics", Sept. 3-7, 2012, Ligure, Italy. Reg. go May 15, 2012 | Pinning-FMR
Arantxa |
| 6) 3rd Eur. Workshop on Self-organized Nanomagnets, 2012,
April 16-20, Madrid. Abs. go Feb. 2, 2012 | Nanotubes-DW
A. B. B. B. |
| 7) Int. Symposium on Dynamics May 30-June 1, 2012, Hamburg
Her contributed talks u conf. fee, rousuo invited | Vortex - rev.
V-dot-pair $(\tilde{m}^2) = 0$
Que.
Multipole mom.
Que. |

Значение δ и магнитное поле B также заданы -
 - угловыми моментами l, l' и m, m' .

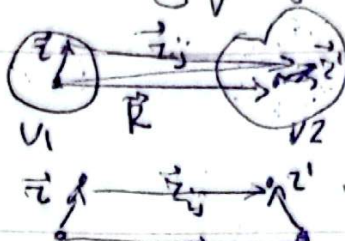
Abriel · Aprilia

13

Viernes · Ostirala

$$U_{int} = \sum_{l, l'=0}^{\infty} (-1)^{l'} \binom{2l+2l'}{2l} V_2 \sum_{m=-l}^l \sum_{m'=-l'}^{l'} (-1)^{m+m'} I_{l+l'}^{-m-m'}(\vec{R}) \times$$

$$+ Q_l^m Q_{l'}^{m'} \langle lm; l'm' | l+l', m+m' \rangle \text{ котгр. Clebsch-Gordan}$$



$$I_{l+l'}^{-m-m'} = \left(\frac{4\pi}{2l+2l'+1} \right)^{V_2} \frac{1}{R^{l+l'+1}} Y_{l+l'}^{-m-m'}(\hat{R})$$

$$Q_l^m = \sum_i q_i r_i^l Y_l^m(\hat{r}_i), \quad Y_l^m - \text{сферич. гармоники.}$$

$$q_i = q(\vec{r}_i) - \text{пл. заряды. } Y \text{ на с. } \sum_i (\cdot) \rightarrow \int d^3\vec{r} (\cdot), \quad q(\vec{r}) = \text{div } \vec{m}(\vec{r})$$

$$Y_l^m(\hat{r}) = Y_l^m(\theta, \varphi) = N_{lm} P_l^m(\cos\theta) e^{im\varphi}, \quad N_{lm}^2 = \frac{(2l+1)(l-m)!}{4\pi(l+m)!}$$

Еще есть тонкое polar angles - θ , $\theta = \pi/2$, $\vec{r} = \vec{s} = (s, \theta)$. $\cos\theta \geq 0$ так как у нас есть $P_l^m(0) \neq 0$. То есть $\theta \rightarrow 0$ (thin disk).

$$Q_l^m = \int d^3\vec{r} q(\vec{r}) r^l Y_l^m(\hat{r}) = L \int d^2\vec{s} q(\vec{s}) s^l Y_l^m(\hat{s})$$

$$Y_l^m(\hat{s}) = N_{lm} P_l^m(0) e^{im\varphi}, \quad Q_l^m = L N_{lm} P_l^m(0) \int d^2\vec{s} s^l q(\vec{s}) e^{im\varphi}$$

$q(\vec{s}) = \text{div } \vec{m}(\vec{s})$ - сферич. м. $\cos\varphi, \sin\varphi \Rightarrow$ орды u/v $\int d\varphi (\cos\varphi, \sin\varphi) e^{im\varphi}$ орды м. $m = \pm 1$.

Угловые моменты $l=l'=1$ (dipolar), $l=1, l'=2$ (dip. - quadr.) и $l=2, l'=2$ (quadr. - quadr.). One paper on. Burag $u/v \text{ and } d = \frac{D}{R} \gg 1$.
 D - center-to-center interaction interdot distance. Cui, Gus. PRL 2001. 105 262

$$\text{Решение м. и } \frac{1}{|\vec{R}-\vec{r}|} = \frac{1}{R} + \frac{\vec{R} \cdot \vec{r}}{R^3} + \frac{3(\vec{R} \cdot \vec{r})^2 - R^2 r^2}{2R^5} + \frac{5(\vec{R} \cdot \vec{r})^3 - 3R^2(\vec{R} \cdot \vec{r})r^2}{2R^7} + \dots$$

B pole-free model $f(z) = \frac{1}{2} [i\vec{c}z + \frac{a}{2} - \frac{\bar{a}}{2} z^2]$, $\vec{a} = (a_x, a_y)$

Larunbata · Sábado
 $\text{div } \vec{m} = -(\hat{s} \cdot \vec{a}), \quad \langle \vec{m} \rangle = \frac{1}{3} \vec{a}, \quad \vec{a} = -2\hat{s} \times \vec{S}, \quad \vec{S} = \vec{r}/R$

(8/04/26) no a_x, y (problem).
 Arc. Kitei - FM-MA m. m. m.

18/XI RTNSA papers. Нормы на Arantxe review on Magnonics. Multipole expansions c Arc. Нормы на AB3 to ICSM'12, dip-dip interaction и обр. и др. quadr. moment of shifted vortex.

19-25/XI Noezgva c P. на TNT'11, Tenerife, Canary Islands. c микроб. Noezgva no Tenerife, c м. и б. и др. P. и W. к. м. и др. у. б. и др. (123+45E) Gy. Teide. u. q. o. a. n. "Sharp" Arantxe (70 E). Subm. Abs. to ICSM'12 - vortex rev.

26.27/XI KPSA papers, paydop multi job pavesol Oac
 dip-dip interaction, Q (vertex dot $\vec{X}$) = 0? Pa mersa
 APL u Nature-Commun. vortex papers na review
 16 C. Hättig et al. Molec. Phys. 81, 813-824 (1994)

Astelehena - Lunes

$$U_{int} = \int_{V_A} d^3\vec{r} \int_{V_B} d^3\vec{r}' \frac{g^A(\vec{r}) g^B(\vec{r}')}{|\vec{r} - \vec{r}'|} = \sum_{l_1, l_2, m_1, m_2} T_{AB}^{l_1, m_1, l_2, m_2} Q_{l_1, m_1}^A Q_{l_2, m_2}^B$$

$$Q_{lm} = \int d^3\vec{r} g(\vec{r}) R_{lm}(\vec{r}), R_{lm}(\vec{r}) = \left(\frac{4\pi}{2l+1}\right)^{1/2} r^l Y_l^m(\theta, \phi)$$

$$\hat{r} = \hat{r}(\vec{R}_{AB}) \quad \vec{R}_{AB} - \text{coeg. usnupur pacupagen. Zapses}$$

$$\vec{r} \in V_A \text{ barupya A, } \vec{r}' \in V_B \text{ barupya B. } |\vec{R}_{AB}| \gg r, r'$$

$$T_{l_1, m_1, l_2, m_2}(\vec{R}) \text{ obu. yumbepcamowum u uporedyupobawum.}$$

28/XI Paures dip-dip interaction uz odushe multiple expansion
 (Hättig 1994).

$$T_{1d1p}^{ab} = \frac{1}{R^3} [3\tau_a^a \tau_b^b + C_{1p}] = \frac{1}{R^3} \left[-\frac{3}{R^2} (\vec{e}_a \cdot \vec{R})(\vec{e}_b \cdot \vec{R}) + \delta_{ab} \right]$$

$$\vec{R} = \vec{R}_{AB} \text{ coegumee usnupur of charge distributions A u B.}$$

$$W_{int}^{d-d} = \sum_{m_1, m_2} T_{AB}^{m_1, m_2} Q_{m_1}^A Q_{m_2}^B$$

Orcana: namu
 omuony b W dip-dip
 unepemee Qlm dot
 r-polefree b rep-pole

$$W_{int}^{d-d} \text{ choqurce } \propto W_{int}^{d-d} = \frac{1}{R^3} [\vec{\mu}_1 \vec{\mu}_2 - \frac{3}{R^2} (\vec{\mu}_1 \vec{R})(\vec{\mu}_2 \vec{R})]$$

$$Q_1^m = \int d^3\vec{r} g(\vec{r}) R_{1m}(\vec{r}), R_{1m}(\vec{r}) = \sqrt{\frac{4\pi}{3}} r Y_1^m(\theta, \phi), g(\vec{r}) = \text{div} \vec{m}$$

$$Q_1^{m=+1} = \int d^2\vec{s} \int d^2\vec{s}' \text{div} \vec{m}(\vec{s}) \left(-\frac{1}{2}\right) \sqrt{\frac{3}{2\pi}} r \sin \theta e^{i\phi} \sqrt{\frac{4\pi}{3}} = \left| \text{div} \vec{m} = -(\hat{s} \cdot \vec{a}) \right|$$

$$= -\frac{1}{2} \int d^2\vec{s} \int d^2\vec{s}' \text{div} \vec{m}(\vec{s}) (x+iy) = +\frac{\sqrt{2}}{2} L \int d^2\vec{s} (\hat{s} \cdot \vec{a}) (x+iy) =$$

$$= \frac{\sqrt{2}}{2} L \int_0^R ds s \int_0^{2\pi} d\phi (a_x \cos \phi + a_y \sin \phi) s (\cos \phi + i \sin \phi) = \frac{\sqrt{2}}{2} L \int_0^R ds s^2 \int_0^{2\pi} d\phi [a_y \sin^2 \phi + a_x \cos^2 \phi]$$

$$= \frac{\sqrt{2}}{2} L \frac{R^3}{3} \pi (a_x + i a_y), Q_1^{-1} = -(Q_1^{+1})^* = -\frac{\sqrt{2}}{2} L \frac{R^3}{3} \pi (a_x - i a_y)$$

$$Q_x = \frac{1}{\sqrt{2}} (Q_1^{-1} - Q_1^{+1}) = \frac{1}{\sqrt{2}} (-1) \frac{\sqrt{2}}{2} L \frac{R^3}{3} \pi 2a_x = -VR \frac{1}{3} a_x, V = \pi R^2 L$$

$$Q_y = \frac{i}{\sqrt{2}} (Q_1^{-1} + Q_1^{+1}) = \frac{i}{\sqrt{2}} \frac{\sqrt{2}}{2} L \frac{R^3}{3} \pi 2i a_y = -VR \frac{1}{3} a_y$$

$$\text{Dne pole-free model } \langle \vec{m} \rangle_V = \frac{1}{3} \vec{a} \text{ u } \vec{a} = -2 \hat{z} \times \vec{X}$$

$$Q_x = -V \langle m_x \rangle = -\mu_x, Q_y = -V \langle m_y \rangle = -\mu_y. R \text{ b } Q_{x,y} \text{ usnupur}$$

$$W_{int}^{d-d} = \sum_{\alpha\beta} T_{AB}^{(\alpha)\beta} Q_{\alpha}^{(1)} Q_{\beta}^{(2)} = \sum_{\alpha\beta} \frac{1}{R^3} \left[-\frac{3}{R^2} (\vec{e}_{\alpha} \cdot \vec{R})(\vec{e}_{\beta} \cdot \vec{R}) + \delta_{\alpha\beta} \right] \mu_{\alpha}^{(1)} \mu_{\beta}^{(2)} = \frac{1}{R^3} \left[-\frac{3}{R^2} (\vec{\mu}^{(1)} \cdot \vec{R})(\vec{\mu}^{(2)} \cdot \vec{R}) + \vec{\mu}^{(1)} \cdot \vec{\mu}^{(2)} \right]$$

Wabunee popupya gne dip-dip interaction.

29/XI B.M. Extrangeras, Rio X...
 tarjetas de residencia K.A.A. Vida laboral no nupcio, no Anu...
 NANO GUNE I. Schuller, San Diego .. Exchange Bras.
 17

pauses multiple moments c Acc. Q_L^m b u/mor. pole-free
 model of shifted vortex. $W_{int}(\text{dot pair}) = \frac{Q_1 Q_2}{D^3} + \frac{Q_1 Q_3}{D^5} + \frac{(Q_1 Q_5 + Q_3 Q_5)}{D^7}$ n/m $\beta \ll 1, \frac{2R}{D} \ll 1$
 D Φ Φ - interdot separation. B APL 10 c Alien Oursu. 200 que square
 dot array banco quadr. - quadr. interaction $\sim \frac{Q_2 Q_2}{D^5}$
 nor-mor-por, comparison in dip-act. interaction $\frac{Q_1 Q_3}{D^5}$ n/m $\beta \ll 1, \frac{2R}{D} \ll 1$
 $\rightarrow$ 1-Q3-banco que dot pair. $\frac{Q_1 Q_3}{D^5}$ n/m $\beta \ll 1, \frac{2R}{D} \ll 1$

30/XI Passer no vem. Tenerife, TMT-2011.
 Passagor no yany #ACA1 (Cubun): 115,00€ (Acc. fee Parlemi) +
 + 1.856,02 € (Gus' Parlemi-kiev) + 668,00€ (Acc. Parlemi) + 849,91€ (Acc. Parlemi)
 Passagor no yany #A4CB (Cubunano): 731,42 € (Julian NANOSMART) + 892,72 €
 + 8... (Julian, Comp)

Perseus JAP - paper Lin - stripes Co/Fen magnomies.
 Passer Nature Com. (perseus) paper by Ian et al. D2-Moria inter.
 c Arantxa. No mours Anuoy no xumun. Update RTNSA papers.

1/XII Boccen. password new comp. : 123456 (PDI). Pers. Nature Com.
 - Im paper. 20enne conyr. papers by Bogdanov - Kössler.
 Porrobor Oca. 2e mequen. passagor: be esse ne vorpoma $I_{x,y}(D)$ b
 multiple expansion que dot pair. **Dzeromunacai - Morpome vortex**

$E_D = DM \cdot \text{rot} \vec{M}$ - energy (density erg/cm²) Dzer. - Morpome interact.
 The centered vortex $\vec{m} = \vec{M}/M_s = (0, m_\phi, m_z)$
 $\text{rot} \vec{m}$ b uuv. koefpugurax. $\text{rot} \vec{m} = \vec{\nabla} \times \vec{m} = \frac{1}{g} \begin{vmatrix} \hat{g} & g\hat{\phi} & \hat{z} \\ \frac{\partial}{\partial \phi} & \frac{\partial}{\partial \phi} & \frac{\partial}{\partial z} \\ m_\phi & g m_\phi & m_z \end{vmatrix} =$
 $= \frac{1}{g} \left[\hat{z} \frac{\partial}{\partial \phi} (g m_\phi) - \frac{\partial}{\partial \phi} (g m_z) \hat{\phi} \right]$
 $E_D = DM_s^2 \vec{m} \cdot \text{rot} \vec{m} = DM_s^2 \left[\frac{m_z}{g} \frac{\partial}{\partial \phi} (g m_\phi) - m_\phi \frac{\partial}{\partial \phi} (g m_z) \right] =$
 $= DM_s^2 \frac{1}{g} \left[g m_z m_\phi - m_\phi m_z + g m_z \frac{\partial m_\phi}{\partial \phi} - m_\phi \frac{\partial m_z}{\partial \phi} g \right]$
 $E_D = DM_s^2 \left[m_z \frac{\partial m_\phi}{\partial \phi} - m_\phi \frac{\partial m_z}{\partial \phi} \right]$, eam $m_\phi = C \sin \theta, m_z = p \cos \theta, \theta \in [0, \pi/2]$
 $\rightarrow E_D = DM_s^2 p C \frac{\partial \theta}{\partial \phi} \sim D p C$ u enpegen. vorbus vortex core, 2ge $\theta \neq 0$

T.e. E_D ne vorbus vorpymocnane energy, no esse $\neq 0$ vorbus
 Bunchme E_D ka v. dot c $R = 500-1000 \text{ nm}$ $\sim R_c \sim 15-20 \text{ nm}$
 vorbus. $DM_s^2 \sim 0.01 \text{ erg/cm}^2 \rightarrow E_D \sim 10^5 \text{ erg/cm}^3$ bngp u. core.
 Semana • Aste 16

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Ostrata.

24/711

25/Jul

110/255

Carton

$|Y_+(w)|^2 H_0^2 = |X(w)|^2$, - que seria a ^{circulação} de ressonância w
 u ^{resposta} $|V(w)|^2 = w^2 |X(w)|^2$. No caso geral $X(t) = \dots$
 $v(1-v) \sin(1-v)\tau + dv(2-v) \cos(1-v)\tau = d e^{-d\tau}$ $(1-v) = a \cos \psi$, $d(1-v) = a \sin \psi$
 $a \sin[(1-v)\tau + \psi] = \frac{d}{v} e^{-d\tau}$, $\tan \psi = \frac{d(1-v)}{(1-v)}$, $a^2 = (1-v)^2 + d^2(1-v)^2$

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$a \sin[(1-v)\tau + \psi]$, $\text{haveria uma mancha abt. } d/(1-v)$
 u $v \approx 1$ $\Rightarrow$ d $\rightarrow$ 0 $\Rightarrow$ $\tau_m \rightarrow 0$.
 Note $\text{u} \text{m } v=1$, $d = d e^{-d\tau}$, $\text{u} \text{m } d \rightarrow 0$ $\tau_m = 0$.

$F(\tau) = v^2 + e^{-2d\tau} - 2ve^{-d\tau} [\cos(1-v)\tau - d \sin(1-v)\tau]$, $p=+1$.
 $|V(\tau)| = |Y_+(w)| H_0 w_0 \sqrt{F(\tau)}$, $V(\tau)$ $\text{g} \text{o} \text{m} \text{a} \text{x}$ $\text{u} \text{m } \tau_m = \frac{\pi}{1-v}$, $d \rightarrow 0$, $v \rightarrow 1$.
 $|Y_+(w)| = \frac{3}{2} \frac{\delta R}{w_0} \frac{1}{\sqrt{(1-v)^2 + d^2 v^2}}$. Em caso de $\text{g} \text{e} \text{r} \text{a} \text{l}$ $\text{V} \text{C}$ switching $|V(\tau)| = V_{cr}$

to $\text{g} \text{e} \text{r} \text{a} \text{l}$ switching $V_{cr} = \frac{3}{2} \delta R H_0 \frac{\sqrt{F(\tau, v)}}{\sqrt{(1-v)^2 + d^2 v^2}}$ $\text{ch} \text{e} \text{z} \text{m} \text{b} \text{a} \text{r}$ switching
 field amplitude H_0 , frequency of a.c. field $v = w/w_0$ u switch. time $\tau = \tau_s$.
 $\text{G} \text{a} \text{u} \text{s} \text{e}$ $\text{u} \text{m} \text{m} \text{e} \text{n} \text{t} \text{o}$ (τ) $\text{e} \text{c} \text{o}$ $\tau_s \leq \tau_m$ (can $\text{d} \text{e}$ τ_m $\text{h} \text{e}$ $\text{b} \text{o} \text{r} \text{m} \text{e} \text{n} \text{t} \text{o}$)
 $\tau = w_0 t$

Pigeau Nat. Ph. 10 $\text{O} \text{u} \text{r} \text{a} \text{e} \text{s}$ $\tau_s = w$ - pulse length $\text{u} \text{m}$
 $\text{V} \text{C}$ switching by $h^x(w)$ - pulse
 $H_0^2(v, \tau_s) = \left(\frac{2}{3} \frac{V_{cr}}{\delta R} \right)^2 \frac{(1-v)^2 + d^2 v^2}{F(\tau_s, v)}$ $H_0^c(v=1) = \frac{2V_{cr}d}{3\delta R}$ - $\text{a} \text{b} \text{s} \text{.} \text{m} \text{i} \text{n} \text{.} \text{switch. field.}$
 Em H_0 $\text{r} \text{e} \text{b} \text{e} \text{n} \text{h} \text{o}$, $\text{e} \text{o}$ $H_0(v)$ $\text{u} \text{m} \text{e} \text{s}$ $\text{m} \text{i} \text{n}$ $\text{u} \text{m } \tau = \text{const}$.
 Pigeau's $\text{r} \text{e} \text{s} \text{u} \text{l} \text{t}$. v $\text{u} \text{z}$ $\text{m} \text{i} \text{n}$ $H_0(v, \tau)$ - optimal frequency $v^*(w)$.

$\text{h} \text{o} \text{g} \text{f} \text{o} \text{r} \text{m} \text{a}$ $\text{m} \text{-w. energy}$ $E \sim w H_0^2(v, w)$, $\text{m} \text{i} \text{n}$ $\text{p} \text{o} \text{w} \text{e} \text{r}$ $P \sim H_0^2[v^*(w), w]$
 $\frac{dH_0^2(v, \tau)}{dv} = \frac{(1)^2}{F^2(\tau, v)} [\{ 2(1-v) + 2d^2v \} F(\tau, v) - \{ (1-v)^2 + d^2v^2 \} \frac{dF(\tau, v)}{dv}] = 0$

- $\text{g} \text{e} \text{r} \text{a}$ $\text{g} \text{e} \text{r} \text{a} \text{m} \text{e} \text{n} \text{t} \text{o}$ $\text{h} \text{a}$ $v^*(\tau) = v^*(w)$ - optimal freq.
 $F(\tau, v) = v^2 + e^{-2d\tau} - 2ve^{-d\tau} \cos(1-v)\tau$ $(d \rightarrow 0)$. $\frac{dF}{dv} = 2v + 2ve^{-d\tau} (1-v) \sin(1-v)\tau - 2e^{-d\tau} \cos(1-v)\tau$
 $\text{d} \text{u} \text{c} \text{a}$ $w_0 = w_0^+ = 2\pi \cdot 250 \text{ MHz}$, $\text{t} \text{u} \text{n} \text{e} \text{r}$ $\tau = w_0^+ w = 2\pi \frac{w}{w_0^+} \approx 25\pi \times 80$ ($w = 50 \text{ ns}$)
 $d\tau \approx 0.03 \cdot 80 \approx 2.4$, $e^{-d\tau} \ll 1$ ($\text{q} \text{u} \text{e}$ $w = 50 \text{ u} \text{ } 100 \text{ ns}$).

$\text{B} \text{.} \text{r} \text{e} \text{s} \text{u} \text{l} \text{t}$ $\text{u} \text{m} \text{d} \text{u} \text{m} \text{e} \text{n} \text{t} \text{o}$ $e^{-d\tau} \ll 1$, $F(\tau, v) = v^2$.
 $2(1-v + d^2v)v^2 = \{ (1-v)^2 + d^2v^2 \} 2v = 0$, $v(1-v) + d^2v^2 = \{ v^2 - 2v + 1 + d^2v^2 \} = 0$
 $-v + 2v - 1 = 0$, $v^* = 1$ - $\text{r} \text{e} \text{s} \text{u} \text{l} \text{t}$, $\text{h} \text{o}$ $v^* = v^*(\tau)$ $\text{g} \text{o} \text{r} \text{e} \text{n} \text{d} \text{o}$ $\text{c} \text{r} \text{i} \text{t} \text{e} \text{r} \text{i} \text{o}$ $\tau = w$
 $F(\tau, v=1) = 1 + e^{-2d\tau} - 2e^{-d\tau} = (1 - e^{-d\tau})^2$. $\text{H} \text{e} \text{r} \text{o} \text{m} \text{o}$ $e^{-d\tau} \rightarrow 0$, $\text{I} \text{A} \text{252}$
 $E(w) \approx w H_0^2(v^*, w) = w \left(\frac{2V_{cr}}{3\delta R} \right)^2 \frac{d^2}{(1 - e^{-dw})^2}$, $\frac{2}{3}$.

$E(w) = \frac{1}{a^2} w H_0^2(v^*, w) = \frac{1}{a^2} \left(\frac{3V_{cr}d}{\delta R} \right)^2 \frac{w}{(1 - e^{-dw})^2}$, a - $\text{c} \text{o} \text{n} \text{v} \text{e} \text{r} \text{s} \text{i} \text{o} \text{n}$ $\text{f} \text{a} \text{c} \text{t} \text{o} \text{r}$ Pigeau's
 $\text{g} \text{e} \text{r} \text{o}$ $\text{c} \text{o} \text{b} \text{n} \text{.}$ c $\text{E} \text{q. (2)}$ - Pigeau's $\text{z} \text{a}$ $\text{u} \text{e} \text{r}$, y $\text{m} \text{e} \text{n} \text{t} \text{o}$ "3", y $\text{P} \text{i} \text{g} \text{e} \text{a} \text{u}$ "6" e $\text{m} \text{e} \text{n} \text{t} \text{o}$.
 $\frac{dE(w)}{dw} = C \frac{1}{(1-e)^4} [(1-e^{-dw})^2 - w 2(1-e^{-dw}) d e^{-dw}] = 0$, $1 - e^{-dw} - 2dw e^{-dw} = 0$
 Pigeau's $\text{a} \text{p} \text{r} \text{o} \text{x} \text{i} \text{m} \text{a} \text{z} \text{a} \text{z} \text{o}$. $w_{\text{min}} = 1.26/d$ (!?). $\text{T} \text{a} \text{n} \text{t} \text{o}$ $w_{\text{min}} d \approx 1$ u $\text{h} \text{e} \text{r} \text{o} \text{g} \text{e} \text{r} \text{o}$ $e^{-dw} \ll 1$.

Te. Wmin (pulse length) = 1.26/dw0 Pigeau'10 before nerve
 April: Abril
 nonyrons orens upydo ⇒ oroga u zabouennse b 2 paza d=0.008
 Note: 7ro Nipm sb a ne PNi u L110 = 0.002 d = 0.003 7ro
 24 gae duvay = d = 0.008. Torga de 0.008. 80
 crasar e^{-dt} < 1 dyger coban upydo upu pacere d
 Astarteia. Martes

Hago ucras v* = 1 + d e^{-dt} c > 1, 2ro ucras v* u
 upubegor k quennouennse d" uz fitting E(w) vs. w.
 8 $\frac{dH_0^2}{dv} = \frac{(\cdot)^2}{F^2} (v-1) [2F(c,v) - (v-1) \frac{dF}{dv}] = 0$, eam d² < e^{-dt} ~ (v-1)
 euse barnee, 2ro barnee, 2ro H₀(v,c) u E(w) barbouennse que
 Circular field, a b dken. h_z^x - linearly polarized.
 Barbog: Eq.(2) uz Pigeau' Nat. Phys. '10 before nerve u wmin
 10 ~ nonyrenouy uz Eq. (2) toze nerve. Ho trabae reseroueo
 upu barbog optimal freq. v* u min E - most effective pulse length w =
 11 - euse ro, 2ro Eq. (2) a barbog que circular field, a exp. - h_z^x - linear
 → T. e. abrogat Pigeau' N. Ph. '10 upydo upuennouennse ne ro equation.

VC motion in linear polarized field h_z^x(t)

$$-\vec{G} \times \vec{X} - D\dot{\vec{X}} + \alpha\vec{X} + \mu\vec{z} \times \vec{H} = 0, \quad \vec{z} \times \vec{H} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ 0 & 0 & 1 \\ H_x & H_y & 0 \end{vmatrix} = \hat{y}H_x - \hat{x}H_y$$

$$\begin{cases} G_z \dot{Y} - D\dot{X} + \alpha X = \mu H_y \\ -G_z \dot{X} - D\dot{Y} + \alpha Y = -\mu H_x \end{cases} \quad G_z = -G/p \quad H_x(t) = H_0 \sin \omega t, \quad H_y = 0$$

Obusee pen. NO DY $Z(t) = X + iY = Z(0) e^{i\omega_0 t} e^{-d\omega t}$, $\omega_0 = \frac{\mu}{G}$

$$\begin{cases} -p\dot{Y} + d\dot{X} + \omega_0 X = \frac{\mu}{G} \cdot 0 \\ p\dot{X} + d\dot{Y} + \omega_0 Y = -\frac{\mu}{G} H_0 \sin \omega t \end{cases} \quad (1) \quad (2)$$

Uuseu racm. penenne ANDY: $X = a_1 \cos \omega t + b_1 \sin \omega t$

$$-p\omega [-a_2 \sin \omega t + b_2 \cos \omega t] + d\omega [-a_1 \sin \omega t + b_1 \cos \omega t] + \omega_0 [a_2 \cos \omega t + b_2 \sin \omega t] = 0$$

$$p\omega [-a_1 \sin \omega t + b_1 \cos \omega t] + d\omega [-a_2 \sin \omega t + b_2 \cos \omega t] + \omega_0 [a_2 \cos \omega t + b_2 \sin \omega t] = -\frac{\mu}{G} H_0 \sin \omega t$$

(1) $\cos \omega t$: $p\omega b_2 + d\omega b_1 + \omega_0 a_1 = 0$
 (1) $\sin \omega t$: $+p\omega a_2 - d\omega a_1 + \omega_0 b_1 = 0$
 (2) $\cos \omega t$: $p\omega b_1 + d\omega b_2 + \omega_0 a_2 = 0$
 (2) $\sin \omega t$: $-p\omega a_1 - d\omega a_2 + \omega_0 b_2 = -\frac{\mu H_0}{G}$

114/251
$$\begin{pmatrix} \omega_0 & d\omega & 0 & -p\omega \\ -d\omega & \omega_0 & p\omega & 0 \\ 0 & p\omega & \omega_0 & d\omega \\ -p\omega & 0 & -d\omega & \omega_0 \end{pmatrix} \begin{pmatrix} a_1 \\ b_1 \\ a_2 \\ b_2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ -\frac{\mu H_0}{G} \end{pmatrix}, \quad \begin{pmatrix} a_1 \\ b_1 \\ a_2 \\ b_2 \end{pmatrix} = \frac{1}{\det A} \begin{pmatrix} x & x & x & -M_{11} \\ x & x & x & M_{12} \\ x & x & x & -M_{13} \\ x & x & x & M_{14} \end{pmatrix} \begin{pmatrix} 0 \\ 0 \\ 0 \\ -\frac{\mu H_0}{G} \end{pmatrix}$$

Mij - minor A - matrouyob - onpogouennse, barrepx. i - currey

$$M_{11} = \begin{vmatrix} d\omega & 0 & -p\omega \\ \omega_0 & p\omega & 0 \\ p\omega & \omega_0 & d\omega \end{vmatrix} = d^2 p \omega^3 - p \omega \omega_0^2 + p \omega^3 = p \omega [(1+d^2) \omega^2 - \omega_0^2]$$

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$$\det A = \omega_0 \begin{vmatrix} \omega_0 & p\omega & 0 \\ p\omega & \omega_0 & d\omega \\ 0 & -d\omega & \omega_0 \end{vmatrix} - d\omega \begin{vmatrix} -d\omega & p\omega & 0 \\ 0 & \omega_0 & d\omega \\ -p\omega & -d\omega & \omega_0 \end{vmatrix} - p\omega \begin{vmatrix} -d\omega & \omega_0 & p\omega \\ 0 & p\omega & \omega_0 \\ -p\omega & 0 & -d\omega \end{vmatrix} =$$

$= \omega_0 [\omega_0^3 - \omega^2 \omega_0 + d^2 \omega^2 \omega_0] - d\omega [-d\omega \omega_0^2 - d\omega^3 - d^3 \omega^3] -$
 $- p\omega [p d^2 \omega_0^3 - p\omega \omega_0^2 + p\omega^3] = \omega_0^2 [\omega_0^2 + (d^2 - p)\omega^2] + d^2 \omega^2 [\omega_0^2 + (1+d^2)\omega^2] -$
 $- \omega^2 [(1+d^2)\omega_0^2 - \omega_0^2] = (\omega_0^2 + d^2 \omega^2)^2 - \omega^4$. *Probefrags.*

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$p(t) \Big|_{H_0} = \dot{X}(t) + \dot{Y}(t) = \omega^2 [-a_1 \sin \omega t + b_1 \cos \omega t] + \omega^2 [-a_2 \sin \omega t + b_2 \cos \omega t]$
 $\frac{1}{\omega^2} |\dot{V}(t)|^2 = a_1^2 \sin^2 \omega t + b_1^2 \cos^2 \omega t - 2a_1 b_1 \cos \omega t \sin \omega t + a_2^2 \sin^2 \omega t +$
 $+ b_2^2 \cos^2 \omega t - 2a_2 b_2 \cos \omega t \sin \omega t = (a_1^2 + a_2^2) \sin^2 \omega t + (b_1^2 + b_2^2) \cos^2 \omega t -$
 $- (a_1 b_1 + a_2 b_2) \sin 2\omega t$

$\frac{1}{\omega^2} |\dot{V}(t)|^2 \Big|_{H_0} = \frac{1}{2} (a_1^2 + a_2^2 + b_1^2 + b_2^2) + \frac{1}{2} (b_1^2 + b_2^2 - a_1^2 - a_2^2) \cos 2\omega t - (a_1 b_1 + a_2 b_2) \sin 2\omega t$
(3ro sommo HDY - 2acsb, undt $\rightarrow \infty$ nperen.)

$X(t) = X_0 e^{-d\omega t}$ ker $Z_0 e^{i\varphi} = (X_0 + iY_0)(\cos \varphi + i \sin \varphi) = X_0 \cos \varphi - Y_0 \sin \varphi + iY_0 \cos \varphi + iX_0 \sin \varphi$

$X(t) = [X_0 \cos \omega_0 t - Y_0 \sin \omega_0 t] e^{-d\omega t} + a_1 \cos \omega t + b_1 \sin \omega t$
 $Y(t) = [Y_0 \cos \omega_0 t + X_0 \sin \omega_0 t] e^{-d\omega t} + a_2 \cos \omega t + b_2 \sin \omega t$

$\text{Herges } X(0)=0, Y(0)=0, X(0)=X_0 + a_1=0, Y(0)=Y_0 + a_2=0,$
 $\text{no anfangswerte } X_0, Y_0.$ *3ro homog. lygne* $\text{refez } Z(t) = X(t) + iY(t).$

$(27/20) \quad -p\dot{Y} + ip\dot{X} + d(\dot{X} + i\dot{Y}) + \frac{\mu}{|G|}(X + iY) = \frac{\mu}{|G|}(H_y - iH_x)$
 $ip\dot{Z} + d\dot{Z} + \omega_0 Z = -i\frac{\mu}{|G|}(H_x + iH_y), \quad i(p-id)\dot{Z} + \omega_0 Z = -i\frac{\mu}{|G|}(H_x + iH_y)$

$\text{Sam field is circular } H_x + iH_y = H_0 e^{\pm i\omega t}, \text{ so } Z(t) = Z(0) e^{\pm i\omega t}$
 $[\mp \omega(p-id) + \omega_0] Z(0) = -i\frac{\mu}{|G|} H_0, \text{ r.e. } Z_{\pm}(0) = \frac{1}{\omega_0 \mp \omega(p-id)} \left[-i\frac{\mu}{|G|} H_0 \right]$
 $\omega > 0, \omega_0 > 0, Z_{\pm}(0) \text{ abh. c } 20/\text{III} \text{ abh. wpm } \mu \rightarrow -\mu. \mu = 3 \text{ cm/s V/k.}$
 $Z_{\pm}(0) = +i\frac{\mu}{\omega} \text{ wpm } H_0 = H_0^*, Z_0(0) = X(0) + iY(0) = i\frac{\mu}{\omega} H_0^*, Y(0) = \frac{\mu}{\omega} H_0^*$
 $Y_0 \rightarrow H_0^* \quad Y_0 > 0 \text{ wpm } \omega > 0 \text{ bepmo.}$

$YD: \quad i(p-id)\dot{Z} + \omega_0 Z = ih, \quad h = \frac{\mu}{|G|} H, \quad H(t) = H_x(t) + iH_y(t).$
 $\text{Gause pem. } \text{HDY } Z(t) = Z(0) e^{ip\omega t} e^{-d\omega t}, \quad H_y = H_0 \cos \omega t = \frac{H_0}{2} [e^{i\omega t} + e^{-i\omega t}]$

$i(p-id)\dot{Z} + \omega_0 Z = i h_0 \frac{1}{2} [e^{i\omega t} + e^{-i\omega t}]$
 $\text{Gause pem. c } h(t) = h_0 e^{i\omega t} \text{ esb } Z_+(t) = \frac{i h_0}{\omega_0 - \omega(p-id)} [e^{i\omega t} - e^{ip\omega t - d\omega t}]$
 $\rightarrow Z_+(t) = Z_+(0) [e^{i\omega t} - e^{i\omega_0(p+id)t}] H_0$
 $\text{Gause pem. c } h(t) = h_0 e^{-i\omega t} \text{ abh. esb } Z_-(t) = \frac{i h_0}{\omega_0 - \omega(p-id)} [e^{-i\omega t} - e^{i\omega_0(p+id)t}]$

$\rightarrow Z_-(t) = Z_-(0) H_0 [e^{-i\omega t} - e^{i\omega_0(p+id)t}]$
 $Z_- \text{ wprobepm. } i(p-id)Z_- H_0 i [-\omega e^{-i\omega t} - \omega_0(p+id) e^{i\omega_0(p+id)t}] +$
 $+ \omega_0 Z_- H_0 [e^{-i\omega t} - e^{i\omega_0(p+id)t}] = i h_0 e^{-i\omega t}$
 $e^{-i\omega t}: [\omega(p-id) + \omega_0] Z_-(0) H_0 = i h_0, \quad Z_-(0) = i \frac{h_0}{H_0} \frac{1}{[\omega_0 + \omega(p-id)]}$
 $\text{Sam } h(t) = h_y(t) = \frac{h_0}{2} [e^{i\omega t} + e^{-i\omega t}] \text{ wprobepm u mm. kombinausum } Z_+ + Z_-$

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$Z(0) = Z(0)$ abreviar.

$$Z(t) = \frac{1}{2} y_+(w) H_0 e^{i\omega t} + \frac{1}{2} y_-(w) H_0 e^{-i\omega t}$$

nyer $Z(0)=0 \Rightarrow Z(t) = \frac{H_0}{2} y_+(w) e^{i\omega t} + \frac{H_0}{2} y_-(w) e^{-i\omega t}$

H_0 - name of linear field, $H_0 \ln 2 = H_0 \ln e - \text{any gamma } H_0 \rightarrow 2H_0$ cgenar Page 10
 Oteguna: Jueves
 Transient dynamics: $e^{-d\omega t}$ Barren u $y_+(w)$ ne sources.

$$Z(t) = \frac{H_0}{2} \left[y_+(w) e^{i\omega t} + y_-(w) e^{-i\omega t} - \{y_+(w) + y_-(w)\} e^{i\omega t(p+id)t} \right]$$

$$y_{\pm}(w) = i \frac{M}{|G|} \frac{1}{[\omega_0 \mp w(p-id)]}$$

$$y_+(w) \approx i \frac{M}{|G|} \frac{1}{id\omega_0} = \frac{M}{|G|} \frac{1}{d\omega_0}, \quad y_-(w) \approx i \frac{M}{|G|} \frac{1}{[2\omega_0 - id\omega_0]} \approx i \frac{M}{|G|} \frac{1}{2\omega_0}$$

$$\frac{|y_-(w_0)|}{|y_+(w_0)|} = \frac{1}{2\omega_0} d\omega_0 = \frac{d}{2} \ll 1 \quad u \quad y_-(w) \text{ ne Barren, } \text{targa}$$

$$Z(t) \approx_{\omega=\omega_0} \frac{1}{2} H_0 y_+(w) [e^{i\omega t} - e^{i\omega_0 t(p+id)}]$$

Case c y rera $\frac{1}{2} H_0 \rightarrow H_0$.

12 H_0 β cdu. Cuyraa nju barren. switching field $H_0^{sw}(w, t_s)$,
 Cuyraa y rera nju MPD $H_0^{or}(w)$ ω , ω_0 switch.
 13 time $t_s = \omega_0 t_s = f(w, H_0)$ wphenesbar Zueran $y_-(w)$ neyze.

$$Z(t) = \frac{1}{2} Z_+(t) + \frac{1}{2} Z_-(t), \quad Z_{\pm}(t) = y_{\pm}(w) H_0 [e^{\pm i\omega t} - e^{i\omega_0 t(p+id)}]$$

$$\dot{Z} = \frac{1}{2} \dot{Z}_+ + \frac{1}{2} \dot{Z}_-, \quad |\dot{Z}(t)|^2 = \dot{Z}(\dot{Z})^* = \frac{1}{4} [\dot{Z}_+ + \dot{Z}_-] (\dot{Z}_+^* + \dot{Z}_-^*) =$$

$$= \frac{1}{4} [|\dot{Z}_+|^2 + |\dot{Z}_-|^2 + \dot{Z}_- \dot{Z}_+^* + \dot{Z}_+ \dot{Z}_-^*]$$

$$|\dot{Z}_{\pm}|^2 = |y_{\pm}(w)|^2 H_0^2 [\omega^2 + \omega_0^2 e^{-2d\omega t} \mp 2\omega_0 \omega e^{-d\omega t} \{ \cos \varphi_{\pm} - d \sin \varphi_{\pm} \}]$$

c $\varphi_{\pm} = (\omega_0 \mp \omega)t$, cunraen $p = +1$.

$$\dot{Z}_- \dot{Z}_+^* + \dot{Z}_+ \dot{Z}_-^* = 2 \text{Re}(\dot{Z}_+ \dot{Z}_-^*) = 2 \text{Re} y_+ y_-^* H_0^2 [e^{i\omega t} - e^{i\omega_0 t(p+id)}] [e^{i\omega t} - e^{i\omega_0 t(p+id)}]^*$$

$$= 2 H_0^2 \text{Re} y_+ y_-^* [e^{2i\omega t} + 1 - \exp\{it(\omega - \omega_0(1+id))\} - \exp\{it(\omega + \omega_0(1+id))\}]$$

18 - Cogepruus Const(t) uun neyrenno ocunru. c $(\omega - \omega_0)$ - ract. Zueran,
 woyre Barren gure $|\dot{Z}(t)|$ pocr uju manux $t \leq 100$ ns.

$$e^{-it\omega_0(1-id)} + e^{it\omega_0(1+id)} = e^{-d\omega_0 t} [e^{-it\omega_0} + e^{it\omega_0}] = 2e^{-d\omega_0 t} \cos \omega_0 t$$

$$e^{-i\omega_0 t(1-id)} \cdot e^{it\omega_0(1+id)} = e^{-2d\omega_0 t}$$

$$\text{Re}(\dot{Z}_+ \dot{Z}_-^*) = H_0^2 \text{Re} y_+ y_-^* [e^{2i\omega t} + e^{-2d\omega_0 t} - e^{i\omega t} 2e^{-d\omega_0 t} \cos \omega_0 t]$$

$$y_+ y_-^* = \frac{M^2}{G^2} \frac{1}{[\omega_0 - \omega(p-id)] [\omega_0 + \omega(p+id)]} = y_+(w) y_-^*(w) = \frac{M^2}{G^2} \frac{1}{(\omega_0 - \omega)^2 - d^2 \omega^2 + 2id\omega \omega_0}$$

$$= \frac{M^2}{G^2} \frac{1}{[\{d\omega^2 - d^2 \omega^2\}^2 + 4d^2 \omega^2 \omega_0^2]} = a - ib$$

$$[e^{2i\omega t} + 1 - 1 + e^{-2d\omega_0 t} - 2e^{i\omega t} e^{-d\omega_0 t} \cos \omega_0 t] = 2e^{i\omega t} [\cos \omega t - e^{-d\omega_0 t} \cos \omega_0 t] + (e^{-2d\omega_0 t} - 1)$$

$$\text{Re}(\dot{Z}_+ \dot{Z}_-^*) = H_0^2 \text{Re} (a - ib) [2e^{i\omega t} (\cos \omega t - e^{-d\omega_0 t} \cos \omega_0 t) + (e^{-2d\omega_0 t} - 1)] =$$

$$= H_0^2 2 (\cos \omega t - e^{-d\omega_0 t} \cos \omega_0 t) [a \cos \omega t + b \sin \omega t] + H_0^2 a (e^{-2d\omega_0 t} - 1)$$

$$|\dot{z}_\pm|^2 = |\dot{z}_+|^2 + |\dot{z}_-|^2 + 2\text{Re}(\dot{z}_+ \dot{z}_-^*), \quad \varphi_\pm = (\omega_0 \mp \omega)t$$

$$4|\dot{z}_\pm|^2 = |y_+|^2 H_0^2 [\omega^2 + \omega_0^2 e^{-2d\omega t} - 2\omega\omega_0 e^{-d\omega t} (\cos\varphi_+ - d\sin\varphi_+)] +$$

$$+ |y_-|^2 H_0^2 [\omega^2 + \omega_0^2 e^{-2d\omega t} + 2\omega\omega_0 e^{-d\omega t} (\cos\varphi_- - d\sin\varphi_-)] +$$

$$+ 4H_0^2 (\cos\omega t - e^{-d\omega t} \cos\omega_0 t) (a\cos\omega t + b\sin\omega t) + 2H_0^2 a (e^{-2d\omega t} - 1)$$

$|V(t)| = v_{cr}$ gata ghabonue chegabonue switch. field H_0 , sw. time t_s u ω .

gata ghabonue que linear polarized field $H_x(t) = H_0 \cos\omega t$ ghabonue. Caudence

en eq. $v_{cr} = \frac{3}{2} \gamma R H_0 \frac{\sqrt{F(\pi, \nu)}}{\sqrt{(\nu-1)^2 + d^2 \nu^2}}$ que circular field ug Lee PRL'08.

$$\text{Nyst } \omega = \omega_0 : 4|V(t)|^2 = |y_+|^2 H_0^2 \omega_0^2 (1 - e^{-d\omega t})^2 + |y_-|^2 H_0^2 \omega_0^2 \times$$

$$\times [1 + e^{-2d\omega t} + 2e^{-d\omega t} (\cos 2\omega_0 t - d \sin 2\omega_0 t)] + 4H_0^2 \cos\omega_0 t (1 - e^{-d\omega t}) (a\cos\omega_0 t + b\sin\omega_0 t)$$

$$+ 2H_0^2 a (e^{-2d\omega t} - 1)$$

$$a = \frac{\mu^2}{G^2} \frac{(\omega_0 - \omega)^2 - d^2 \omega^2}{[(\Delta\omega^2 - d^2 \omega^2)^2 + 4d^2 \omega^2 \omega_0^2]}, \quad b(\omega = \omega_0) = \frac{\mu^2}{G^2} \frac{(-1)d^2 \omega_0^2}{d^4 \omega_0^4 + 4d^2 \omega_0^4} = -\frac{\mu^2}{G^2} \frac{1}{4\omega_0^2}$$

$$b = \frac{\mu^2}{G^2} \frac{2d\omega\omega_0}{[(\Delta\omega^2 - d^2 \omega^2)^2 + 4d^2 \omega^2 \omega_0^2]}, \quad b(\omega = \omega_0) = \frac{\mu^2}{G^2} \frac{2d\omega_0^2}{4d^2 \omega_0^4} = \frac{\mu^2}{G^2} \frac{1}{2d\omega_0^2}$$

$$a(\omega_0) < b(\omega_0)$$

$$4|V(t)|^2 = |y_+|^2 H_0^2 \omega_0^2 (1 - e^{-d\omega t})^2 + 4H_0^2 \cos\omega_0 t (1 - e^{-d\omega t}) b \sin\omega_0 t +$$

$$+ 2H_0^2 a (e^{-2d\omega t} - 1)$$

$$|V(t)|^2_{\omega=\omega_0} = \frac{1}{4} |y_+|^2 H_0^2 \omega_0^2 (1 - e^{-d\omega t})^2 + \frac{1}{2} H_0^2 (1 - e^{-d\omega t}) b \sin 2\omega_0 t - \frac{1}{2} H_0^2 a (1 - e^{-2d\omega t})$$

$$[\omega_0 - \omega(1-id)][\omega_0 + \omega(1+id)] = (\omega_0 - \omega + id\omega)(\omega_0 + \omega + id\omega) = \Delta\omega^2 - d^2 \omega^2 + 2id\omega\omega_0$$

Caudence $t_s \rightarrow \infty$ when $H_0 \rightarrow H_0^2 + 0$, rorga $|V(t)|^2 \approx \frac{1}{4} |y_+|^2 H_0^2 \omega_0^2 - \frac{1}{2} H_0^2 a +$

$+\frac{1}{2} H_0^2 b \sin 2\omega_0 t$, ghabonue max w/ $2\omega_0 t_m = (2m-1)\frac{\pi}{2}$

$$|V(t)|^2_{\max} \approx \frac{1}{4} |y_+|^2 H_0^2 \omega_0^2 + \frac{1}{2} H_0^2 b, \quad |y_\pm(\omega)|^2 = \frac{\mu^2}{G^2} \frac{1}{(\omega \mp \omega_0)^2 + d^2 \omega^2}$$

$$|H|/|G| = \frac{1}{2} \gamma R \gamma, \quad |y_+(\omega_0)|^2 = \left(\frac{1}{2} \gamma R \gamma\right)^2 \frac{1}{d^2 \omega_0^2}$$

$$|V(t)|^2_{\max} = \frac{1}{4} \left(\frac{1}{2} \gamma R \gamma\right)^2 \frac{1}{d^2} H_0^2 + \frac{1}{2} H_0^2 \left(\frac{1}{2} \gamma R \gamma\right)^2 \cdot b(\omega_0)$$

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$\text{Re}(\dot{z}_+ \dot{z}_-^*)$ no nuan nebepono. Hago $\dot{z}_\pm(t) = y_\pm H_0 [\pm i\omega e^{\pm i\omega t} - i\omega_0(1+id) e^{\pm i\omega_0(1+id)t}]$

$$\text{Re}(\dot{z}_+ \dot{z}_-^*) = \text{Re} y_+ y_-^* H_0^2 i [\pm i\omega e^{\pm i\omega t} - \omega_0(1+id) e^{\pm i\omega_0(1+id)t}]^*$$

$$\times i [-\omega e^{-i\omega t} - \omega_0(1+id) e^{-i\omega_0(1+id)t}] = H_0^2 \text{Re} y_+ y_-^* [\omega e^{\pm i\omega t} - \omega_0(1+id) e^{\pm i\omega_0(1+id)t}]$$

$$\times [-\omega e^{-i\omega t} - \omega_0(1-id) e^{-i\omega_0(1-id)t}] = H_0^2 \text{Re} y_+ y_-^* [-\omega^2 e^{2i\omega t} + \omega_0^2 e^{-2i\omega_0 t} + 2i\omega\omega_0 e^{-i\omega t} e^{-i\omega_0(1+id)t}]$$

$$+ \omega_0^2 e^{-2d\omega_0 t} - \omega\omega_0(1-id) e^{i\omega t} e^{-i\omega_0(1-id)t} + \omega\omega_0(1+id) e^{i\omega t} e^{-i\omega_0(1+id)t}] =$$

$$-(1-id) e^{-i\omega_0 t} e^{-\omega_0 t} + (1+id) e^{i\omega_0 t} e^{-\omega_0 t} = e^{-d\omega_0 t} [e^{i\omega_0 t} - e^{-i\omega_0 t} + id(e^{i\omega_0 t} + e^{-i\omega_0 t})]$$

$$= e^{-d\omega_0 t} 2i [\sin\omega_0 t + d\cos\omega_0 t]$$

$$\text{Re}(\dot{z}_+ \dot{z}_-) = H_0^2 \text{Re} y_+ y_-^* [-\omega^2 e^{2i\omega t} + \omega_0^2 e^{-2d\omega_0 t} + 2i\omega\omega_0 e^{-d\omega_0 t} (\sin\omega_0 t + d\cos\omega_0 t)]$$

$$= H_0^2 \text{Re} (a-ib) [-\omega^2 (\cos 2\omega t + i\sin 2\omega t) + \omega_0^2 e^{-2d\omega_0 t} + 2i\omega\omega_0 e^{-d\omega_0 t} (\sin\omega_0 t + d\cos\omega_0 t) (i\cos\omega t - \sin\omega t)]$$

$$= H_0^2 [-\omega^2 a \cos 2\omega t + \omega_0^2 a e^{-2d\omega_0 t} + 2a\omega\omega_0 e^{-d\omega_0 t} (\sin\omega_0 t + d\cos\omega_0 t) (-1) \sin\omega t - \omega^2 b \sin 2\omega t +$$

$$+ 2b\omega\omega_0 e^{-d\omega_0 t} (\sin\omega_0 t + d\cos\omega_0 t) \cos\omega t$$

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$$4|V(t)|^2 = |\dot{Z}_+|^2 + |\dot{Z}_-|^2 + 2\text{Re}(\dot{Z}_+ \dot{Z}_-^*)$$

$$30 \quad 4|V(t)|^2 = |\dot{Z}_+|^2 + |\dot{Z}_-|^2 + 2H_0^2 [-\omega^2 a \cos 2\omega t - 2a\omega\omega_0 e^{-d\omega_0 t} (\sin\omega_0 t + d\cos\omega_0 t) \sin\omega t - \omega^2 b \sin 2\omega t +$$

$$\times (\sin\omega_0 t + d\cos\omega_0 t) \cos\omega t] = |\dot{Z}_+|^2 + |\dot{Z}_-|^2 + 2H_0^2 [-\omega^2 (a \cos 2\omega t + b \sin 2\omega t) + \omega_0^2 a e^{-2d\omega_0 t} + 2\omega\omega_0 e^{-d\omega_0 t} (\sin\omega_0 t + d\cos\omega_0 t) (b \cos\omega t - a \sin\omega t)]$$

8. Considera $\omega = \omega_0$ u. y. m. r. $a(\omega_0) < b(\omega_0)$, $|\dot{Z}_+|^2 > |\dot{Z}_-|^2$ u. m. r. resonancia p.

$$4|V(t)|^2 \approx |\dot{Z}_+|^2 + 2H_0^2 [-\omega_0^2 b \sin 2\omega_0 t + \omega_0^2 a e^{-2d\omega_0 t} + 2\omega_0^2 e^{-d\omega_0 t} \sin\omega_0 t \times$$

$$\times b \cos\omega_0 t] = |\dot{Z}_+|^2 + 2H_0^2 \omega_0^2 [(e^{-d\omega_0 t} - 1) b \sin 2\omega_0 t + a e^{-2d\omega_0 t}]$$

$$10 \quad |V(t)|^2 \approx \frac{1}{4} |\dot{Z}_+|^2 + \frac{1}{2} H_0^2 \omega_0^2 b (e^{-d\omega_0 t} - 1) \sin 2\omega_0 t$$

$$11 \quad |\dot{Z}_+|^2 = \frac{1}{4} |Y_+|^2 H_0^2 \omega_0^2 (1 - e^{-d\omega_0 t})^2 - \frac{1}{2} H_0^2 \omega_0^2 b(\omega_0) (1 - e^{-d\omega_0 t}) \sin 2\omega_0 t$$

$$12 \quad |Y_+|^2 \omega_0^2 = (\frac{1}{2} R_X)^2 \frac{1}{d^2}, \quad b(\omega_0) \omega_0^2 = (\frac{1}{2} R_X)^2 \frac{1}{2d}$$

$$13 \quad |V(t)|^2 = \frac{1}{4} (\frac{1}{2} R_X)^2 \left[\frac{1}{d^2} (1 - e^{-d\omega_0 t})^2 - \frac{1}{d} (1 - e^{-d\omega_0 t}) \sin 2\omega_0 t \right] H_0^2$$

14. Mas. u. m. r. d < 1: $|V(t)|^2 = \frac{1}{2} (\frac{1}{2} R_X)^2 H_0^2 \frac{1}{d} (1 - e^{-d\omega_0 t})$

15. no no choque u. circular case, y. m. r. $(H_0)^{\text{lin}} \leftrightarrow H_0^{\text{circ.}} (\omega = \omega_0)$.

16. T. e. u. m. $\omega = \omega_0$ lin-polariz. $H_x(t)$ choque u. circular case.

$$17 \quad |V(t)|^2 = \frac{1}{4} |\dot{Z}_+|^2 + \frac{1}{4} |\dot{Z}_-|^2 + \frac{1}{2} H_0^2 [-\omega^2 (a \cos\omega t + b \sin\omega t) + \omega_0^2 a e^{-2d\omega_0 t} + 2\omega\omega_0 e^{-d\omega_0 t} \sin\omega_0 t (b \cos\omega t - a \sin\omega t)]$$

$$18 \quad |\dot{Z}_\pm|^2 = |Y_\pm(\omega)|^2 H_0^2 [\omega^2 + \omega_0^2 e^{-2d\omega_0 t} \mp 2\omega\omega_0 e^{-d\omega_0 t} \cos(\omega_0 \mp \omega)t]$$

19. Yp. e $|V(t)| = V_{cr}$ zagaer chego switch. field H_0 , switch. time t_s u. ω .

20. $|V(t)| \rightarrow \max$ enlegen. y. m. r. switching MPD $H_0^{\text{cr}}(\omega)$. Mas. b. u. g.

21. g. a. r. m. e. n. e. $\frac{d(t)}{dt}$ ne $\sim d$, i. e. $d \ll 1$.

$$22 \quad \frac{d}{dt} |V(t)|^2 = \frac{1}{4} |Y_+|^2 H_0^2 [4\omega\omega_0 e^{-d\omega_0 t} (\omega_0 - \omega) \sin(\omega_0 - \omega)t] +$$

$$23 \quad + \frac{1}{4} |Y_-|^2 H_0^2 [-2\omega\omega_0 e^{-d\omega_0 t} (\omega_0 + \omega) \sin(\omega_0 + \omega)t] +$$

$$24 \quad + \frac{1}{2} H_0^2 [-2\omega^3 (-a \sin\omega t + b \cos\omega t) + 2\omega\omega_0^2 e^{-d\omega_0 t} \cos\omega_0 t (b \cos\omega t - a \sin\omega t) +$$

$$25 \quad + 2\omega^2\omega_0 e^{-d\omega_0 t} \sin\omega_0 t (-b \sin\omega t - a \cos\omega t)] = 0 \quad \text{qua. n. o. a. e. t. m.}$$

26. E. e. m. e. n. e. c. r. u. s. a. d. $d\omega_0 t_m \gg 1$, u. o.

27. 120/245 $-a \sin 2\omega t_m + b \cos 2\omega t_m = 0$, $\tan 2\omega t_m = \frac{b}{a}$

$$28 \quad t_m = \frac{1}{2\omega} \arctg\left(\frac{b}{a}\right), \quad \frac{b}{a} = \frac{2d\omega\omega_0}{(\omega - \omega_0)^2 - d^2\omega^2}, \quad \arctg\left(\frac{b}{a}\right) = \arctg\left(\frac{2}{d}\right) = \frac{\pi}{2}$$

$$29 \quad \omega t_m \approx \pm \frac{\pi}{4} n, \quad \text{y. m. r. e. } (-\frac{\pi}{2} n).$$

30. Problema: $\dot{Z} = \frac{1}{2} \dot{Z}_+ + \frac{1}{2} \dot{Z}_- = \frac{i}{2} Y_+ H_0 [\omega e^{i\omega t} - \omega_0 (1 + id) e^{i\omega_0 (1 + id)t}] + \frac{i}{2} Y_- H_0 [-\omega e^{-i\omega t} - \omega_0 (1 + id) e^{i\omega_0 (1 + id)t}] = \frac{i}{2} H_0 [Y_+ e^{i\omega t} - Y_- e^{-i\omega t}] - \frac{i}{2} H_0 \omega_0 (1 + id) e^{i\omega_0 t} (Y_+ + Y_-)$

$\omega = \omega_0$: $f_+(\omega_0) = i \frac{\mu}{G} \frac{1}{i d \omega_0} = \frac{\mu}{G} \frac{1}{d \omega_0}$, $f_-(\omega_0) = i \frac{\mu}{G} \frac{1}{2 \omega_0 - i d \omega_0} = i \frac{\mu}{G} \frac{1}{\omega_0} \frac{1}{2 - i d}$

$\dot{z}(\omega = \omega_0) = \frac{1}{2} H_0 \omega_0 f_+(\omega_0) e^{i \omega_0 t} - \frac{i}{2} H_0 \omega_0 (1 + i d) e^{i \omega_0 t} e^{-d \omega_0 t} f_+ = |f_+| = 1$

$| \dot{z} |_{\omega = \omega_0}^2 = \frac{1}{4} H_0^2 \omega_0^2 |f_+|^2 [1 - (1 + i d) e^{-d \omega_0 t}] [1 - (1 - i d) e^{-d \omega_0 t}] = \frac{H_0^2 \omega_0^2}{4} |f_+|^2 [1 - e^{-d \omega_0 t}] + O(d^2)$

$f_-(\omega_0) = i \frac{\mu}{G} \frac{1}{\omega_0} \frac{1}{2 - i d} = i \frac{\mu}{G} \frac{1}{2 \omega_0} \frac{1 + i d/2}{1 + (d/2)^2} = \frac{\mu}{G} \frac{1}{2 \omega_0} (-\frac{1}{2} + i) \approx i \frac{\mu}{G} \frac{1}{2 \omega_0} = i f_+''$

$\dot{z} = \frac{1}{2} H_0 \omega_0 [f_+ e^{i \omega_0 t} - i f_+'' e^{-i \omega_0 t}] - \frac{i}{2} H_0 \omega_0 (1 + i d) e^{i \omega_0 t} e^{-d \omega_0 t} [f_+ + i f_+'] =$

$= \frac{1}{2} H_0 \omega_0 e^{i \omega_0 t} [f_+ - i f_+'' e^{-2i \omega_0 t} - (1 + i d) e^{-d \omega_0 t} (f_+ + i f_+')] , \quad (f_+'' = \frac{d}{2} f_+')$

$| \dot{z} |_{\omega = \omega_0}^2 = \frac{1}{4} H_0^2 \omega_0^2 [f_+^2 (\cos 2 \omega_0 t + \sin 2 \omega_0 t) - e^{-d \omega_0 t} (f_+^2 - d f_+^2 + i (d f_+^2 + f_+^2))]$

$= \frac{1}{4} H_0^2 \omega_0^2 [f_+^2 (1 - e^{-d \omega_0 t}) - f_+'' \sin 2 \omega_0 t - i [f_+'' (\cos 2 \omega_0 t + e^{-d \omega_0 t}) + d f_+^2 e^{-d \omega_0 t}]]$

$= \frac{1}{4} H_0^2 \omega_0^2 [(f_+^2)^2 (1 - e^{-d \omega_0 t})^2 - 2 f_+^2 f_+'' (1 - e^{-d \omega_0 t}) \sin 2 \omega_0 t + (f_+''^2) \sin^2 2 \omega_0 t +$

$+ (f_+''^2) (\cos 2 \omega_0 t + e^{-d \omega_0 t})^2 + 2 f_+^2 d f_+^2 (\cos 2 \omega_0 t + e^{-d \omega_0 t}) e^{-d \omega_0 t} + d^2 (f_+^2)^2 e^{-2 d \omega_0 t}]$

$\text{For } d \omega_0 t \ll 1 \quad 1 - e^{-d \omega_0 t} \sim d \quad \text{and } \sin 2 \omega_0 t \sim 2 \omega_0 t \quad \text{so } | \dot{z} |^2(t) \sim d^2 (f_+^2)^2$

$\text{Note } \frac{f_+''}{f_+^2} \sim d, \quad f_+'' \sim d f_+^2$

$(d \omega_0)^{-1} \sim (0.01 \cdot 2\pi \cdot 0.1 \text{ GHz})^{-1} \sim 100 \text{ ns}$

$\rightarrow | \dot{z} |_{\omega = \omega_0}^2 = \frac{1}{4} H_0^2 \omega_0^2 [(1 - e^{-d \omega_0 t})^2 - (1 - e^{-d \omega_0 t}) d \sin 2 \omega_0 t + \frac{1}{4} d^2 \sin^2 2 \omega_0 t +$

$+ \frac{1}{4} d^2 (\cos 2 \omega_0 t + e^{-d \omega_0 t})^2 + d^2 (\cos 2 \omega_0 t + e^{-d \omega_0 t}) e^{-d \omega_0 t} + d^2 e^{-2 d \omega_0 t}] (f_+^2)^2$

$(27/ii) \text{ a b } | \dot{z} |_{\omega = \omega_0}^2 \text{ depends on } d^2, \text{ so when } d \rightarrow 0, \text{ response } \rightarrow 0$

$| \dot{z} |_{\omega = \omega_0}^2 = \frac{1}{4} (\frac{1}{2} R \gamma)^2 \frac{H_0}{d^2} [(1 - e^{-d \omega_0 t})^2 - (1 - e^{-d \omega_0 t}) d \sin 2 \omega_0 t]$

$\text{For } d \omega_0 \ll 1 \text{ b item } \text{response} \text{ is } \sim d^2$

$| \dot{z} |_{\omega = \omega_0}^2 = \frac{1}{4} H_0^2 \omega_0^2 (f_+^2)^2 d^2 [\omega_0^2 t^2 - \omega_0 t \cdot 2 \omega_0 t + \frac{1}{4} 4 \omega_0^2 t^2 + \frac{1}{4} \{1 - \frac{1}{2} 4 \omega_0^2 t^2 + 1 - d \omega_0 t\}^2]$

$= \frac{1}{4} H_0^2 \omega_0^2 (f_+^2)^2 d^2 [1 + 2 + 1 + O(t^3)]$

$| \dot{z} |_{\omega = \omega_0}^2 = \frac{1}{4} H_0^2 \omega_0^2 (f_+^2)^2 [(1 - e^{-d \omega_0 t})^2 - d (1 - e^{-d \omega_0 t}) \sin 2 \omega_0 t + \frac{1}{4} d^2 +$

$+ \frac{1}{2} d^2 e^{-d \omega_0 t} \cos 2 \omega_0 t + d^2 (\cos 2 \omega_0 t + e^{-d \omega_0 t}) e^{-d \omega_0 t} + \frac{5}{4} d^2 e^{-2 d \omega_0 t}] =$

$= \frac{1}{4} H_0^2 \omega_0^2 (f_+^2)^2 [(1 - e^{-d \omega_0 t})^2 - d (1 - e^{-d \omega_0 t}) \sin 2 \omega_0 t + \frac{d^2}{4} + \frac{3}{2} d^2 e^{-d \omega_0 t} \cos 2 \omega_0 t + \frac{9}{4} d^2 e^{-2 d \omega_0 t}]$

Escaneado con CamScanner

Mayo

18 Asté - Semana
Circular field 20/III 087., see $H_0 = H_0^*$ - linear polariz. field.

VC Switch. when $V(t) = V_{cr}$. $V_{cr} = \frac{2}{3} R \frac{H_0 \omega_0 t_s}{2}$, $t_s = \frac{2V_{cr}}{R \frac{H_0 \omega_0}{2}}$
 Def. $2V_{cr} = H_0^{cr}$, $t_s = \frac{1}{d\omega_0} \left(\frac{H_0^{cr}}{H_0} \right)$ - VC switch. time.
 Def. circular field H_0 : $t_s(\omega = \omega_0) = -\frac{1}{d\omega_0} \ln(1 - \frac{H_0^{cr}}{H_0}) \approx \frac{1}{d\omega_0} \left(\frac{H_0^{cr}}{H_0} \right)$
 $H_0 \gg H_0^{cr}$ t.e. $V(t)$ u t_s when $t \rightarrow 0$, $H_0 \gg H_0^{cr}$ very much times more!

we have a pure circular field. maximum when $H_0^{lin}/2 = H_0^{cr}$ and $\gamma = 1$
 $|x-1|^2$ u $|x+1|^2$ then.
 inhomogeneous $d\omega_0 \ll 1$, no we when $\omega_0 t \ll 1$.

$$|V(t)|^2_{\omega=\omega_0} = (.) \left[x^2 + x d \sin 2\omega_0 t + \frac{d^2}{2} (1 - \cos 2\omega_0 t) \right], \quad x = d\omega_0 t$$

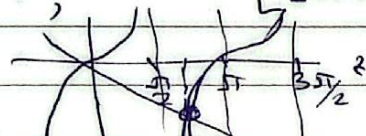
$$|V(t)|^2 = \frac{1}{4} H_0^2 \omega_0^2 (x'_+)^2 d^2 \omega_0^2 \left[t^2 + t \frac{1}{\omega_0} \sin 2\omega_0 t + \frac{1}{2\omega_0^2} (1 - \cos 2\omega_0 t) \right]$$

Even have max $V(t)$ when $t = t_m$, so $V(t_m) = V_{cr}$ for $H_0^{cr} (\omega = \omega_0)$.
 where $V(H_0, t_s) = V_{cr}$ - give expression $H_0^{cr}(t_s)$ and $t_s(H_0)$.

$$\frac{d|V(t)|^2}{dt} = (..) \left[2t + \frac{1}{\omega_0} \sin 2\omega_0 t + 2t \cos 2\omega_0 t + \frac{1}{\omega_0} \sin 2\omega_0 t \right] = 0 \rightarrow t_m$$

$$t(1 + \cos 2\omega_0 t) + \frac{1}{\omega_0} \sin 2\omega_0 t = 0, \quad z(1 + \cos 2z) + \sin 2z = 0, \quad z = \omega_0 t_m$$

$$1 + \cos 2z = 2 \cos^2 z, \quad \cos z \left[\frac{1}{2} \cos z + \sin z \right] = 0, \quad z_1 = \frac{\pi}{2} (2n+1)$$

we $\tan z = -z$.  For $z_2 > 0$, only solution $\pi/2$.
 before $z_1 = \omega_0 t_m = \pi/2$.

$$\frac{d^2|V(t)|^2}{dt^2} = (..) \left[2 + 2 \cos 2\omega_0 t + 2 \cos 2\omega_0 t - 4\omega_0 t \sin 2\omega_0 t \right] < 0$$

$$|V(t)|^2_{max} = \frac{1}{4} H_0^2 \omega_0^2 (x'_+)^2 d^2 \omega_0^2 \left[\left(\frac{\pi}{2} \right)^2 \frac{1}{\omega_0^2} + \frac{1}{\omega_0^2} \right] = \frac{1}{4} H_0^2 \omega_0^2 (x'_+)^2 d^2 \left[\left(\frac{\pi}{2} \right)^2 + 1 \right]$$

$$(x'_+)^2 = \frac{\mu^2}{G^2} \frac{1}{d^2 \omega_0^2} \rightarrow \frac{1}{4} H_0^2 \frac{\mu^2}{G^2} \left[\left(\frac{\pi}{2} \right)^2 + 1 \right] = |V(t_m)|^2 = V_{cr}^2$$

$$K_{ms. switch. field} H_0 \frac{\mu}{G} \frac{1}{2} \sqrt{1 + (\pi/2)^2} = V_{cr}$$

$$(3) H_0^{cr} (\omega = \omega_0) = \frac{2}{\sqrt{1 + (\pi/2)^2}} \frac{2V_{cr}}{3R\gamma}, \quad (H_0^{cr})_{\omega_0} = \frac{2V_{cr} d}{3R\gamma}, \text{ we have } \mu = d$$

Because H_0^{cr} can be higher, before $d\omega_0 t \ll 1$, a when $H_0^{cr} t_s \rightarrow \infty$,
 Indeed, $t_m = \frac{\pi}{2} \frac{1}{\omega_0} = \frac{\pi}{2} \frac{1}{2\pi \cdot f} \approx \frac{1}{4} \frac{1}{250 \text{ MHz}} = 10^{-3} \cdot 10^{-6} \text{ s} \approx 1 \text{ ns}$
 $t_s \gg 1 \text{ ns}$ before critic. line $H_0^{cr}(\omega)$. Panel $(t \rightarrow 0) d\omega_0 t_s = \left(\frac{H_0^{cr}}{H_0} \right) \ll 1$ more.

$$|V(t)|^2_{\omega=\omega_0} = \frac{1}{4} H_0^2 \omega_0^2 (x'_+)^2 \left[(1 - e^{-d\omega_0 t})^2 + d(1 - e^{-d\omega_0 t}) \sin 2\omega_0 t + \frac{d^2}{2} (1 - e^{-2d\omega_0 t} \cos 2\omega_0 t) + \frac{d^2}{4} (e^{-2d\omega_0 t} - 1) \right], \text{ yagho } t \rightarrow 0$$

$$(2) \text{ Even } d\omega_0 t \gg 1, \text{ so } |V(t)|^2_{\infty} = \frac{1}{4} H_0^2 \omega_0^2 (x'_+)^2 [1 + d \sin 2\omega_0 t] - 123/242$$

under current when. enough good enough $B_h(t)$ u give enough
 $H_0^{cr} (\omega = \omega_0)$, $|V(t)|^2_{\infty} = V_{cr}^2$, $V_{cr} = \frac{1}{2} H_0 \omega_0 |x_+| \sqrt{1+d}$

$$|x_+| = \left(\frac{3}{2} R \gamma \right) \frac{1}{d\omega_0}, \quad \frac{1}{2} \sqrt{1+d} H_0 \frac{1}{d} \left(\frac{3}{2} R \gamma \right) = V_{cr}, \quad H_0^{cr} = \frac{2}{\sqrt{1+d}} \frac{dV_{cr}}{(3/2 R \gamma)}$$

$H_0^{cr} = \frac{2}{\sqrt{1+d}} (H_0^{cr})_{cr}$, $(H_0^{cr})_{cr} = \frac{2V_{cr}}{3R\gamma}$ - circular field $\omega = \omega_0$
 Borog: a common switch, time $t_s(H_0) = \frac{2V_{cr}}{3R\gamma} \frac{1}{H_0}$ can. a circular field, $H_0^{cr} \approx 2(H_0^{cr})_{cr}$

$t_s = \left(\frac{1}{3}\right)^{-1} \frac{v_{cr}}{R\gamma\omega_0 H_0} \cdot v_{cr} \approx 2 \cdot 10^2 \text{ m/s}, R \approx 100 \text{ nm} = 10^{-7} \text{ m}, \omega_0/2\pi = 100 \text{ MHz} = 10^8 \text{ s}^{-1}$
 $t_s(H_0) = \frac{3 \cdot 2 \cdot 10^2 \text{ m/s} \cdot (2\pi)^{2-2}}{5 \cdot 10^{-7} \text{ m} \cdot 3 \frac{\text{MHz}}{\omega_0} 10^8 \frac{1}{s}} \frac{1}{H_0} = \frac{20}{5(2\pi)^2} \cdot 10^{-6} \frac{\text{M N J V S D}}{\text{s}} \approx 10^2 \frac{\text{M N J V S D}}{\text{s}}$

4

Ostia... $\omega/\omega_0 \neq 1$ u... $H_0^c(\omega)$

$|v(t)|^2 = \frac{1}{4} H_0^2 \omega^2 [|y_+|^2 + |y_-|^2 + 2\sqrt{a^2+b^2}] = \frac{1}{4} H_0^2 \omega^2 [|y_+|^2 + |y_-|^2] = v_{cr}^2$

$|y_+(\omega)| + |y_-(\omega)| = \frac{\mu}{G} \left[\frac{1}{\sqrt{(\omega-\omega_0)^2 + d^2\omega^2}} + \frac{1}{\sqrt{(\omega+\omega_0)^2 + d^2\omega^2}} \right]$

$\frac{1}{2} H_0^c \omega \left[\frac{1}{\sqrt{(\omega-\omega_0)^2 + d^2\omega^2}} + \frac{1}{\sqrt{(\omega+\omega_0)^2 + d^2\omega^2}} \right] = \frac{G}{\mu} v_{cr} = \frac{2v_{cr}}{3R\gamma}$

$H_0^c(\omega) = \frac{2v_{cr}}{3R\gamma} \frac{\sqrt{(\omega-\omega_0)^2 + d^2\omega^2}}{[1 + e^{-d\pi/\omega-1}]}$ - out-field-arcular case

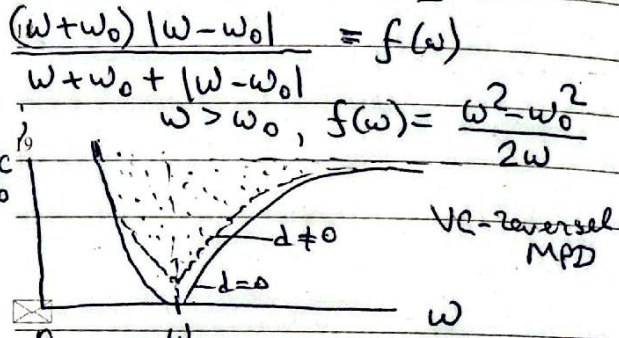
$\frac{1}{2} H_0^c(\omega) = \left(\frac{2v_{cr}}{3R\gamma} \right) \frac{1}{\omega} \left[\sqrt{(\omega+\omega_0)^2 + d^2\omega^2} + \sqrt{(\omega-\omega_0)^2 + d^2\omega^2} \right] \frac{1}{\sqrt{t_+} \sqrt{t_-}}$

$\text{Ecu } |\omega - \omega_0| \gg d\omega \approx 0,01\omega$

$\omega < \omega_0, f(\omega) = -\frac{(\omega^2 - \omega_0^2)}{2\omega_0}$

$H_0^c(\omega) = 2 \left(\frac{2v_{cr}}{3R\gamma} \right) \frac{1}{\omega} f(\omega)$

$\frac{1}{\omega} f(\omega) = \frac{1}{2} \left(1 - \frac{\omega_0^2}{\omega^2} \right)$



$\rightarrow f(\omega) = (\omega + \omega_0) \frac{\sqrt{(\omega - \omega_0)^2 + d^2\omega^2}}{[\omega + \omega_0 + \sqrt{(\omega - \omega_0)^2 + d^2\omega^2}]}$

$H_0^c(\omega_0) = 2 \left(\frac{2v_{cr}}{3R\gamma} \right) d$ norm. e. u. reg. ananai $H_0^c(\omega_0) = \frac{2}{\sqrt{1+d}} d$

$H_0^c(0) \approx \left(\frac{2v_{cr}}{3R\gamma} \right) \left(1 - \frac{\omega_0^2}{\omega^2} \right), \frac{\omega}{\omega_0} \gg 1, \frac{3v_{cr}}{R\gamma} \approx \frac{3 \cdot 2 \cdot 10^2 \text{ m/s}}{5 \cdot 10^{-7} \text{ m} \cdot 3 \cdot \frac{\text{MHz}}{2\pi}} \approx 10^2 \text{ k}$

$\text{Monno nareu abw } H_0^{sw}(\omega) \text{ u. asuero } |v(t)|^2$

$\frac{dH_0^{sw}(\omega, t_s)}{d\omega} = 0$ nareu $\omega^*(t_s)$ tan 20 min $H_0^{sw}(\omega^*, t_s) = f(t_s)$

u... supplied power $P \sim (H_0^{sw})^2 = f^2(t_s)$ as function pulse-length $t_s = \omega$ kare b Rigeau 'Nat. Ph.' 10.

Larunbata... bobog: Hamen pulse- ω^* , u. energy $E = \omega P$

$\text{Switch vortex core. } t_s(H_0) \text{ u. zbeana, tunc } t_s(H_0) = -\frac{1}{\ln} \left[1 - \frac{H_0}{H_0^c} \right]$

Stego noreu switch, probability $P(H_2) = 1 - e^{-t_s/\tau}$, $\tau(H_2)$ - relaxation time u noreu MPD $H_0 - \omega$ ne zabunur or H_2 .

$\text{Min } H_0^c(\omega_0) = 2d \cdot \frac{2v_{cr}}{3R\gamma}, \text{ no } v_{cr}(H_2) \uparrow \uparrow \text{ zabunur or } H_0$

creu u. bagarunno - Khvalk. APL'10, Yoo ARB'10.

C. N. & Eroshi - Garbera. Nanyina nincmo o upoguenno moero
 May 10. Maiatza
 Torgola dos Residencia na Rio-XII. Chazam, zoo pavo, negro, 17 Jan. 2012.
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1/1 2012. C. N. & Eroshi - Garbera. Nanyina nincmo o upoguenno moero
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2/1 Do orbeza to France-Conf. 3/11 nocno b nocno papers:
 1) Abt. Mat. - FMR dot arrays - Melker - conference Subm.
 2) Pinning - FMR c Ties, Arantxa - game. Top. Dado (ARB)
 3) Vortex dyn. in dot pair c Duc. - orphodato text + JAP
 4) VC reversal in time-domain c de Lourens - barben eqs. u odz. an. exp.
 5) DW in nanotube c AiPing - nanoscale text Subm. 10/1/12 JAP

Meeting c Arantxa : ona nocno Mz(w) gna H(t) = H0 sin(wt) - exci-
 tion gna Vortex dot - Py c d = 0.01, R = 1000 nm, L = 12 nm (Melker request)
 Main peak c w1/2pi = 4.2 GHz, dw = 0.6 GHz, f22(w1) = 12 (max value)
 - first radial spin wave in vortex state c H2(t) - excitation.
 Oxygene exp. VC reversal by de Lourens. Nomer na Vc(H2), a
 vortex expelling from the dot |X| = R as reversal criterion of VC?

Xoro gna dot c R = 520 nm u L = 44 nm, rge vortex orno graduen, 750
 nanobecno.

Nanyina e-mails or Chabun (Nature Mat. conference go Letters),
 de Lourens, AiPing (Jan/12 meeting), Tindara Verdun (Zanpoc PhD-position),
 Bonfibus to Melker file of simulations f22(w) of radial SW c comments
 Nanyina Zanpoc Verdun to Julian u Chizhik.

Due circular ac. field Curocto |V(t)| = |f+(w)| H0 w0 / sqrt(F(t)) tau = w0 t.
 (H(t) = H0 e^{iwt}) D = w/w0.

$$f_+(w) = \frac{1}{\sqrt{1 - (w/w_0)^2}} = i \frac{M}{16} \frac{1}{[w_0 \mp w(p - id)]} \quad |f_+(w)| = \frac{M}{16} \frac{1}{\sqrt{(w_0 \mp pw)^2 + d^2 w^2}}$$

$$p = +1, |f_+(w)| = \frac{M}{16} \frac{1}{w_0 \sqrt{(v-1)^2 + d^2 v^2}} \cdot H_0 w_0 H_2 \neq 0 \quad G_2 u w_0 = f(H_2)$$

$$Pasocem bnyu w \approx w_0, v \approx 1, |V(t)| = H_0 \frac{M}{16} \frac{\sqrt{F(t)}}{\sqrt{(v-1)^2 + d^2 v^2}} \quad 127/238$$

$$G_2(H_2) = G_2(0) [1 - H_2/H_c] \quad gna p = +1, \quad \chi(H_2) = \chi(0) [1 - (H_2/H_c)^2] = \chi(0) \sin^2 \theta_0$$

$$\cos \theta_0 = H_2/H_c, \quad w_0(H_2) = \chi(H_2)/|G_2(H_2)| = w_0(0) [1 + H_2/H_c] \quad \text{de Lourens' PR 09}$$

$$\frac{M}{16} = \frac{3 M_s \pi R L}{2 \pi M_s L (1 - H_2/H_c)} = \frac{3}{2} R L \frac{1}{(1 - H_2/H_c)} \cdot \frac{M H_0 \sqrt{F(t)}}{|G(H_2)| \sqrt{(v-1)^2 + d^2 v^2}} = v_{cr}(H_2)$$

$$v_{cr}(H_2) = v_{cr}(0) (1 + H_2/H_c) \Rightarrow \frac{M H_0}{16} \frac{\sqrt{F(t)}}{|G(t)| \sqrt{...}} = v_{cr}(0) (1 + \frac{H_2}{H_c}) (1 - \frac{H_2}{H_c}) = v_{cr}(0) [1 - \frac{H_2^2}{H_c^2}]$$

Max $v(t) = \frac{1}{|G|} H_0 \frac{1}{\sqrt{(v-1)^2 + d^2 v^2}} \max \sqrt{F(t)}$, $\max F(t) \text{ when } t = \frac{\pi}{2}$

8

$\max \sqrt{F(t)} = \sqrt{1 + e^{-d\pi}}$ Crit. line $H_0^C(v) \sim \frac{1}{|G|} \frac{H_0}{\sqrt{(v-1)^2 + d^2 v^2}}$ $\max v(t) = v_{cr}$

$\frac{1}{|G|} H_0 \frac{(v + e^{-d\pi})}{\sqrt{(v-1)^2 + d^2 v^2}} = v_{cr}$ $H_0^C(v) = \frac{1}{|G|} \frac{H_0}{\sqrt{(v-1)^2 + d^2 v^2}}$
 Astoria - Martes $\tau = \pi/(v-1) \rightarrow \infty$ $H_0^C(1) = \frac{1}{|G|} \frac{H_0}{d}$ min VC-switching field

Diag. $D = -\frac{1}{2} \int d\theta \left[(\partial\theta)^2 + \sin^2\theta (\partial\phi)^2 \right]$ component Curvature
 line core, $\cos(\partial\theta)^2 \approx 0$, $\sin^2\theta \approx \sin^2\theta_0 = 1 - \cos^2\theta_0$, $\cos\theta_0 = (H_2/H_c)$

Yaso upm pacree $W_{ex} \sim D$ each energy in core upm $H_0^C(v) \sim v_{cr}(H_2)/D(H_2) = v_{cr}(0)/D(0)$
 line core $D(H_2) \approx \sin^2\theta_0 \cdot D(0)$ $H_0^C(\min) \sim v_{cr}(H_2)/D(H_2) = v_{cr}(0)/D(0)$

$\sim (1 + H_2/H_c) [1 - (H_2/H_c)^2]$, $\cos v_{cr}(H_2) \sim [1 + H_2/H_c]$, min H_0^C change $f(H_2)$

Yoo PRB' zero gener $v_{cr}(H_2) \sim R_c(H_2) [1 + H_2/H_c]$ - kbagpas. pacs $H_2!$
 Coruano $2/\pi$ roosr.

$\mathcal{L} = -\frac{1}{2} \int d\theta \left[(\partial\theta)^2 + \sin^2\theta (\partial\phi)^2 + \frac{1}{g^2} \sin^2\theta \hat{p} \hat{p} \right]$, r.k.

Juste static vortex $\theta(\vec{r}) = \theta_0(\vec{r})$ u $\phi(\vec{r}) = \phi_0 + q\psi$
 Unscr. no ψ (yresen $\hat{g}\hat{g}, \hat{p}\hat{p}$ ref $\hat{x}\hat{x}, \hat{g}\hat{g}$ gear $D_{xx} = D_{yy} = D$)

$D = -\frac{1}{2} \pi \int d\theta \left[\left(\frac{d\theta}{ds} \right)^2 + \frac{1}{g^2} \sin^2\theta \right]$. D. ansatz $H_2 = 0$ $\theta' = \frac{\sin\theta}{s}$, $s \leq R$

Ecun $H_2 \neq 0$, ro $(\cos. u/vill. ogi.)$ $m_2(s) = m_2^0(s) [1 - p m_2^{\text{out}}] + m_2^{\text{out}}$, $m_2^{\text{out}} = \cos\theta_{\text{out}} = H_2/H_c$

$\lambda = \lambda(H_2) = 1 - p m_2^{\text{out}}$ $m_2(s) = \cos\theta(s) = \lambda m_2^0(s) + m_2^{\text{out}}$, $m_2^0 = \cos\theta_0 = \frac{b^2 s^2}{b^2 + s^2}$
 line core $m_2 = m_2^{\text{out}} = H_2/H_c$
 Bmgs/lu core $m_2(s)$ pacs $m_2(0) = +1$



$H_2 > 0$ $H_0^C(\min) \sim v_{cr}(H_2) D(H_2) \sim R_c(H_2) (1 + H_2/H_c) (1 - \frac{H_2^2}{H_c^2})$
 $\approx [1 - (\frac{H_2}{H_c})^2]$ - change $f(H_2)$ upm $H_2 < \frac{1}{2} H_c$. B. en $R_c(H_2) \sim (1 + H_2/H_c)$

$D = -\frac{1}{2} \pi \int d\theta \left[\left(\frac{d\theta}{ds} \right)^2 + \frac{\sin^2\theta}{g^2} \right] - \frac{1}{2} \pi \int d\theta \frac{1}{g^2} \sin^2\theta_{\text{out}}$, $m_2^0(s)$ - pacs. Yaso.

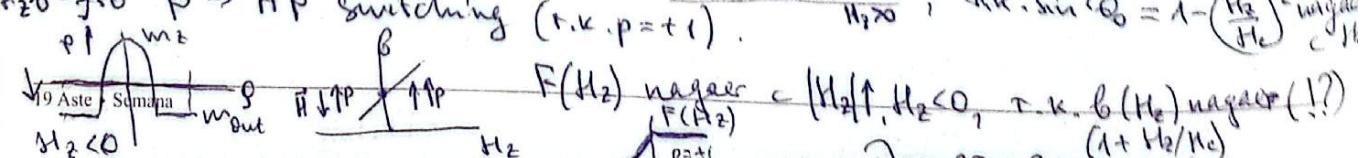
Moner upm $m_2(s) = \cos\theta(s) = \begin{cases} \cos\theta_{\text{out}}(s), & s \leq b \\ \cos\theta_{\text{out}}, & s > b \end{cases}$, $\cos\theta_{\text{out}} = \frac{b^2 s^2}{b^2 + s^2}$
 D. ansatz $H_2 = 0$ $\frac{d\theta_{\text{out}}}{ds} = \frac{\sin\theta_{\text{out}}}{s}$ $s = b$ - Her $\cos\theta_{\text{out}} = \frac{b^2}{b^2 + s^2}$

$\int d\theta \left[(\partial\theta)^2 + \frac{1}{g^2} \sin^2\theta \right] = 2 \int d\theta \frac{1}{g^2} \sin^2\theta_{\text{out}} = 2 \int d\theta \left(\frac{2bs}{b^2 + s^2} \right)^2 = 2 \int d\theta \left(\frac{2s}{b^2 + s^2} \right)^2$

$D = -\frac{1}{2} \pi - \frac{1}{2} \pi \sin^2\theta_{\text{out}} \ln \frac{R}{b} = -\frac{1}{2} \pi \left[2 + \sin^2\theta_{\text{out}} \ln \frac{R}{b} \right]$, $D(H_2) \sim \sin^2\theta_{\text{out}}(H_2)$
 $\cos\theta_{\text{out}} = (H_2/H_c)$ $D(H_2) = -\frac{1}{2} \pi \frac{M_s L}{J} \left[2 + \sin^2\theta_{\text{out}}(H_2) \ln \frac{R}{b(H_2)} \right]$

Min $H_0^C \sim v_{cr}(H_2) D(H_2) \sim b(H_2) [1 + H_2/H_c] \left[2 + \sin^2\theta_{\text{out}} \ln \frac{R}{b} \right] = F(H_2)$

Ecun $H_2 > 0$, ro $b(H_2)$ pacs, u $F(H_2) \propto \text{const}$ $H_2 > 0$, $\sin^2\theta_0 = 1 - (\frac{H_2}{H_c})^2$ magad



Hago Depinytse $m_z(s) = m_z^{us}(s)[1 - m_z^{out}p] + m_z^{out} = \frac{4\pi\alpha}{s} \frac{M_{SL}}{R} \frac{b(H_z)}{b(H_z)}$ Maiatza

$$D(H_z) = -\frac{4\pi\alpha M_{SL}}{s} \left[\int_0^{\theta} d\theta' \left\{ (\theta'_s)^2 + \frac{1}{s^2} \sin^2 \theta' \right\} + \sin^2 \theta_{out} \ln \frac{R}{b} \right], \quad \theta_{out} = \theta(H_z)$$

$$m_z(s) = \lambda m_z^{us}(s) + m_z^{out}, \quad \cos \theta = \lambda \cos \theta_{us} + m_0, \quad \lambda = 1 - m_0, \quad m_0 = \frac{H_z}{H_c}$$

$$-\sin \theta \theta'_s = -\lambda \sin \theta_{us} \theta'_{us} = -\lambda \sin \theta_{us} \frac{1}{s} \sin \theta_{us}$$

$$(\theta'_s)^2 = \frac{1}{\sin^2 \theta} \frac{\lambda^2}{s^2} \sin^4 \theta_{us}, \quad \sin^2 \theta = 1 - (\lambda \cos \theta_{us} + m_0)^2 =$$

$$= 1 - \lambda^2 \cos^2 \theta_{us} - 2\lambda m_0 \cos \theta_{us} - m_0^2 = 1 - (1 - m_0)^2 \cos^2 \theta_{us} - 2m_0(1 - m_0) \cos \theta_{us}$$

$$-m_0^2 = \sin^2 \theta_{us} - 2m_0 \cos \theta_{us} (1 - \cos \theta_{us}) - m_0^2(1 - \cos \theta_{us})^2, \quad p = +1.$$

3/1 Comparison Nature Mat. - FMR paper u hogan Crabony.

$$1 - \cos \theta_{us} = 2 \sin^2 \frac{\theta_{us}}{2}, \quad \sin^2 \theta = 4 \sin^2 \frac{\theta_{us}}{2} \left[\cos^2 \frac{\theta_{us}}{2} - m_0 \cos \frac{\theta_{us}}{2} - m_0^2 \sin^2 \frac{\theta_{us}}{2} \right]$$

$$J(H_z) = \int_0^{\theta} d\theta' \left[(\theta'_s)^2 + \frac{\sin^2 \theta'}{s^2} \right] = \int_0^{\theta} \frac{d\theta'}{s} \left[\lambda^2 \frac{\sin^4 \theta_{us}}{\sin^2 \theta} + \sin^2 \theta \right]$$

$$\cos \theta = \lambda \cos \theta_{us} + h_z, \quad (\lambda = 1 - h_z), \quad h_z = H_z/H_c, \quad \sin \theta_{us}(s) = \frac{2\theta s}{\theta^2 + s^2} = \frac{2\theta'}{1 + (\theta')^2}$$

Note, when gamma s/b = s', VC radius increases w/ J(H_z) u b(H_z) eugus b lambda, h_z.

$$J(h_z) = \int_0^1 \frac{ds'}{s'} \left[\lambda^2 \frac{\sin^4 \theta_{us}}{\sin^2 \theta} + \sin^2 \theta \right], \quad J(0) = 2 \int_0^1 \frac{ds'}{s'} \sin^2 \theta_{us} = 2(1 - h_z)$$

$$J(h_z \rightarrow 1-0) = \int_0^1 \frac{ds'}{s'} \left[\lambda^2 \frac{\sin^4 \theta_{us}}{2\lambda(1 - \cos \theta_{us})} + 2\lambda(1 - \cos \theta_{us}) \right] \sim \lambda \frac{J(h_z)}{2} \sqrt{1 - h_z}$$

$$\sin^2 \theta_{out} = (1 - h_z^2).$$

$$D(H_z) = -\frac{4\pi\alpha M_{SL}}{s} \left[J(h_z) + (1 - h_z^2) \ln \frac{R}{b} \right], \quad J(h_z) \text{ uogenu zueu. b MathCad}$$

$$\text{Min } H_0^c(h_z) \sim v_{cr}(H_z) D(H_z) \sim b(H_z) [1 + h_z] \cdot [J(h_z) + (1 - h_z^2) \ln \frac{R}{b}]$$

then u biogren uogenu anu parys c h_z ↑, a 3ui - uogues, H_0^c(h_z) ≈ const.

Hobog. b circular polariz field H = H_0 e^{i\omega t} critical field of VC reversal
 woson ne zabuans or perpend. bias field H_z.
 b lin. polarized field gamma H_0^{lin}/2 → H_0^{circ}. - ta me zabuamogso min H_0^c(H_z)

1/1 Meeting c Chizhuk: penamun byes PhD student Tindara Verdaci,
 version ei stipend u ufunu. na interview. O rem ei u hawman.

Meeting c Ai Ping: JTW-DW geom. dependence nanotubes to PRB. Brief
 hane represent u yosmenue N_z(AR/R, L/R); J DW-MPD to JMMM.
 Osa nunes these 2 papers na bumenno d.c. current (H_0) na DW motion
 in nanotubes. Szab Rejerec na F/N/F-JAP- sekhostavets (major rev.)

Alternative VC reversal (not v(t) = v_{cr}) a VC expelling from the dot:

$$|Z(t)| = R, \quad Z_{\pm}(t) = X_{\pm}(\omega) H_0 [e^{\pm i\omega t} - e^{\pm i\omega_{0pt}} e^{-d\omega t}] - e^{i\omega t} \text{ polariz } h(t)$$

$$p = +1, \quad h(t) = e^{i\omega t} h_0 \rightarrow |Z(t)|^2 = |X_{+}(\omega)|^2 H_0^2 [e^{i\omega t} - e^{i\omega_{0pt}} e^{-d\omega t}] [e^{-i\omega t} - e^{-i\omega_{0pt}} e^{-d\omega t}]$$

$$= |X_{+}(\omega)|^2 H_0^2 [1 + e^{-2d\omega t} - 2e^{-d\omega t} \cos(\omega - \omega_{0pt})t], \quad \text{Max } |Z(t)| \text{ wlu } t_m = \frac{1}{\omega - \omega_{0pt}}$$

$\text{Max } |Z(t)| = |X| H_0 (1 + e^{-\dots})$
 $H_0^{\text{cr}}(\omega) = \frac{R}{H_0} \frac{|G| \sqrt{(\omega - \omega_0)^2 + d^2 \omega^2}}{(1 + e^{-\dots})}$
 $\text{Min } H_0^{\text{cr}}(\omega_0) = \frac{R}{H_0} |G| d \omega_0$

$H_0^{\text{cr}}(H_z) \sim D(H_z) \omega_0(H_z)$, $\omega_0(H_z) \sim (1 + \frac{H_z}{H_c})^{1/2}$
 $\text{Min } H_0^{\text{cr}}(H_z) \sim [1 + H_z] [J(H_z) + (1 - H_z^2) \ln \frac{R}{\theta}]$

$VC \text{ reversal } \text{Sygler} \text{ engegnerie } \text{min} [V_{cr}, V_R]$, $V_R = \omega_0 R$
 $V_R \sim 2\pi f_0 R = 6.43 \text{ GHz} \cdot 300 \text{ nm} \approx 600 \text{ m/s}$

$VC \text{ escape mechanism reversal dominates at } V_R = \omega_0 R < V_{cr}$, T.e. v/m near R .
 // One de laubens $V_R = 2\pi \cdot 0.25 \text{ GHz} \cdot 500 \text{ nm} \approx 400 \text{ m/s}$
 a $V_{cr} \approx 200 \text{ m/s}$. $VC \text{ reversal}$ ja eras goaume. V_{cr} .

5/I Razdor paper Vaglenkieste 'Nat. Phys.' '09 - V_{cr} u $H_0(\omega)$ - exp.
 u Kammerer 'Nature Comm' VC revers. u μ azim. SW frequency pump
 u phase CW/CCW Dymyngelmo c zakoro SW ω_1/ω_2 u $17 \times 10 \text{ nm}$, $V_{cr} = 5 \text{ (m \& SW)}$
 Namcaz Indro, edited FMR - pinning MS c uocan fuesy .

6/I Odeyng. c fues pinning FMR paper. fues odensent $6/1$ u fuecas revised MS
 E-mail to Kim o SMU-Carf . nefermaka c dymobnu o dch postdoc A. Hrabec
 Onmaru kb. 975 € za Jan. 2012 . E-mail to Oka.

7/I C A. u W. B. "Eroski" Garzera: kynnuu TV "Sannang" $31 - 333 \text{ €}$.
 - Kammerer - $\text{preprint Dec. 2011}$ - VC reversal by azim. SW.
 tgr ke egeaent menome 200 ps ($R = 800 \text{ nm}$) uz ze koncerni .
 Gagoren SW , neferoacenyx Dnepuro (Orfamer . azim. SW - nogkarnu).
 Uabun u pegroruu Namcaz paper o cbegem Vortex 9D nanlin .
 ke ew $1D$ $\text{non-bi. oscillator}$.

16 Kerne $\text{preprint (Nov. 2011)}$ by Zvezdin : cux fomysuun $2 \times$
 Vortex STO in nanopillar pair .

8/I Kammarfested Nanotube-DW-MPD paper u uocan ee to Ai Ping, Julian

9/I Patxi u fucan Saldo no been 3-u uocan u fucan (Magnonics , Spin Dyn
 "SAIOTEK"). Tek. pag. : ① $170,52 \text{ €} + 512,32 \text{ €}$ Gus - TNT '11 , Tenerife
 - $\text{Spin Dyn. Quc. grant}$ - Dec. 1, 2011 ; ② $169,90$ ($143,98 \text{ €}$ $\text{80\% IVA}$) € - disco duro -
 19 Arantxa - Magnonics grant - 16 Dec. 2011 ; ③ $39,42 \text{ €}$ - Substarets - SAIOTEK - $13/11$.

19 Ogan Patxi u uocan com. - Paris - 668 € u com. Duc. Computer Ai Ping - tel uz Dec. 3/11

Becega c Julian : 1) UPV u Basque gov. Calls na PhD - stipend $\sim$ March 2012 ,
 no nealno creus u uocan na T. Verdaci , uocan u fucan . ee na interview u
 u fucan recom by Vavassori . 2) Postdoc 2 calls dygys Bubemeno $\sim$ Mar 11
 regeat u glicobus - 10 gwei (Dromik + Krauec).

Becega c Ai Ping : Figs. 4, 5 - 200 u fucan paznomenu min E - DW energy
 $\text{min E} = E_{\text{exch}} + E_m + E_{\text{an}}$ na u fucan recom b uocan u fucan AR, L/R . Fig 3 -
 2) MPD - 200 DW ceobes . min E , DW uocan circular $\vec{m} = \pm \hat{e}_z$ downin .

10/I Revised and submitted to JMMM "DW in nanotubes" MS no
 Simulations Ai Ping . Edited Q^m coupl. MS c Oka .

1/1) Obyznenno c Julian postdoc openings (2 nozmeny) Mayo • Maiatza
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 na postdoc i ypyne u Boguono. PhD Stipends que Urbane.
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 2-3 mes. Deadline Jan 20.
 70) na postdoc nozmeny kumoro upeyuyunse no
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 99) na postdoc nozmeny kumoro upeyuyunse no
 2-3 mes. Deadline Jan 20.
 100) na postdoc nozmeny kumoro upeyuyunse no
 2-3 mes. Deadline Jan 20.

2/1) Kim u de Loubens ne moyt upeyuyunse postdocs que nac.
 Meeting c Arantxa (vortex excitation by $H_z(A)$): ecm $H_z(t) = H_0 \frac{\sin(\omega t)}{\omega t}$
 - no new peaks observed, just radial sw, same ecm $H_0 = 200, 1000$ Oe;
 ecm $H_z(t) = H_0 \sin \omega t$, ω_1 - first radial sw, no abradb mark at $\omega_c \approx 33 \text{ GHz}$?
 upeyuyunse $H_z(t) \in 33 \text{ GHz}$ u nozmeny mays snapshots.
 Becega c Fied o FMR-pinning MS progress u c Ouc. of JAP panyun, ta. gax.
 Zaypoc postdoc to Papay u Hillebrands. Neperemka c Dapumk // Proof JSN-
 nanyun postdoc zaypoc to Virginia Estevez (Ouc. Inst., Madrid). - F/N/F paper

15/1) Obyznenno c Kokazei nozmeny upeyuyunse FMR-pinning paper,
 zaypoc u Arantxa o gen. info - simul. upeyuyunse V. Estevez na intervieu.
 JAP-F/N/F paper pers. c Ouc. upeyuyunse y ne Megu, upeyuyunse kurtene (~5 cop.)
 Cgeu u opeu. b JSN edited proof of vortex dyn. F/N/F paper.
 Kobot. perepymka b DIPIC: nozmeny c postdoc Genan u upeyuyunse Nagai.

15/2) Ugeu kax chucab pinning d(θ_n) zapog surface m. energy $E_s \sim (m_s)$
 upeyuyunse pinning d(θ_n) u simulat. kax $\frac{\partial m_s}{\partial s} + \delta m_s = 0$, $d(\theta_n) \sim \frac{\partial m_s}{\partial s}$
 Oliga et al. J. Phys. 2011: criterion of VC reversal chymy goxax
 $\Delta E_{ex} = E_{pair}(V - AV)$. $\Delta E = f(\text{cell size})$ zaypoc u upeyuyunse via Bloch point? 131/234

Kax chogab upeyuyunse V_{or} u $\Delta E = E_{pair}$ upeyuyunse? VC reversal criterion
 Deuemo conec. $E_{kin} \sim MV_{or}^2$ u $E_{pair} = 8\pi AL$.
 Deuemo conec. $(M \approx \frac{L}{f_2})$ $MV_{or}^2 \sim \frac{L}{f_2} f_2^2 2A \approx 2AL$ upeyuyunse E_{pair}

Forme [Fotikov 'PRB'07]: $E_{skym.} = 8\pi AL \approx 3.3 \cdot 10^{-18} \text{ J (FeNi)}$ co ceuyun na
 Larunbata • Sábado Domingo • Igandea

Belavin-Blyekov '75 skymions c toqal. charge $q = \pm 1$.
 Fotikov '07, buquino, neperemka V-AV pair (c ceuyun $q = \pm 1$) $[q = \frac{1}{2} \text{ NP}]$
 h-wind. number ($n = +1$ - vortex, $n = -1$ - AV) co BP-skymion c $q = \pm 1$.

Xore, no $E_{ex} = A \int d^3 \vec{r} (\nabla \vec{m})^2$ zaypoc u upeyuyunse V u AV - half skymions, i.e.
 upeyuyunse skymion-BP ceuyun yu tenemo buquino core, no merans ($m_z = 0$) bu

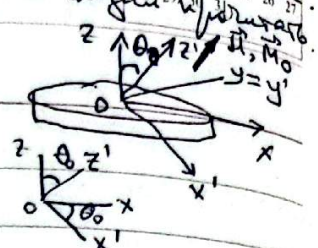
Due single vortex $E_{ex}(\text{core}) = AL \int_{\text{core}} d^2 \vec{r} [(\nabla \theta)^2 + \sin^2 \theta (\nabla \varphi)^2] = AL \cdot 2\pi \int_0^R d\rho [\rho^2 (\theta')^2 + \frac{1}{\rho^2} (\rho^2 \theta')^2] =$
 $= \frac{1}{2} \int_0^R d\rho \sin^2 \theta = 4\pi AL \int_0^R d\rho \sin^2 \theta = 4\pi AL$, $\frac{1}{V M^2} E_{ex}(\text{core}) = \frac{4\pi A}{M^2 R^2} = \frac{2 L_{ex}^2}{R^2}$, $L_{ex}^2 = 2A/M^2$

$E_{ex}(V-AV \text{ pair}) \approx 2 \cdot E_{ex}(\text{core}) = 8\pi AL$ - buquino core. No core out of core upeyuyunse.

(16/5) E-mails to V. Estevez & T. Verdaci (Ph D stipends), Osvaldo Chumacero
 Interview Estevez via web, Jan. 19. Ober & G. de laubens - VC
 Maitatza - Mayo
 Negroon postdoc to D. Dieleman.
 14 horepaeue c Maitatza FMR pinning d (On). M. Dazoj, D. = OX^M c. changes
 to JAP. Manojillars MPD u uses 30jue. horepaeue VC rewarde Carver
 pacherarau oxc. ~ 20 new papers 2005-2010
 17/5 B Yumb b 715 - veraro file que Arizona.
 Maitatza - Lunes

FMR pinning d as function of $\hat{n}$ -angle On.

$\hat{n}, \vec{M}_0 \parallel \hat{O}z'$, No uncer you $\theta_0 = \angle \hat{O}z' \text{ det plane } xy$.
 (On) $\hat{n}$ - you On ($\theta_n \leq \theta_0$).



Consider, two deg. pinning na faces of the det $z=0, L$

Typ. - Mervob, Ga. 7.

FMR pinning

Lotcyrcayes, $\vec{m} \neq f(z)$

$E_s = -K_s (\vec{m} \cdot \vec{n})^2$, $K_s > 0$ carb. Surface anisotropy ON, $\vec{n}$ - eq. bearp
 vbreukau napam & neberxocm S

Pr. y cuobue na S: $q \vec{M} \times \frac{\partial \vec{M}}{\partial n} + \frac{2K_s}{M_s^2} (\vec{n} \cdot \vec{M}) \vec{n} \times \vec{M} = 0$, $q = 2A/M_s^2$

11 Ecu $\vec{M} = \vec{M}_0 + \vec{m} e^{i\omega t}$, so $\hat{z}_0 \times \frac{\partial \vec{m}}{\partial n} + \frac{2}{3} [(\vec{n} \cdot \vec{m}) \vec{n} \times \hat{z}_0 + (\vec{n} \cdot \hat{z}_0) \vec{n} \times \vec{m}] = 0$, (2)

$\frac{2}{3} = 2K_s/qM_s^2$ - pinning, $\hat{z}_0$ - eq. bearp $\parallel \vec{M}_0$.

12 y hac pinning na donobai neberxocm det, $\theta = R$, $\vec{n} = \hat{g}$, $\hat{z}_0 = (\sin \theta_0, 0, \cos \theta_0)$

13 $\vec{n} \times \hat{z}_0 = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ n_x & n_y & 0 \\ \sin \theta_0 & 0 & \cos \theta_0 \end{vmatrix} = \hat{x} n_y \cos \theta_0 - \hat{y} n_x \cos \theta_0 - \hat{z} n_y \sin \theta_0$

$n_x = \cos \varphi$, $n_y = \sin \varphi$, $n_z = 0$.

14 $\vec{n} \times \vec{m} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ n_x & n_y & 0 \\ m_x & m_y & m_z \end{vmatrix} = \hat{x} n_y m_z + \hat{z} (n_x m_y - m_x n_y) - \hat{y} n_x m_z$

15 $\hat{z}_0 \times \frac{\partial \vec{m}}{\partial n} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \sin \theta_0 & 0 & \cos \theta_0 \\ \frac{\partial m_x}{\partial n} & \frac{\partial m_y}{\partial n} & \frac{\partial m_z}{\partial n} \end{vmatrix} = \hat{y} (\cos \theta_0 \frac{\partial m_x}{\partial n} - \sin \theta_0 \frac{\partial m_z}{\partial n}) + \hat{z} \sin \theta_0 \frac{\partial m_y}{\partial n} - \hat{x} \cos \theta_0 \frac{\partial m_y}{\partial n}$

16 $m_y = m_y'$, $m_x = m_x' \cos \theta_0$, $m_z = -m_x' \sin \theta_0$

17 horepaeue. pr. y cuobue (*) na $\hat{x}, \hat{y}, \hat{z}$:

18 $\hat{x}$: $\frac{1}{3} (-\cos \theta_0) \frac{\partial m_y}{\partial n} + (\vec{n} \cdot \vec{m}) n_y \cos \theta_0 + (\vec{n} \cdot \hat{z}_0) n_y (-m_x' \sin \theta_0) = 0$

19 $\hat{y}$: $\frac{1}{3} \frac{\partial}{\partial n} (m_x' \cos \theta_0 - m_z' \sin \theta_0) + (\vec{n} \cdot \vec{m}) (-n_x \cos \theta_0) + (\vec{n} \cdot \hat{z}_0) (+n_x m_x' \sin \theta_0) = 0$

20 $\hat{z}$: $\frac{1}{3} \sin \theta_0 \frac{\partial m_y'}{\partial n} + (\vec{n} \cdot \vec{m}) (-n_y \sin \theta_0) + (\vec{n} \cdot \hat{z}_0) [n_x m_y' - n_y m_x' \cos \theta_0] = 0$

21 $(\vec{n} \cdot \vec{m}) = n_x m_x + n_y m_y = \cos \varphi m_x' \cos \theta_0 + \sin \varphi m_y'$

$(\vec{n} \cdot \hat{z}_0) = n_x \sin \theta_0 + n_y \cdot 0 = n_x \sin \theta_0 = \sin \varphi \sin \theta_0$

22 $\hat{x}$: $-\frac{1}{3} \cos \theta_0 \frac{\partial m_y'}{\partial n} + \sin \varphi \cos \theta_0 (m_x' \cos \varphi \cos \theta_0 + \sin \varphi m_y') + \sin \varphi \sin \theta_0 \cos \varphi m_x' = 0$

$-\frac{1}{3} \cos \theta_0 \frac{\partial m_y'}{\partial n} + \sin^2 \varphi \cos \theta_0 m_y' + \cos \varphi \sin \varphi m_x' = 0$

23 $\hat{y}$: $\frac{1}{3} \frac{\partial m_x'}{\partial n} + (\cos \varphi \cos \theta_0 m_x' + \sin \varphi m_y') (-1) \cos \varphi \cos \theta_0 + \sin \varphi \sin \theta_0 \cos \varphi \sin \theta_0 m_x' = 0$

$$\frac{1}{3} \frac{\partial m_x'}{\partial n} + (\cos^2 \varphi \cos^2 \theta_0 (-1) + \sin \varphi \cos \varphi \sin^2 \theta_0) m_x' - \sin \varphi \cos \varphi \cos \theta_0 m_y' = 0$$

$$\frac{1}{3} \frac{\partial m_y'}{\partial n} + (\cos \varphi \cos \theta_0 m_x' + \sin \varphi m_y') (-\sin \varphi) \sin \theta_0 + \sin \varphi \sin \theta_0 [\cos \varphi m_y' - \sin \varphi \cos^2 \theta_0 m_x'] = 0$$

Уравнение где $\partial m_y' / \partial n$ го устремление по φ не обнуляется. Прого.
 устремление по φ , нуль равно: $-\frac{1}{3} \frac{\partial m_y'}{\partial n} + \frac{1}{2} m_y' = 0$ из (1) $\hat{x}$.

$$\frac{1}{3} \frac{\partial m_x'}{\partial n} - \frac{1}{2} \cos^2 \theta_0 m_x' = 0 \text{ из (1) } \hat{y}. \quad \frac{1}{3} \frac{\partial m_y'}{\partial n} - \frac{1}{2} \cos^2 \theta_0 m_x' - \frac{1}{2} m_y' = 0 \text{ из (1) } \hat{z}$$

Уравнение где $\partial m_y' / \partial n$ не обнуляется.
 Переносим в $x'y'z'$ систему, где $Oz' \parallel \vec{M}_0$ и $\vec{m} = (m_x', m_y', 0)$
 $\vec{z}_0 = (0, 0, 1)$.

$$\vec{n} = (n_x, n_y, 0) \text{ в } xyz. \quad \begin{cases} n_z' = n_x \sin \theta_0 = \cos \varphi \sin \theta_0 \\ n_x' = n_x \cos \theta_0 = \cos \varphi \cos \theta_0, \quad n_y' = n_y = \sin \varphi. \end{cases}$$

$\vec{n} = (n_x', n_y', n_z')$ в $x'y'z'$.

$$\vec{n} \times \vec{z}_0 = \begin{vmatrix} \hat{x}' & \hat{y}' & \hat{z}' \\ n_x' & n_y' & n_z' \\ 0 & 0 & 1 \end{vmatrix} = \hat{x}' n_y' - \hat{y}' n_x'; \quad \vec{n} \times \vec{m} = \begin{vmatrix} \hat{x}' & \hat{y}' & \hat{z}' \\ n_x' & n_y' & n_z' \\ m_x' & m_y' & 0 \end{vmatrix} = \hat{y}' n_z' m_x' + \hat{x}' n_z' m_y' (-1) + \hat{z}' (n_x' m_y' - n_y' m_x')$$

$$\vec{z}_0 \times \frac{\partial \vec{m}}{\partial n} = \begin{vmatrix} \hat{x}' & \hat{y}' & \hat{z}' \\ 0 & 0 & 1 \\ \frac{\partial m_x'}{\partial n} & \frac{\partial m_y'}{\partial n} & 0 \end{vmatrix} = \hat{y}' \frac{\partial m_x'}{\partial n} - \hat{x}' \frac{\partial m_y'}{\partial n}$$

Вектор (*) на оси $\hat{x}', \hat{y}', \hat{z}'$:

$$\hat{x}': \frac{1}{3} (-1) \frac{\partial m_y'}{\partial n} + (\vec{n} \vec{m}) n_y' + (\vec{n} \vec{z}_0) (-1) n_z' m_y' = 0$$

$$\hat{y}': \frac{1}{3} \frac{\partial m_x'}{\partial n} + (\vec{n} \vec{m}) (-1) n_x' + (\vec{n} \vec{z}_0) n_z' m_x' = 0$$

$$\hat{z}': (\vec{n} \vec{m}) 0 + (\vec{n} \vec{z}_0) (n_x' m_y' - n_y' m_x') = 0, \quad \cos \varphi \cos \theta_0 m_y' - \sin \varphi m_x' = 0$$

- это условие. и мы устремление по φ .

$$\vec{n} \cdot \vec{m} = n_x' m_x' + n_y' m_y' + n_z' m_z' = \cos \varphi \cos \theta_0 m_x' + \sin \varphi m_y'$$

$$(\vec{n} \vec{z}_0) = (n_x', n_y', n_z') (0, 0, 1) = n_z' = \cos \varphi \sin \theta_0.$$

$$\hat{x}': \frac{1}{3} (-1) \frac{\partial m_y'}{\partial n} + (\cos \varphi \cos \theta_0 m_x' + \sin \varphi m_y') \sin \varphi - \cos \varphi \sin \theta_0 \cos \varphi \sin \theta_0 m_y' = 0$$

$$\frac{d\varphi}{dn} (...) \text{ где } -\frac{1}{3} \frac{\partial m_y'}{\partial n} + \frac{1}{2} m_y' - \frac{1}{2} \sin^2 \theta_0 m_y' = 0, \quad -\frac{1}{3} \frac{\partial m_y'}{\partial n} + \frac{1}{2} \cos^2 \theta_0 m_y' = 0$$

$$\hat{y}': \frac{1}{3} \frac{\partial m_x'}{\partial n} - (\cos \varphi \cos \theta_0 m_x' + \sin \varphi m_y') \cos \varphi \cos \theta_0 + \cos^2 \varphi \sin^2 \theta_0 m_x' = 0$$

$$\frac{d\varphi}{dn} (...) \text{ где } \frac{1}{3} \frac{\partial m_x'}{\partial n} - \frac{1}{2} \cos^2 \theta_0 m_x' + \frac{1}{2} \sin^2 \theta_0 m_x' = 0$$

$$\left(\frac{1}{3} \frac{\partial m_x'}{\partial n} - \frac{1}{2} \cos^2 \theta_0 m_x' = 0 \right) - \text{с помощью го знания } \frac{\partial}{\partial n} \text{ и } \frac{1}{2} \text{ (из-за (1))}$$

нуль равно. упр. упр. Сххх, (1.38) Гр-Мэ

$$\frac{\partial \Phi}{\partial n} = (\nabla \Phi \cdot \vec{n}) = (\nabla \Phi \cdot \hat{s}) = \frac{\partial \Phi}{\partial s}, \text{ если } \vec{n} = \hat{s} - \text{нормаль к поверхности.}$$

16

Mayo $\frac{1}{|z|} \frac{\partial m_y}{\partial g} + \frac{1}{2} \cos^2 \theta_0 m_y = 0$, Arantxa uskana $m_y(9,0)$ $\times 0.2$
 H' b'aus. B uskana $\times 0.2$
 eam ceronne $x=0$. $\frac{\partial m_y}{\partial g} + \frac{1}{2} \cos^2 \theta_0 m_y = 0$
 B.C. $\frac{\partial m_y}{\partial g} + \frac{1}{2} |z| \cos^2 \theta_0 m_y = 0$

Asteazkena, Miércoles


 $\frac{u}{u_{max}}$
 $\frac{y}{R}$

$\hbar/m \quad y/R = +1, \quad \frac{\partial m_y}{\partial y} + \frac{d}{2R} m_y = 0$

 $\frac{\partial m_y}{\partial y} + \frac{d}{2R} m_y = 0 \quad \text{or} \quad \frac{\partial m_y}{\partial y} + \frac{1}{2} \left| \frac{3}{2} \right| \cos^2 \theta_0 m_y = 0 \quad \text{noisy sum}$

10 $d(\theta_0) = R/3 \cos^2 \theta_0 = d(0) \cos^2 \theta_0$, $d(0) = R/3$
 11 No, pinning the geyser = 0 ^(?) w.r.t $\theta_0 = \pi/2$ ($\vec{N}_0$ in-plane), a
 geyser occurs w.r.t $\theta_0 = \pi/2$.

12. Ans: PRB'S: $d = \frac{2\pi [1 - (K_s / \epsilon \mu_0^2 L)]}{\dots}$ ← surface m. charges + K_s

$P \left[a + b \ln \frac{1}{P} + \frac{L^2}{L^2} \right] \leftarrow$ m. field of volume charges
 + exch.
 $E_s = -\frac{K_s}{M^2} (\vec{M} \cdot \vec{n}_a)^2$
 Bezge magn. charges are dynamic.

8/12/2004. Some homework in. Inequality surface integral $m_s = \vec{m} \cdot \vec{n}$
 $\frac{1}{V} W_m(S) = F(\beta) m_s^2(R), \quad F(\beta) = 2\beta \left[\ln \frac{8}{\beta} + \frac{3}{2} \right], \quad \text{no pinning}$

Note, no bound. cond. cylinder in Gns' PRB. $\vec{m}$ is vortex-centered, a diamagnet. wave function $\psi_m \sim \vec{m}$. (???)

$\vec{M} = \vec{M}_0 + \vec{m}$, $\vec{H}_m = \vec{H}_m^0 + \vec{h}_m$, $\vec{M}_0$ - uniform (FMR), $\vec{h}_m \sim \vec{m}$
 $(\vec{M}_0 + \vec{m}) \times \left[g \frac{\partial \vec{M}}{\partial t} + L \vec{H}_m^0 + L \vec{h}_m \right] = 0$, $\vec{M}_0 \times \vec{H}_m^0 = 0$ - equil.

$$\vec{M}_0 \times \left[q \frac{\partial \vec{h}_m}{\partial n} + L \vec{h}_m \right] + L \vec{m} \times \vec{H}_m^0 = 0, \quad \frac{\vec{M}_0}{M_s} = \begin{pmatrix} \sin \theta_0 & 0 & \cos \theta_0 \end{pmatrix}$$

$$\begin{matrix} M_x^0 = M_x \cos \varphi + M_y \sin \varphi = M_s \sin \theta_0 \cos \varphi \\ M_y^0 = -M_x \sin \varphi + M_y \cos \varphi = -M_s \sin \theta_0 \sin \varphi \end{matrix}$$
$$(\vec{H}_m)_g = \int d^2z' \int d^2\bar{g}' \left[\underbrace{G_{\varphi\varphi} M_g^0}_{\substack{\text{"u.k. } d\varphi d\varphi'}} + \underbrace{G_{g\varphi} M_\varphi^0}_{\substack{\text{"u.k. } d\varphi d\bar{g}'}} + \underbrace{G_{g\bar{g}} M_{\bar{g}}^0}_{\substack{\text{"u.k. } d\bar{g}' d\bar{g}'}} \right] = 0 \quad \text{там где } \varphi \text{ не } \varphi''$$
$$(H_m^0)_\varphi = \int d\mathbf{z}' \int d\mathbf{z} \vec{\sigma}' \cdot \left[\underbrace{G_{\varphi\varphi}}_{\text{diag. 1}} M_\varphi^0 + \underbrace{G_{\varphi\varphi}}_{\text{diag. 2}} M_\varphi^0 + \underbrace{G_{\varphi z}}_{\text{diag. 3}} M_z^0 \right] = 0 \quad \text{---}$$
$$G_{20} M_0 + G_{22} M_0 + G_{24} M_0 + \dots$$

$$G_{\alpha\beta}(\vec{r}, \vec{r}') = -\frac{\partial^2}{\partial x_\alpha \partial x_\beta} \int d\vec{k} e^{i\vec{k} \cdot (\vec{r} - \vec{r}')} \sum_{\mu} J_{\mu}(\vec{k}, \omega) J_{\mu}(\vec{k}, \omega')$$

$$\sum_{\mu} J_{\mu}(\vec{k}, \omega) J_{\mu}(\vec{k}, \omega') e^{i\mu(\varphi - \varphi')}$$

Mayo • Maiatz

FMR pinning

17

Jueves, Osteguna

$$B_{xyz} : H_m^0 = -N_{dd} M_d^0, \text{ r.k. } N_{\beta\beta} \text{ gu. r.}$$

$$h_m^0 = \int d\vec{r}' \int d\vec{r}'' [G_{ss} m_s + G_{sp} m_p + G_{sz} m_z]$$

$$B_{xyz} : \vec{m} = (m_x, m_y, 0) \quad B_{xyz} : \vec{m} = (m_x, m_y, m_z) \quad \begin{cases} m_x = m_x' \cos \theta_0 \\ m_y = m_y' \\ m_z = -m_x' \sin \theta_0 \end{cases}$$

Donde $m_z = -m_x' \sin \theta_0$ or $\sin \varphi, \cos \varphi$ he zabucua. $m_x', m_y' = \text{const}$ que FMR. (2, \varphi)

Ho no " \varphi " nago yepagueru ne $\vec{H}_m^0, \vec{h}_m$, a caun b. conditions.

One saturated cylinder $\vec{H}_m^0 = -4\pi M_s \hat{z}$ $\vec{M}_0 = M_s \hat{z}$.

$$B_{xyz} \in \partial z' \parallel \vec{M}_0 : \vec{M}_0 \times \frac{\partial \vec{m}}{\partial n} = \begin{vmatrix} \hat{x}' & \hat{y}' & \hat{z}' \\ 0 & 0 & 1 \end{vmatrix} M_s = \hat{y}' M_s \frac{\partial m_x'}{\partial n} - \hat{x}' M_s \frac{\partial m_y'}{\partial n}$$

$$\vec{M}_0 \times \vec{h}_m = \begin{vmatrix} \hat{g}' & \hat{p}' & \hat{z}' \\ 0 & 0 & 1 \\ h_m^x & h_m^y & h_m^z \end{vmatrix} = \hat{p}' h_m^x - \hat{g}' h_m^y = \hat{y}' h_m^x - \hat{x}' h_m^y$$

$$\vec{m} \times \vec{H}_m^0 = \begin{vmatrix} \hat{x}' & \hat{y}' & \hat{z}' \\ m_x & m_y & 0 \\ H_m^{0x} & H_m^{0y} & H_m^{0z} \end{vmatrix} = \hat{x}' m_y H_m^{0z} - \hat{y}' m_x H_m^{0z} + \hat{z}' [m_x H_m^{0y} - m_y H_m^{0x}]$$

$$\text{Escribir nro. de } \hat{x}' : -q M_s \frac{\partial m_y'}{\partial n} - L h_m^y H_m^{0z} + L m_y' H_m^{0z} = 0$$

$$h_m^y = h_m^y = h_m^y \sin \varphi + h_m^y \cos \varphi \quad \text{Nago } \langle h_m^y \rangle_\varphi = ? \text{ cu. 2/2}$$

$$\text{Nocue } \int d\vec{r} d\vec{r}' : h_m^y = \int d\vec{r} d\vec{r}' [g_{ss} m_s + g_{sp} m_p]$$

$$h_m^y = \sin \varphi \int d\vec{r} d\vec{r}' [g_{ss} (m_x \cos \varphi' + m_y \sin \varphi') + g_{sp} (-m_x \sin \varphi' + m_y \cos \varphi')]$$

$$m_{x,y} \text{ or } \varphi' \text{ he zabucua. } (g_{\alpha\beta}(\vec{r}, \vec{r}')) = \frac{1}{L} \int d\vec{r} d\vec{r}' G_{\alpha\beta}(\vec{r}, \vec{r}')$$

$$g_{ss} = \sum_{\mu} a_{\mu} e^{i\mu(\varphi - \varphi')} \quad \langle h_m^y \rangle_\varphi \sim \int d\varphi \sin \varphi [g_{ss} (m_x \cos \varphi' + m_y \sin \varphi') +$$

$$+ g_{sp} (-m_x \sin \varphi' + m_y \cos \varphi')]$$

$$\int d\varphi d\varphi' g_{ss} \sin \varphi \cos \varphi' = \sum a_{\mu} \int d\varphi d\varphi' \sin \varphi \cos \varphi' e^{i\mu\varphi} e^{-i\mu\varphi'} =$$

$$= \sum a_{\mu} \int d\varphi \frac{1}{2i} (e^{i\varphi} - e^{-i\varphi}) e^{i\mu\varphi} \int d\varphi' \frac{1}{2} (e^{i\varphi'} + e^{-i\varphi'}) e^{-i\mu\varphi'} = \sum a_{\mu} \frac{(2\pi)^2}{4i} (\delta_{\mu-1} - \delta_{\mu+1})$$

$$\times (\delta_{\mu+1} + \delta_{\mu-1}) = \frac{(2\pi)^2}{4i} \sum a_{\mu} (+\delta_{\mu-1} - \delta_{\mu+1}) = \frac{(2\pi)^2}{4i} (a_{-1} - a_1) = 0, \text{ r.k. } a_{\mu} = 2\pi$$

$$\int d\varphi d\varphi' g_{ss} \sin \varphi \sin \varphi' = \frac{(2\pi)^2}{2i \cdot 2i} \sum a_{\mu} (\delta_{\mu-1} - \delta_{\mu+1}) (\delta_{\mu+1} - \delta_{\mu-1}) = 2$$

$$= -\frac{(2\pi)^2}{(-4)} \sum a_{\mu} (\delta_{\mu+1} + \delta_{\mu-1}) = \frac{(2\pi)^2}{4} (a_1 + a_{-1}) = \frac{(2\pi)^2}{4} 2a_1 \neq 0$$

$$g_{sp} = \sum_{\mu} b_{\mu} e^{i\mu(\varphi - \varphi')} \text{ he } \neq 0 \text{ gger } \int d\varphi d\varphi' \sin \varphi g_{sp} \cos \varphi', \text{ r.k. } b_{\mu} = \text{vera.}$$

$$g_{sp} = \frac{1}{2\pi} \sum_{\mu} g_{\mu}^{\text{sp}} e^{i\mu(\varphi - \varphi')} \quad g_{\mu}^{\text{sp}} = (\dots) \quad G_{sp} = -\frac{\partial}{\partial \varphi} \frac{\partial}{\partial \varphi'} \int d\vec{k} e^{i\vec{k} \cdot (\vec{r} - \vec{r}')} \sum_{\mu} J_{\mu}(\vec{k}, \omega) J_{\mu}(\vec{k}, \omega')$$

$$= \frac{1}{2i} i\mu \int d\vec{k} e^{i\vec{k} \cdot (\vec{r} - \vec{r}')} \sum_{\mu} \frac{\partial J_{\mu}}{\partial \varphi} J_{\mu}(\vec{k}, \omega) e^{i\mu(\varphi - \varphi')}, \quad G_{sp}(\mu) \sim \mu.$$

Semana • Aste 20

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$$g_{\mu\nu}^{\alpha\beta} = g_{\nu\mu}^{\alpha\beta}, \quad g_{\mu\nu}^{\alpha\beta} = \sum_{\lambda} g_{\mu\nu}^{\alpha\beta\lambda} e^{i\lambda(\varphi - \varphi')}, \quad g_{\mu\nu}^{\alpha\beta}, g_{\mu\nu}^{\alpha\beta\lambda} - \text{Lorentz cov.}$$

Ostirala • Viernes

$$g_{\mu\nu}^{\alpha\beta} + g_{\nu\mu}^{\alpha\beta} = i\mu f_{\mu} + (-i\mu) f_{\nu} = 0, \quad g_{\mu\nu}^{\alpha\beta} - g_{\nu\mu}^{\alpha\beta} = 2g_{\mu\nu}^{\alpha\beta\lambda} \sin \lambda \varphi$$

$$H_m^{0z'} = H_m^{0x} \sin \theta_0 + H_m^{0z} \cos \theta_0 \quad \text{ne eago gurekume } \varphi.$$

Whereas $\hat{x}'$ of bound. condition:
$$-qM_s \frac{\partial m_y}{\partial n} - L \lambda(\varphi) m_y + L H_m^{0z'} m_y = 0$$

$$\lambda(\varphi, \varphi) \rightarrow \lambda(\varphi, \varphi) = \lambda(\varphi), \text{ a } g=R.$$

$$-qM_s \frac{\partial m_y}{\partial n} [H_m^{0z'} - \lambda] m_y = 0, \quad H_m^{0z'} = -N_x M_s \sin \theta_0 \cdot \sin \theta_0 - N_z M_s \cos \theta_0 \cdot \cos \theta_0$$

$$N_x \ll N_z \text{ u } H_m^{0z'} \approx -N_z M_s \cos^2 \theta_0.$$

$$\lambda \text{ or } \theta_0 \text{ ne gurekume } \frac{\partial m_y}{\partial n} + \frac{L}{qM_s} [\lambda - N_z M_s \cos^2 \theta_0] m_y = 0, \quad \text{Zhan?}$$

$$\lambda \sim g_{ss}, g_{se} \sim f(\beta k) \xrightarrow{\beta \rightarrow 0} 0. \quad \text{nu } \beta \rightarrow 0 \quad \frac{\partial m_y}{\partial n} + \frac{N_z L \cos^2 \theta_0}{q} m_y = 0 \quad (\text{ver.})$$

$$\frac{\partial}{\partial n} = \frac{\partial}{\partial y} = \frac{\partial}{\partial y} R^{-1}, \quad y = y/R.$$

$$\frac{\partial m_y}{\partial y} + d(\theta_0) m_y = 0 \quad \text{gaur } d(\theta_0) = \frac{N_z L R \cos^2 \theta_0}{q} = d(0) \cos^2 \theta_0$$

$$d(0) = \frac{N_z L R}{2A/M_s^2} = N_z \frac{LR}{L_0^2}, \quad \text{a } \delta \text{ u } d(0) \sim \cos^2 \theta_0 \text{ c } d(0) = R/3 = R \frac{2K_s}{L_0^2 M_s^2}$$

$$d(0) = 4\pi \frac{LR}{L_0^2}, \quad \delta \text{ u } d(0) = \frac{2R}{L_0^2} \frac{K_s}{M_s^2}, \quad \text{cobnaguz } \mu \text{ u } K_s = 2\pi M_s^2 L_0$$

No uku $\theta_0 \rightarrow \pi/2$ nago gurekume $\lambda \neq 0, N_x \neq 0$ u $d(\pi/2)$ - konstante.

$$d(0) \approx 4\pi \frac{50 \cdot 500 (\text{nm})^2}{(20)^2 \text{ nm}^2} = 4\pi (2.5)^2 (25)^2 \gg 1, \quad d(0)_{\text{exp}} \approx 13 \text{ beko.}$$

$\theta_0 = 0$ or gurekume uko gurekume. $(m_x \vec{H}_m)_x = m_y H_m^{0z}, \quad \vec{H}_m^0 \approx -4\pi M_s \hat{z} = -4\pi \vec{M}_0$

$$\vec{M}_0 \times [\dots] + L \vec{m} \times (-4\pi) \vec{M}_0 = 0, \quad q \frac{\partial \vec{m}}{\partial n} + L \vec{h}_m + 4\pi L \vec{m} = 0$$

138/227 $\vec{h}_m$ gurekume. $\vec{h}_m \sim 4\pi m$, $\vec{h}_m \sim$

$$\vec{h}_m \sim g_{ss}, g_{se} \sim f(\beta k) \sim \beta \ll 1, \quad \vec{m} = (m_x, m_y, 0) \text{ in-plane.}$$

$\vec{h}_m$ - dynamic bce ne uko gurekume $\vec{h}_m \sim 4\pi m_s$ bce uko gurekume.

$$\vec{h}_m = \vec{h}_s + \vec{h}_v \approx -2\pi m_y + \beta \frac{\partial m_y}{\partial n}$$

Larunbata • Sábado $2\pi m_y$ gurekume. $\vec{h}_m$ - bce uko gurekume. $\vec{h}_m$ - bce uko gurekume. $\vec{h}_m$ - bce uko gurekume.

139/226 $\vec{h}_v \sim \beta \frac{\partial m_y}{\partial n} \rightarrow \frac{q}{L} \frac{\partial m_y}{\partial n}$ (exchange) u $\vec{h}_m$ - bce uko gurekume.

phenomenon pinning. Cu. 10, 23/12/2004, $\vec{h}_m$ - dynamic $\vec{h}_m$, $\vec{h}_m$ - bce uko gurekume. $\vec{h}_m$ - bce uko gurekume.

$$\lambda = h_m^y / m_y = \int d^2 \vec{r}' \sin \varphi [g_{ss} \sin \varphi' + g_{se} \cos \varphi'] - \text{u } h_m^y, \text{ nago euse } h_m^y.$$

$$h_m^y = \int d^2 \vec{r}' [g_{yx} m_x + g_{yy} m_y + g_{yz} m_z] = | \text{Cu. 28/12/2002.} | =$$

$$= \int d^2 \vec{r}' m_x [(g_{ss} - g_{se}) \cos \varphi' \dots] + O(m_y).$$

$$\delta = h_m \sin \varphi + h_m \cos \varphi = \sin \varphi \int d\vec{r}' [g_{ss} (m_x \cos \varphi' + m_y \sin \varphi')] + \cos \varphi \int d\vec{r}' [g_{ss} (m_x \cos \varphi' + m_y \sin \varphi')] +$$

$$+ g_{ss} (-m_x \sin \varphi' + m_y \cos \varphi') + g_{ss} (-m_x \sin \varphi' + m_y \cos \varphi') = (m_x) \int d\vec{r}' [g_{ss} \sin \varphi \cos \varphi' - g_{ss} \sin \varphi \sin \varphi' +$$

$$+ g_{ss} \cos \varphi \cos \varphi' - g_{ss} \cos \varphi \sin \varphi'] + (m_y) \int d\vec{r}' [g_{ss} \sin \varphi \sin \varphi' + g_{ss} \sin \varphi \cos \varphi' +$$

$$+ g_{ss} \cos \varphi \sin \varphi' + g_{ss} \cos \varphi \cos \varphi'] , m_{xy} = f(\varphi) .$$

$$G_{\beta\beta}(\vec{r}, \vec{r}') = - \frac{\partial^2}{\partial x \partial x'} \frac{1}{|\vec{r} - \vec{r}'|} = - \frac{\partial^2}{\partial x \partial x'} \int dk e^{-k|z-z'|} \sum_{\mu} J_{\mu}(k\rho) J_{\mu}(k\rho') e^{i\mu(\varphi-\varphi')}$$

$$g_{\beta\beta}(\vec{r}, \vec{r}') = \frac{1}{L} \int dz dz' G_{\beta\beta}(\vec{r}, \vec{r}') = - \frac{\partial^2}{\partial x \partial x'} 2 \int \frac{dk}{k} f(kL) \sum_{\mu} J_{\mu} J_{\mu}(1) e^{i\mu(\varphi-\varphi')}$$

$$\frac{1}{L} \int dz dz' e^{-k|z-z'|} = \frac{1}{L} \frac{2L}{k} f(kL) , f(x) = 1 - \frac{1}{x} (1 - e^{-x}) .$$

$$g_{ss}(\vec{r}, \vec{r}') = -2 \frac{\partial^2}{\partial s \partial s'} \int \frac{dk}{k} f \sum_{\mu} J_{\mu} J_{\mu}(1) e^{i\mu(\varphi-\varphi')}$$

$$g_{ss'}(\vec{r}, \vec{r}') = -2 \frac{\partial}{\partial s} \frac{1}{s'} \frac{\partial}{\partial \varphi'} (\cdot) = \frac{2i}{s'} \frac{\partial}{\partial s} \int \frac{dk}{k} f \sum_{\mu} \mu J_{\mu} J_{\mu}(1) e^{i\mu(\varphi-\varphi')}$$

$$g_{ss'}(\vec{r}, \vec{r}') = -2 \frac{\partial}{\partial s} \frac{\partial}{\partial \varphi} \frac{\partial}{\partial s'} = -\frac{2i}{s} \frac{\partial}{\partial s'} \sum_{\mu} \int \frac{dk}{k} f \cdot \mu J_{\mu} J_{\mu}(1) e^{i\mu(\varphi-\varphi')}$$

$$g_{ss'}(\vec{r}, \vec{r}') = -2 \frac{\partial}{\partial s} \frac{\partial}{\partial \varphi} \frac{\partial}{\partial s'} (\cdot) = -\frac{2}{ss'} \int \frac{dk}{k} f \sum_{\mu} \mu^2 J_{\mu} J_{\mu}(1) e^{i\mu(\varphi-\varphi')}$$

$$g_{\beta\beta}(\vec{r}, \vec{r}') = \sum_{\mu} g_{\beta\beta}^{ss'}(ss') e^{i\mu(\varphi-\varphi')} , g_{\mu}^{ss} = -2 \frac{\partial^2}{\partial s \partial s'} \int \frac{dk}{k} f J_{\mu} J_{\mu}(1)$$

$$g_{\mu}^{ss'} = \frac{2i\mu}{s'} \frac{\partial}{\partial s} \int \frac{dk}{k} f J_{\mu} J_{\mu}(1) , g_{\mu}^{ss} = -\frac{2i\mu}{s} \frac{\partial}{\partial s'} \int \frac{dk}{k} f J_{\mu} J_{\mu}(1)$$

$$g_{\mu}^{ss} = -\frac{2}{ss'} \mu^2 \int \frac{dk}{k} J_{\mu} J_{\mu}(ks') , \text{Def. } F_{\mu}(ss') = \int \frac{dk}{k} f(kL) J_{\mu}(k\rho) J_{\mu}(k\rho')$$

$$g_{\mu}^{ss} = -2 \frac{\partial^2 F_{\mu}}{\partial s \partial s'} , g_{\mu}^{ss'} = \frac{2i\mu}{s'} \frac{\partial F_{\mu}}{\partial s} , g_{\mu}^{ss} = -\frac{2i\mu}{s} \frac{\partial F_{\mu}}{\partial s'} , g_{\mu}^{ss} = -\frac{2}{ss'} \mu^2 F_{\mu} .$$

$$F_{\mu} = F_{-\mu} , g_{\mu}^{ss, \varphi\varphi} = g_{-\mu}^{ss, \varphi\varphi} , g_{\mu}^{ss, \varphi s} = -g_{\mu}^{ss, \varphi s} = (g_{\mu}^{ss, \varphi s})^*$$

$$\int d\varphi' \text{ e } i\mu(\varphi-\varphi') \sin \varphi \sin \varphi' = \int d\varphi' e^{i\mu\varphi} \sin \varphi' = \left| \frac{2\pi}{2i} (\delta_{\mu-1} - \delta_{\mu+1}) \right|^2 =$$

$$= \pi^2 (\delta_{\mu-1} + \delta_{\mu+1}) , \int d\varphi' e^{i\mu(\varphi-\varphi')} \cos \varphi \cos \varphi' = \pi^2 (\delta_{\mu-1} + \delta_{\mu+1})$$

$$\int d\varphi' e^{i\mu(\varphi-\varphi')} \sin \varphi \cos \varphi' = \frac{\pi}{i} (\delta_{\mu-1} - \delta_{\mu+1}) \pi (\delta_{\mu-1} + \delta_{\mu+1}) = \frac{\pi^2}{i} (\delta_{\mu-1} - \delta_{\mu+1})$$

$$\int d\varphi' e^{i\mu(\varphi-\varphi')} \cos \varphi \sin \varphi' = \pi (\delta_{\mu-1} + \delta_{\mu+1}) \frac{(\pi)}{i} (\delta_{\mu-1} - \delta_{\mu+1}) = -\frac{\pi^2}{i} (\delta_{\mu-1} - \delta_{\mu+1})$$

$$\int d\varphi' d\varphi' g_{\beta\beta} \sin \varphi \sin \varphi' = \sum_{\mu} \int d\varphi' d\varphi' \sin \varphi \sin \varphi' g_{\beta\beta} e^{i\mu(\varphi-\varphi')} =$$

$$= \pi^2 \sum_{\mu} g_{\beta\beta} (\delta_{\mu-1} + \delta_{\mu+1}) = \pi^2 (g_{\beta\beta}^{-1} + g_{\beta\beta}^1) = \pi^2 \{ 2g_{\beta\beta}^1 , \text{ e } g_{\beta\beta}^{\varphi\varphi} \}$$

$$\int d\varphi' d\varphi' g_{\beta\beta} \sin \varphi \cos \varphi' = \sum_{\mu} g_{\beta\beta} \int d\varphi' d\varphi' \sin \varphi \cos \varphi' e^{i\mu(\varphi-\varphi')} = \pm \sum_{\mu} g_{\beta\beta} \pi^2 (\delta_{\mu-1} - \delta_{\mu+1})$$

$$= \pm \pi^2 (g_{\beta\beta}^{-1} - g_{\beta\beta}^1) = \pm \pi^2 i (g_{\beta\beta}^1 - g_{\beta\beta}^{-1}) = \{ 0 , g_{\beta\beta}^{\varphi\varphi} \} (\pm \pi^2 i)$$

$$\text{The } \int d\varphi' d\varphi' \text{ o } \cos \varphi \sin \varphi' \text{ que } g_{ss} , g_{\varphi\varphi} , \text{ no } \sin \varphi \cos \varphi' \text{ que } g_{ss} , g_{\varphi\varphi} .$$

Bee zener e my buenagares uz h_m wmu jdie jdie'(...).

Mainza y Mayo

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$$\int \frac{d\varphi}{2\pi} \int d\mathbf{s}' m_y(\mathbf{s}') [g_{ss} \sin\varphi \sin\varphi' + g_{\varphi\varphi} \sin\varphi \cos\varphi' + g_{\varphi s} \cos\varphi \sin\varphi' + g_{s\varphi} \cos\varphi \cos\varphi'] = \frac{1}{2\pi} \int d\mathbf{s}' m_y(\mathbf{s}') [2\pi^2 g_1^{ss} + 2\pi^2 g_1^{\varphi\varphi} + 2\pi^2 i g_1^{s\varphi} - 2\pi^2 i g_1^{\varphi s}]$$

Asi...

$$\pi \int d\mathbf{s}' s' m_y(\mathbf{s}') [g_1^{ss} + g_1^{\varphi\varphi} + i g_1^{s\varphi} - i g_1^{\varphi s}]$$

$$[\cdot] = g_1^{ss} + g_1^{\varphi\varphi} + i g_1^{s\varphi} - i g_1^{\varphi s} = -2 \frac{\partial^2 F_1}{\partial s \partial s'} - \frac{2}{g s'} F_1 + i \frac{2i}{s'} \frac{\partial F_1}{\partial s} - i \frac{(-2i)}{s} \frac{\partial F_1}{\partial s'} =$$

$$= -2 \left[\frac{1}{g s'} F_1 + \frac{1}{s'} \frac{\partial F_1}{\partial s} + \frac{1}{s} \frac{\partial F_1}{\partial s'} + \frac{\partial^2 F_1}{\partial s \partial s'} \right], F_1(s s') = \int \frac{dk}{k} f(k) J_1(k s) J_1(k s')$$

$$[\cdot] = -2 \int dk k f(k) \left[\frac{J_1(x)}{x} \frac{J_1(x')}{x'} + \frac{dJ_1(x)}{dx} \frac{J_1(x')}{x'} + \frac{dJ_1(x')}{dx'} \frac{J_1(x)}{x} + J_1'(x) J_1'(x') \right]$$

$$= -2 \int dk k f(k) \left[\frac{J_1(x)}{x} + J_1'(x) \right] \left[\frac{J_1(x')}{x'} + J_1'(x') \right]$$

$$\frac{d}{dx} Z_d(x) + \frac{dZ_d(x)}{dx} = Z_{d-1}(x), \quad \frac{1}{x} J_1(x) + J_1'(x) = J_0(x)$$

$$[\cdot] = -2 \int dk k f(k) J_0(k s) J_0(k s') - \text{Wpobezn}$$

$$\langle h_m^y \rangle_\varphi = -2\pi \int d\mathbf{s}' s' m_y(\mathbf{s}') \int dk k f(k) J_0(k s) J_0(k s'), \quad \frac{s}{R} \rightarrow \frac{s}{t} = kR.$$

$$h_m^y(s) = -2\pi \int d\mathbf{s}' s' m_y(\mathbf{s}') \int_0^\infty dt f(\beta t) J_0(t s) J_0(t s')$$

$$f(\beta t) = 1 - \frac{1}{\beta t} (1 - e^{-\beta t}) \quad \int_0^\infty dt J_0(t s) J_0(t s') = \frac{1}{s} \delta(s - s')$$

$$\rightarrow h_m^y(s) = -2\pi m_y(s) + \frac{2\pi}{\beta} \int_0^\infty d\mathbf{s}' s' m_y(\mathbf{s}') \int_0^\infty dt (1 - e^{-\beta t}) J_0(t s) J_0(t s')$$

$$h_m^y(s) = h_s(s) + h_v(s), \quad h_s(s) = -2\pi m_y(s) = -2\pi m_y(1) -$$

$$g_{zz}(s, s') = -\frac{4\pi}{\beta} \int_0^\infty dt (1 - e^{-\beta t}) J_0(t s) J_0(t s'). \quad - \text{Beynoui Surf. Znen.}$$

Def. $g(s s') = -2\pi \int dt f(\beta t) J_0(t s) J_0(t s')$, $h_m^y(s) = \int d\mathbf{s}' s' m_y(\mathbf{s}') g(s s')$

$$h_s(s) = m_y(1) \int d\mathbf{s}' s' g(s, s'), \quad \int_0^\infty d\mathbf{s}' s' J_0(t s') = \frac{1}{t^2} t^2 J_1(t s') \Big|_0^\infty = \frac{J_1(t)}{t}$$

$$h_s(s) = m_y(1) \int d\mathbf{s}' s' (-2\pi) \int dt f(\beta t) J_0(t s) J_0(t s') = -2\pi m_y(1) \int dt f(\beta t) J_1(t) J_0(t s)$$

16/IX/07. a b eq. ananomonan $h_m^y(s) = \int d\mathbf{s}' s' g(s s') m_y(\mathbf{s}')$

$$\text{bzen } m_y(\mathbf{s}') \approx m_y(s) + \frac{\partial m_y}{\partial s} (s' - s), \quad s = 1, \text{ zo garo } h_s \text{ u } h_v.$$

18/I hogara goe. na vloguene Tarjeta de Residencia. J. u A. appl. byggz norobri zelyz ~ 2 nec. noche Dec. 5. // Buzur u kpatobacoay

Anany orherob Referree of JAP - Manopil. MPD. - unaine o V. Estevez?

14/223 Becega < V. Estevez - postdoc candidate. Becega < Dec. o de vlogueneay

Zbomer Payxag: onpehru-luy support leti, obenzan bzu. (?)

neme b F/N/F dyn. paper.

19/I hogara application na postdoc < V. Estevez (xorb ostzeln. yofan, no application mri hogam). Daxuag V. Estevez "TMR in nanoparticle

1D arrays" y neme b kenu. Buzur V. Estevez "TMR in nanoparticle

Obovome kinetic simul. Mante-Carlo by Estevez: 1) pacen. gnamsky

FM electrodes, 2) cruceb nanoparticles as FM e paz gnamsky

21 Asti. Semana TMR current // Obeg < Julian u Virginia. JAP < Dec.

$h_m^y(s) = \int d\mathbf{s}' g(\mathbf{s}\mathbf{s}') m_y(\mathbf{s}') = \int d\mathbf{s}' g(\mathbf{s}, \mathbf{s}') \left[m_y(s) + \frac{\partial m_y}{\partial s'} \Big|_{s'=s} (s' - s) \right]$ FMR pinning Maizta $s \rightarrow 1-0$

$h_m^y(s) = m_y(s) \int d\mathbf{s}' g(\mathbf{s}\mathbf{s}') + \frac{\partial m_y}{\partial s} \int d\mathbf{s}' g(\mathbf{s}\mathbf{s}') (s' - s)$

$\int d\mathbf{s}' g(\mathbf{s}\mathbf{s}') = J(s, \beta) \approx -2\pi + O(\beta)$ $s \rightarrow 1-0$
 $\beta \ll 1$

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$\int d\mathbf{s}' g(\mathbf{s}\mathbf{s}') = (-2\pi) \int d\mathbf{s}' s'^2 \int dt f(\beta t) J_0(t s) J_0(t s')$ Miércoles • Asteazkena

$\int dx x^2 J_0(x) = \int_{x=u}^{\infty} x J_0(x) dx = -u J_1(u)$ - не берем

Рассм. $J_s(s, \beta) = -\frac{1}{2\pi} J(s, \beta) = \int dt f(\beta t) J_1(t) J_0(t s)$, $s \rightarrow 1-0$.

$J_s(s, \beta) = \int_0^\infty dt J_1(t) J_0(t s) - \frac{1}{\beta} \int_0^\infty dt (1 - e^{-\beta t}) J_1(t) J_0(t s) = \frac{1}{\beta} \int_0^\infty dt J_0(t) J_1(t s) -$

$J_1(\beta) = \int_0^\infty J_1(t) dt \approx 1$ с. 16/17 $= \frac{1}{\beta} \left[\frac{1}{2} \beta - \frac{\beta^2}{4\pi} \left(\ln \frac{\beta}{2} + \frac{1}{2} \right) \right] =$

$= \frac{1}{2} + \frac{\beta}{4\pi} \left(\ln \frac{\beta}{2} + \frac{1}{2} \right)$. $J_s(\beta, s \rightarrow 1-0) = \frac{1}{2} + O(\beta)$.

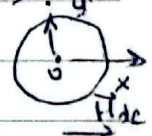
$h_s(s \rightarrow 1-0) = -2\pi m_y(1) J_s(\beta, s \rightarrow 1-0) = -\pi m_y(1) + O(\beta)$.

Сколько h_m^y на поверхности $s=R$ вдоль Oy будет $2\pi m_y(R)$?
 А не $4\pi m_y(1)$? (кстати $h_s = 4\pi (\vec{m} \cdot \vec{n})_s = 4\pi m_s$ и $h_s(s \rightarrow 1-0) = -2\pi m_s(s \rightarrow 1-0)$. У нас $\langle h_m^y \rangle_\varphi$ с $s \rightarrow 1-0$, т.е. не h_s а h_y , еще и усредненное по всей поверхности $d\varphi(\dots)$).

Тогда если dynamic $m_x(\vec{s})$, $m_y(\vec{s})$ зависит $m_x(s)$, $m_y(s)$ - radial. sym.

$h_y(s, \varphi) = \int d\vec{s}' [g_{yx} m_x + g_{yy} m_y]$ все равно есть $F(\varphi)$.

Скорее $h_m^y(s, \varphi) = a \sin \varphi \cos \varphi (m_x) + b \sin^2 \varphi (m_y)$ и (m_x) нечетно φ $\int_0^{2\pi} d\varphi(\dots)$. Но затем $\langle \dots \rangle_\varphi = \frac{1}{2\pi} \int d\varphi(\dots)$?

Вот надо обдумать φ . у с. 1. Вдоль Oy , т.е. $\varphi = \pi/2$. 

Oz' - ось координат $\parallel \vec{M}_0$. Граничные условия (нормальные к $\hat{x}'$):

$-g M_s \frac{\partial m_y}{\partial n} - L h_m^y M_s + L m_y H_m^{Oz'} = 0$. $h_m^y(s, \varphi)$, $m_y(s, \varphi)$

- берется на поверхн. гора, доковы, $s=1$, но φ - arbitrary.
 Вдоль micromag. simul. Авантха, сверху $\frac{\partial}{\partial n} = \frac{\partial}{\partial y}$ и $\varphi = \pi/2$
 - через $m_y(s, \varphi)$ вдоль Oy , т.е. $m_y(y)$!

$h_m^y(s, \varphi) = h_m^s \sin \varphi + h_m^\varphi \cos \varphi$, $\varphi = \pi/2 \rightarrow h_m^y(s) = h_m^s(s)$.

$h_m^y(s, \pi/2) = \int d\vec{s}' m_x(s') [g_{ss} \cos \varphi' - g_{sy} \sin \varphi'] + \int d\vec{s}' m_y [g_{ss} \sin \varphi' + g_{sy} \cos \varphi']$

$g_{\mu\nu}(\vec{s}, \vec{s}') = \sum_{\mu} g_{\mu}^{\nu}(\mathbf{s}\mathbf{s}') e^{i\mu(\varphi - \varphi')}$, $g_{\mu}^{\nu} = \text{с. 17/1}$

$\int d\varphi' g_{\mu}^{\nu} e^{i\mu(\varphi - \varphi')} \sin \varphi' = \sum_{\mu} g_{\mu}^{\nu} e^{i\mu\varphi} \int d\varphi' e^{-i\mu\varphi'} \sin \varphi' = \left| \frac{1}{2i} (e^{-i\mu} - e^{i\mu}) \right|$

$= \sum_{\mu} g_{\mu}^{\nu} e^{i\mu\varphi} \frac{\pi}{i} (\delta_{\mu,1} - \delta_{\mu,-1}) = \frac{\pi}{i} (g_1 e^{i\pi/2} - g_{-1} e^{-i\pi/2}) = \pi (g_1^{\nu} + g_{-1}^{\nu}) \neq 0$

$\sum_{\mu} g_{\mu}^{\nu} e^{i\mu\varphi} \int d\varphi' e^{-i\mu\varphi'} \cos \varphi' = \sum_{\mu} g_{\mu}^{\nu} e^{i\mu\varphi} \pi (\delta_{\mu,-1} + \delta_{\mu,1}) = \pi (g_{-1} e^{i\pi/2} + g_1 e^{-i\pi/2}) =$

$= \pi i (g_1 - g_{-1}) = 2\pi i g_1$ и $\neq 0$ только для $s\varphi, \varphi s$. (m_x) всегда есть

$h_m^y(s, \pi/2) = \int d\mathbf{s}' s' m_y(s') [2\pi g_1^s + 2\pi i g_1^\varphi]$

24

$$g_{1,1}^{ss} + g_{1,1}^{ss} = -2 \frac{\partial F_1}{\partial g_{1,1}} + 2i_1 \frac{\partial F_1}{\partial g_{1,1}} = -2 \frac{\partial}{\partial g_{1,1}} \left[\frac{\partial F_1}{\partial g_{1,1}} + \frac{1}{g_{1,1}} F_1 \right]$$

$$F_1 = \int dk f(k) J_1(kg) J_1(kg')$$

$$\frac{\partial J_1(x)}{\partial x} + \frac{1}{x} J_1(x) = J_0(x)$$

$$g_{1,1}^{ss} + g_{1,1}^{ss} = -2 \frac{\partial}{\partial g_{1,1}} \int dk f(k) J_1(kg) k \left[\frac{\partial J_1(kg')}{\partial (kg')} + \frac{1}{kg'} J_1(kg') \right] = -2 \frac{\partial}{\partial g_{1,1}} \int dk f(k) J_1(kg) J_0(kg') = -2 \bar{g}(g, g')$$

$$h_m^y(g, g') = -4\pi \int dg' s' \bar{g}(g, g') m_y(g'), \quad \bar{g}(g, g') = \int dk f(k) \frac{\partial J_1(kg)}{\partial g} J_0(kg')$$

$$\frac{\partial J_1(kg)}{\partial g} = k \left[J_0(kg) - \frac{1}{kg} J_1(kg) \right], \quad \bar{g}(g, g') = \int dk f(k) \left[k J_0(kg) - \frac{1}{g} J_1(kg) \right] J_0(kg')$$

$$\bar{g}(g, g') = \int dk k f(k) J_0(kg) J_0(kg') - \frac{1}{g} \int dk f(k) J_1(kg) J_0(kg')$$

$$\text{Derivative } \bar{J}(g, \beta) = \int dg' s' \bar{g}(g, g') = \int dg' s' \frac{\partial}{\partial g} \int dk f(k) J_1(kg) J_0(kg') = \frac{\partial}{\partial g} \int dk f(k) J_1(kg) J_1(kg)$$

$$\bar{J}(g, \beta) = \frac{\partial}{\partial g} \int dk \left[1 - \frac{1}{\beta k} (1 - e^{-\beta k}) \right] J_1(kg) J_1(kg), \quad \bar{J}(g, \beta) = \frac{\beta}{2} \frac{\partial}{\partial g} \int dk J_1(kg) J_1(kg)$$

$$\int_0^\infty dx J_{n+2m+1}(x) J_{n+2m+1}(x) = \frac{\delta_{mn}}{(4n+2m+2)}, \quad n > -1, \quad \text{Gr. P. 6.538}$$

$$\int_0^\infty dx x^{\nu-\mu-1} J_\nu(ax) J_\mu(bx) = 2^{\nu-\mu-1} a^{-\nu} \Gamma(\nu) \frac{a^\mu}{\Gamma(1+\mu)}, \quad b > a, \quad 0 < \text{Re } \nu < \text{Re } \mu + 2$$

$$\rightarrow \nu = \mu = 1: \quad \int_0^\infty \frac{dx}{x} J_1(ax) J_1(bx) = \frac{1}{2} \left(\frac{a}{b} \right) \frac{\Gamma(1)}{\Gamma(2)} = \frac{1}{2} \left(\frac{a}{b} \right) \frac{0!}{1!} = \frac{1}{2} \frac{a}{b}, \quad b > a$$

$$\frac{\partial}{\partial g} \int dk J_1(kg) J_1(kg) = \frac{\partial}{\partial g} \frac{1}{2} \frac{g}{1} = \frac{1}{2} (g \rightarrow 1-0)$$

$$\int dk (1 - e^{-\beta k}) J_1(kg) J_1(kg) = Q(\beta, g) = \frac{\beta}{2} + \frac{\beta^2}{2\pi} \left(\ln \frac{\beta}{g} + \frac{1}{2} \right), \quad 1/g \gg \beta$$

Но надо учесть $Q(\beta, g)$, тогда $\bar{g}$ норм. См. Conway J.T. 'IE' 2001

$$\frac{dQ}{d\beta} = \int dk e^{-\beta k} J_1(kg) J_1(kg) - \text{берем аналогично, но с поправкой}$$

$$h_m^y(g, g') = -4\pi \int dg' s' \bar{g}(g, g') m_y(g') = -4\pi \int dg' s' \bar{g} \left[m_y(g) + \frac{\partial m_y}{\partial g} (g' - g) \right] =$$

$$= -4\pi m_y(1) \int dg' s' \bar{g}(g, g') - 4\pi \left(\frac{\partial m_y}{\partial g} \right) \int dg' s' (g' - 1) \bar{g}(g, g') = -4\pi m_y(1) \bar{J}(g, \beta) - 4\pi \left(\frac{\partial m_y}{\partial g} \right) \int dg' s' (g' - 1) \bar{g}(g, g')$$

$$\bar{J}(g, \beta) = \frac{\partial}{\partial g} \int dk f(k) J_1(kg) J_1(kg) \xrightarrow{g \rightarrow 1-0, \beta \rightarrow 1} \frac{1}{2} + 0$$

$$h_m^y(g) = -2\pi m_y(1) \cdot \text{sign}(1-g) - 4\pi \left(\frac{\partial m_y}{\partial g} \right) \int dg' s' (g' - 1) \bar{g}(g, g')$$

$$\text{Всё же } \bar{J}(g, \beta) = \int dg' s' \bar{g}(g, g') \text{ надо при } g=1 \text{ надо считать. Тогда надо брать } \bar{g} \text{ (} \frac{\partial m_y}{\partial g} \text{) норм.}$$

$$\bar{J}(g, \beta) = \frac{1}{2} - \frac{1}{\beta} \frac{\partial Q(\beta, g)}{\partial g}, \quad Q(\beta, g) \text{ вычислено ранее при } 1/g$$

$$\bar{J}(g, \beta) = \frac{\beta}{2} \frac{\partial}{\partial g} \int dk J_1(kg) J_1(kg) = \frac{\beta}{2} \int dk k \frac{1}{2} [J_0(kg) - J_2(kg)] J_1(kg) =$$

$$= \frac{1}{4} \beta \int dk k [J_0(kg) - J_2(kg)] J_1(kg) = \frac{1}{2} \beta \int dk k \frac{\partial J_1(kg)}{\partial k} J_1(kg) = \frac{1}{4} \beta \int dk \frac{d(J_1^2)}{dk}$$

$$A = \int dk \frac{d}{dk} J_1^2(kg) = \left| \frac{dJ_1^2}{dk} = \frac{dV}{dk} \right|_{u=k} = \frac{1}{20} k^2 J_1^2(kg) \Big|_0^\infty = \int_0^\infty J_1^2(kg) dk - \text{undefinite}$$

$$\bar{J}_0(g, \beta) = \int dg' s'^2 \bar{g}(g, g') = \frac{\partial}{\partial g} \int dg' s'^2 \int dk f(k) J_1(kg) J_0(kg')$$

$$\int_0^1 dg' s'^2 J_0(kg') \text{ не берем в расчёт. } h_m^y(g) = -2\pi m_y(1) - 4\pi \frac{\partial m_y}{\partial g} \left[\dots \right] \text{ volume}$$

$$h_m^y(s) = -2\pi m_y(1) + O(\beta) m_y(1) + \left(\frac{\partial m_y}{\partial s}\right) F(\beta), \quad F(\beta) = O(\beta)$$

$$-2M_s \frac{\partial m_y}{\partial y} - L h_m^y M_s + L m_y H_m^{0z'} = 0, \quad H_m^{0z'} = -M_s [N_x \sin^2 \theta_0 - N_z \cos^2 \theta_0]$$

$$\frac{\partial m_y}{\partial y} - h_m^y + m_y \frac{H_m^{0z'}}{M_s} = 0, \quad h_m^y = -2\pi m_y + \frac{\partial m_y}{\partial y} F(\beta)$$

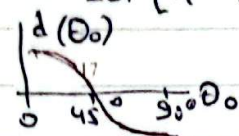
$$-\frac{L}{LR} \frac{\partial m_y}{\partial y} + 2\pi m_y - F(\beta) \frac{\partial m_y}{\partial y} + m_y H_m^{0z'}/M_s = 0$$

$$-\left[\frac{L}{LR} + F(\beta)\right] \frac{\partial m_y}{\partial y} + \left[2\pi + \frac{H_m^{0z'}}{M_s}\right] m_y = 0, \quad \frac{\partial m_y}{\partial y} - \frac{[2\pi + H_m^{0z'}/M_s]}{[\frac{L}{LR} + F(\beta)]} m_y = 0$$

$$\frac{\partial m_y}{\partial y} + d(\theta_0) m_y = 0 \rightarrow d(\theta_0) = -\frac{[2\pi + H_m^{0z'}/M_s]}{[\frac{L}{LR} + F(\beta)]}$$

$$\lim_{\beta \ll 1} \frac{H_m^{0z'}}{M_s} = -N_x \sin^2 \theta_0 - N_z \cos^2 \theta_0 \approx -4\pi \cos^2 \theta_0 + O(\beta)$$

$$d(\theta_0) = \frac{2\pi}{[\frac{L}{LR} + F(\beta)]} \cos 2\theta_0$$



P. Landeros: Mat. Mat. MS - FMR-nondif. P. Landeros: Mat. Mat. MS - FMR-nondif. P. Landeros: Mat. Mat. MS - FMR-nondif.

P. Landeros: DW dyn. in nanotubes. K. Neilsch Group (Garmburg) - JAP 2005. APL 90, 102501 (2007) Vortex in TW. $\vec{M}(\vec{r})$ uniform along nanotube. A canner? Kanne AR-? $\vec{M}(\vec{r}) = M_\theta(\vec{r})\hat{\theta} + M_z(\vec{r})\hat{z}$. $E_{max}(\rho)$ wpm $\rho = \pi/2, 3\pi/2$ E_{min} wpm $\rho = 0, \pi$. $M_\theta = \cos \rho \sin \theta$, ΔE - barrier. What kind of precession if $H > H_w$ (between CCW and CW-walls)? H_c - critic. field to switch chirality ($H_c < H_w$). Angle ρ oscillates. Frequency of the ρ -angle oscillations? $\omega_\rho = \delta H$ -? Larmor?

A field of δ current $c \sim \cos \rho$ magnetic current $\mu_0 p$. You did mention M_{0w} and particle-like motion. What is value M_{0w} ?

K. Richter: APL, v_{sw} up to 9 km/s. Domingo. Igandea: APL, v_{sw} up to 9 km/s.

P. Landeros: APL, v_{sw} up to 9 km/s. Domingo. Igandea: APL, v_{sw} up to 9 km/s. P. Landeros: APL, v_{sw} up to 9 km/s.

to reference & re-submitted it with OGC. OGC was given
 per of F/N/F nanovillar. OGC. He xored & found no
 in Casa Talento & 2 in Bpeme & no more. But he kept a
 of Limes, 60 ussamerne chubren o nac. E-mails Prooran

1) He bugun VC - radius oscill. mode up to $H_2^0 \approx 1000$ or logarithmic y. 20
Cobnag. $\omega_{osc} \approx \omega_1$ (rad)  , torga yak Wang'API tava

2) Bugreno e nengrma pinning $d(\theta) \sim \cos 2\theta$ uz - za voro, 200 churap 11 02'

Услов. б.е. $\oint \vec{M} \times \frac{\partial \vec{M}}{\partial n} + \int (\vec{M} \times \vec{H}_m) dx = 0, \delta \approx L, \hat{x} \perp \text{поверхности det.}$

12 $dV = S dz$, $-q \vec{M} \times \frac{\partial \vec{M}}{\partial n} + \int dz \vec{M} \times \vec{H}_s = 0$, $\vec{H}_s$ - поле возле поверхности S

13 в приповерхностном слое $\Delta z \approx L$. Теорема о среднем $\langle \vec{H} \rangle_{\Delta z} = \langle \vec{H} \rangle$.

The uranium dot is centered 110y gird band and Barreno H_m 0z' Mo 11z' in xz-plane.

16 N_{xx} & N_{zz} & x, y, z axes & $Oz \perp$ dot plane

$$H_m^{Oz'} = H_m^{Ox} \sin \theta_0 + H_m^{Oz} \cos \theta_0$$

N_{xx} & N_{zz} & x, y, z axes & $Oz \perp$ dot plane

$$17 \quad U_m^{0z}(\vec{q}) = \int d^3\vec{q}' g_{zz}(\vec{q}, \vec{q}') M_0^z(\vec{q}') = M_0^z \int d^3\vec{q}' g_{zz}(\vec{q}, \vec{q}') \\ d^3\vec{q}' = dq'_x dq'_y dq'_z \quad \text{u} \quad (dq'_x g_{zz}(\vec{q}, \vec{q}')) = -4\pi \left(\frac{1}{q} \right) \left(\frac{1}{q'} \right) \left(\frac{1}{q''} \right) \left(\frac{1}{q'''} \right)$$
$$\int_0^t ds' e^{-\beta s'} J_0(t-s') = \frac{1}{\beta} \int_0^t dt (1 - e^{-\beta t}) J_0(t) J_0(t-s')$$

parce que toutes equations, a JAP-2004. $N_{22}(\rho) = -J(\rho, \rho)$
 Hago $J(1, \rho) = -\frac{4\pi}{\rho} \int_0^1 dt (1 - e^{-\rho t}) J_0(t) J_1(t) = -\frac{4\pi}{\rho} J_1(\rho, \rho=1) = \left| \text{cm. } 16/\sqrt{2} \cdot 0.2 \right| =$

$$\text{В малом } H_m^{oz}/M_s \cong H_m^{oz}(q=1) \cos \theta_0 = \cos^2 \theta_0 \cdot J(1, \beta) = \cos^2 \theta_0 [-2\pi + O(\beta)]$$

$$N_{zz} = N_{xx} \sin^2 \theta_0 + N_{yy} \cos^2 \theta_0 \approx \frac{1}{2} (4\pi - N_{xx}) \sin^2 \theta_0 + N_{xx} \cos^2 \theta_0 = \left[\frac{N_{xx} \approx 25}{\text{w/ } \theta = 1} \right]$$

$$= \frac{1}{2} (u\pi - 2\pi) \sin^2 \theta_0 = \pi \sin^2 \theta_0 + 2\pi \cos^2 \theta_0$$

(28/1) γ Arantza $\vec{M}_0(\vec{q})$ - relaxed $\forall \vec{q}_0$ a $N_{xy}(\vec{q})$, $N_{yz}(\vec{q})$ many ideal $N_{ij}(\vec{q})$, γ_{ij} a span $\vec{M}_0(\vec{q}) = \text{const.}$

$H \sin(\theta_0 - \theta_H) = H_{\perp} \sin \theta_0 \cos \theta_0$, $H_{\perp} = N_2 M_s - H_a$, since $H_{\perp} = (N_{\text{eff}} - N_{\text{eff}}) M_s$
 6. a. Semana $(\omega/\gamma)^2 = [H \cos(\theta_0 - \theta_H) - H_{\perp} \cos^2 \theta_0] [H \cos(\theta_0 - \theta_H) - H_{\perp} \cos^2 \theta_0]$ para $\omega = 0$

So I Harnicame FMR - printing paper, goggles, Figs & Hair Nerves. Osteguna
Figs upman revised Fig. 2 Hres (w) u Fig. 3 Hres (O). Olyney. Fr e Dec. 4.
Nepreter D₀(O) que simul. d(O) → d(O₀): corneae o anam. ~ 30%.
Anamz e Dec. padar. mana u cagam Arfken, Kuvens, Mennob.
Nepreter Table 1 x JAP-MPD F/N/F e Dec. // Chabun subm. paper to Nature Mat.
So I Dogeian FMR - printing draft u nocuan Arentxa u Pres. "Magnonics"
Dec. caga R. 1 Typ. - Mennob X(w). Simul. d(O₀) - yqanub uen
ofnechurb max upu D₀ x 25°.

Случай θ_0 и θ_H - нелинейные, при $\theta_H \ll 1$. Если и $\theta_0 \ll 1$ ($\theta_H \rightarrow 0^\circ$)

$$H_1 = (N_{22} - N_{xx}) M_s = (4\pi - 3N_{xx}) M_s = 4\pi M_s \left(1 - 3 \frac{N_{xx}}{4\pi}\right) = 4\pi \cdot 830 \text{ G} \times \left(1 - 3 \frac{N_{xx}(0.1)}{4\pi}\right) = 8.49 \cdot 10^3 \text{ Oe} = 8.50 \text{ kOe}. \text{ Thus } (0^\circ) = 12.39 \text{ kOe},$$

~~$$V_{H_{25}}(2^\circ) = 12.20 \text{ kOe}, V_{H_{25}}(4^\circ) = 11.61 \text{ kOe}, V_{H_{25}}(6^\circ) = 10.55 \text{ kOe}, V_{H_{25}}(8^\circ) = 9.48 \text{ kOe}$$~~

θ_H Max $d(\theta_0)$ -Schmel. v/m $\theta_0 = 98,2^\circ \rightarrow \theta_H = \frac{23.1^\circ}{3.18} = 7.3^\circ$, no

for $d(\theta) \sim \sin \theta$, $\theta_{\text{max}} = 6^\circ$ (from 8°), $d(\theta) \sim \sin \theta \rightarrow \max$ w.r.t $\theta = 6^\circ$

Obayaglene Figs - FMR pinning c Gues u Arentxa

Запрос с П. "permisos de regreso". С П. 8 pye. marazun, Certificado
 List. Anamiz Rigs & FMR - pinning MS в плен \$1.5 миллиона
 (негодная) J. Enc.

Öslegung: $d(\theta_0)$  - max c. Aramtes: $d \rightarrow \max$, unge. Vozdymungeser

max max $\sin \theta$ с $k \parallel OX \parallel \vec{H}_0$. Из условия на $M(\vec{g}, t)$ приращение н/м
будет в $\Delta H(\theta_0)$ и есть max н/м для θ_0 ? Тогда $\theta = 8,10^\circ$.

4H bilgeza c. vnepruvucl' su $\omega_k \approx \omega_0 = 9.85 \text{ GHz}$. $\hbar\omega < \hbar\epsilon_{\text{thresh.}}$

force $\propto$ increase in ω & large damping $\Rightarrow$ increase.

Тогда по формуле $\Delta H(\Theta_n)$ или при $\Theta_n \approx 870^\circ$ (!). Величина $\Delta H(\Theta_n)$ и ее значение интерпретируем.

Вывод. - Оне. ее способности менее обширны: 1) не имеют таких "узлов",

2) "свободно на земле"; 3) во всем мире, ради защиты интересов 151/214

*Знаменитый «миссионер» и миссионерский переводчик; член комиссии по утверждению об издании
переводов Библии на русский язык (Синодальный список).*

2) Wskł. Jąd. na MICHAN na 95% - 500 000

(1) Уприниме записок из МИСИН на одар по "Spin Dyn." project
© Кс. Ч. Наско: Динамик. пастр. les Houches; 31.08.2019

~~1) Wagner - Tristan et Isolde; 2) Giuseppe Verdi -~~

3/11 Final paper draft to Mrs. Prantya Semana Aste 22

⑤ Oeyang, & Arantxa Hz(t) induced v. core dynamics: house "breath" model

Ekamp.

28/11

Astearia 29/10 3

Работа с дес.: разотрешам PRL 012 Phatak meron states in F/N/F dot
и анализиравам $\vec{F}_{ST}(\vec{X})$: дотер. универсуалноа во V. core и консул
но симулар во liquid v. и 2-vortex models гавот $\vec{F}_{ST} \sim \hat{z} \times \vec{X}$ однаков.

11) б) если $\delta \ll r_0$ то V. core - конус с углом α , то $\vec{F}_{ST} = 0$, а 2-модуль
модель $\vec{F}_{ST} \sim c^2$ ($c = R/r_0 \ll 1$), и полагая "0". Все это в $\vec{m} \times \frac{\partial \vec{m}}{\partial x}$ преобраз

Вопросы: почему резина от $\sin^2 \theta_{\text{max}}$ - распада $G_{\text{us}} J^P$ можно и представить (хоть в мн. приближ.) F_{ST} через тон. заряд G ?

Contract Buy from MICINN - NSF grant. // Organism - factories to Patxi.
Can. talk DIPG: Dugaer, 2D el. gas in periodic nar. none, AHE.

ST: $\vec{r}_x + i\vec{r}_y = f(z, s)$, a na $\vec{r}_x + i\vec{r}_y = \frac{zf}{1+|f|^2}$ Bijz. v. cor.
 $\vec{m}(\theta, \phi)$ geer $F^d = \alpha L P(d^2 \vec{e}^2 \cdot \vec{m}_x \frac{\partial \vec{m}}{\partial \theta}) = \alpha f d^2 \vec{e}^2 \sin^2 \theta \frac{\partial \vec{m}}{\partial \theta}$

- иначе мы \$S\$ - б-ая det.

$$I_\varphi = \int_S d^2 \vec{\xi} \frac{\partial \varphi}{\partial X_d} = \frac{\partial}{\partial X_d} \int_S d^2 \vec{\xi} \varphi(\vec{\xi}, X) \quad \text{т.е. неженем } \int_S \text{ от } X_d \text{ не зависит.}$$

$$w = \operatorname{tg} \frac{\theta}{2} e^{i\varphi} = \left\{ \begin{array}{l} \frac{1 - \cos \theta}{1 + \cos \theta} e^{i\varphi} \\ \frac{1 + \cos \theta}{1 - \cos \theta} e^{i\varphi} \end{array} \right\}, \quad \varphi = \arg(w) = \arg\left(\frac{1 - \cos \theta}{1 + \cos \theta}\right) + \arg(e^{i\varphi})$$

$$I_{\varphi} = \frac{\partial}{\partial s_1} \left(\int_S d^2 \vec{s} \operatorname{Im}(\ln f) \right) = \frac{\partial}{\partial s_1} \operatorname{Im} \left(\int_S d^2 \vec{s} \ln f(z, s) \right)$$

Rysers liquid v. model $f(z) = i \frac{\sigma}{\pi} (z-s)^{-1}$, $\ln f = \ln \frac{1}{2} (1 - \frac{s}{z}) = \left(\frac{1}{2} - \frac{s}{z} \right)$
 $= \text{const}(s) + \ln(1 + \epsilon) = \sum_{n=1}^{\infty} (-1)^{n+1} \frac{\epsilon^n}{n} = - \sum_{n=1}^{\infty} \frac{s^n}{z^n} \frac{1}{n} = - \sum_{n=1}^{\infty} \frac{1}{n} \left(\frac{s}{z} \right)^n e^{-i n \phi}$

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тогда $\int_0^{2\pi} d\varphi \ln f = - \int_0^{2\pi} d\varphi \sum_{n=1}^{\infty} \frac{1}{n} \left(\frac{S}{Q}\right)^n e^{-in\varphi} = 0$, т.к. $\int_0^{2\pi} d\varphi e^{-in\varphi} = 0$, т.к. $n \neq 0$ нет.

тогда $\left(\frac{S}{Q}\right)^n = \frac{1}{Q^n} \left(e^{i\varphi_3} - e^{i\varphi} \right)^n = \frac{1}{Q^n} e^{-in(\varphi - \varphi_3)}$, то $\int_0^{2\pi} d\varphi (\dots) = 0$ по правилу

hyper 2-vortex model $f(z) = \frac{1}{c} [iCz + \frac{a}{2} - \frac{\bar{a}}{2}z^2]$, def. $\theta = \frac{1}{c} \frac{a}{2}$ - real value
 $\ln f = \ln \left\{ \frac{1}{c} Cz \left(1 + \frac{\theta}{z} + \bar{\theta}z \right) \right\} = \ln \left(\frac{1}{c} Cz \right) + \ln \left(1 + \frac{\theta}{z} + \bar{\theta}z \right) = \left| \varepsilon = \frac{\theta}{z} + \bar{\theta}z \right| =$

$$= \arctan(x) + \ln(1+x) = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} x^n, \quad \int_0^{2\pi} \ln f = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} \int_0^{2\pi} x^n$$

Wm. H. Ekaina,
Julio, no 42nd

$F(z)$ analytic $\forall z$, κ from $\text{form } f(z) = 0$, T.E. center of the v. core. $\text{Miércoles. Astézkena}$

$f(z) = 0$ ufm $z = s - 2\pi i d v$. u $f(z) = 0$ ufm $z_1 = \frac{ia}{|a|^2} [1 - \sqrt{1 - |a|^2}]$, $|z_1| \leq 1$.

$\Phi(x, y)$ — потенциал скорости $\vec{v} = \nabla \Phi$, кроме $z = 0$,
 $\Phi(x, y)$ симметрична при $z = 0$, $f(z) \approx 0$, $\ln f(z) \rightarrow \infty$, т.к. $\Phi = \text{Im}(\ln f)$,
 $\vec{v} = \nabla \Phi(x, y)$ — совсем не обязано, что это $= 0$ где vortex $\Phi(x, y)$.

$$\vec{m} \times \frac{\partial \vec{m}}{\partial s} = m_x \frac{\partial m_y}{\partial s} - m_y \frac{\partial m_x}{\partial s}, \quad m_x + i m_y = \frac{2w}{1 + |w|^2}, \quad w = \left\{ \frac{5}{15} \right\}$$

$$\left(\frac{\partial \vec{m}}{\partial s_2} \right)_2 = \frac{2i}{(1+w\bar{w})^2} \left[w \frac{\partial \bar{w}}{\partial s_2} - \bar{w} \frac{\partial w}{\partial s_2} \right], \quad \text{no gauging } \left(\vec{m}_x \frac{\partial \vec{m}}{\partial s_2} \right)_2 = \frac{\partial \Phi}{\partial s_2} \text{ line}$$

rigid v. model:

$$= \int d^2\vec{s} \left(\vec{m} \times \frac{\partial \vec{m}}{\partial s} \right)^2 = \int d^2\vec{s} \frac{2i}{(1+|\vec{f}|^2)^2} \left[\int \frac{\partial \vec{f}}{\partial s_2} - \int \frac{\partial \vec{f}}{\partial s_1} \right]$$

$$J_c = \int_{\mathbb{R}^2} \frac{2i}{[1 + |f|^2]^2} \left[\frac{i}{c} (\bar{z} - s_x) \frac{i}{c} + \frac{i}{c} (\bar{z} - s_x) \frac{(-i)}{c} \right] \sim \frac{i^2}{c^2} [z - s_x - \bar{z} + s_x] =$$

$$[1 + 5^2]$$

$$y = y', \quad x = x' + 5, \quad |z - 5_x|^2 = x'^2 + y'^2 = 5'^2$$

$$\vec{\nabla} \times (\text{line core}) = \int d^2 \vec{\sigma} \frac{2i}{y} \left[\frac{\partial}{\partial x} \ln \frac{z}{y} \right] = \frac{\partial}{\partial x} \left(\int d^2 \vec{\sigma} \Phi(x, y, z) \right) = \frac{\partial}{\partial x} \left[\int d^2 \vec{\sigma} \Phi - \int d^2 \vec{\sigma} \Phi \right]$$

$$= \frac{1}{(\bar{z} - s_x)} - \frac{1}{(\bar{z} - s_x)} = \frac{\bar{z} - s_x - (\bar{z} - s_x)}{(\bar{z} - s_x)(\bar{z} - s_x)} = \frac{-2iy}{|\bar{z} - s_x|^2}$$

$$\int_{\text{core}} \frac{y}{|z - s_x|^2} = 0, \quad |z - s_x|^2 = (x - s_x)^2 + y^2 = s^2 + s_x^2 - 2ss_x \cos \varphi$$

Semana • Aste 23

$$J^x(\text{one core}) = \int_0^1 ds \int_0^{2\pi} d\varphi \frac{s \sin \varphi}{s^2 + S^2 - 2sS \cos \varphi} \sim \ln(a - b \cos \varphi) \Big|_0^{2\pi} = 0 \text{ (!?)}$$

Escaneado con CamScanner

$(d^2 \vec{g} / d\tau^2) = 0$ c norm. go X_1^3 no- κ /fukien mere, T.e. Bolyag Gus' JPCS '11
dot (pole-free model) To ST-force uz. za v. core + mono beryn b pole-free mod.

Escaneado con CamScanner

Если $f(z) = (z-a)^n \varphi(z)$ и $\varphi(z)$ не имеет "0" в точке a , то $\frac{f'(z)}{f(z)} = \frac{n}{z-a} + c_1 + \dots$ (допускается)

Для мероморфической функции $f(z)$ в области G справедливо: $\frac{1}{2\pi i} \oint_G \frac{f'(z)}{f(z)} dz = N - P$, где N, P — число "0" и полюсов $f(z)$ в области G (с учетом кратности).

Semana • Aste 23

$$= \frac{1}{2} \left[\frac{\pi}{s} + \int d^2 \vec{\sigma} \frac{1}{(z-s)} + \frac{1}{s^2} \int \frac{d^2 \vec{\sigma}}{(\bar{z}-1)} \right] (1-2\bar{z})$$

$$\int \frac{d^2 \vec{\sigma}}{(z-s)} = \int d\varphi \frac{(z-s)}{(z+s)^2} = \int d\varphi \frac{(s \cos \varphi - s_x - i(s \sin \varphi - s_y))}{[s^2 + s_x^2 - 2s s_x \cos \varphi - i(s s_y \sin \varphi - s s_y \cos \varphi)]} = \frac{|z-s|}{s^2 + s_x^2 - 2s s_x \cos \varphi} = \frac{1}{s^2 + s_x^2 - 2s s_x \cos \varphi}$$

$$\int \frac{d^2 \vec{\sigma}}{(z-s)} = \int \frac{d\varphi e^{-i\varphi}}{s - s_x e^{i\varphi}} = \int \frac{d\varphi e^{-i(\varphi+\varphi_s)}}{s - s_x e^{-i\varphi}} = e^{-i\varphi_s} \int \frac{d\varphi e^{-i\varphi}}{s - s_x e^{-i\varphi}} = e^{-i\varphi_s} \int \frac{d\varphi}{s - s_x e^{-i\varphi}} = e^{-i\varphi_s} \int \frac{dx}{s - s_x x} = e^{-i\varphi_s} (-1) \int \frac{d(s - s_x x)}{s - s_x x} = -\frac{1}{s_x} e^{-i\varphi_s} \ln(s - s_x x) \Big|_0^1 = 0 (?)$$

Wolfram Be.
Buzagge, C.127 (Komm. grynnyu) : cam D-equ. k/uz, n-hary

$$\frac{1}{\pi} \iint_D \frac{z^n d\bar{z} dy}{z - z} = z^{n-1} (1 - z\bar{z}), \quad z = x + iy, \quad n = 1, 2, 3, \dots, z \in D$$

$$\frac{1}{\pi} \iint_D \frac{z^n}{z - s} = s^{n-1} (1 - |s|^2), \quad \text{lyko } n=1, \quad \frac{z}{z-s} = \frac{(z-s)+s}{(z-s)} = 1 + \frac{s}{(z-s)}$$

$$\frac{1}{\pi} \left[\iint_D \frac{dx dy}{(z-s)} + s \iint_D \frac{dx dy}{(z-s)^2} \right] = 1 - |s|^2, \quad \frac{1}{\pi} \left[\pi R^2 + s \iint_D \frac{dx dy}{(z-s)} \right] = 1 - |s|^2$$

$$1 - |s|^2, \quad 1 + \frac{s}{\pi} \int \frac{d^2 \vec{\sigma}}{(z-s)} = 1 - |s|^2, \quad \int \frac{d^2 \vec{\sigma}}{(z-s)} = -\frac{|s|^2}{s} \pi = -\bar{s} \pi \quad \leftarrow \text{RVM}$$

$$I(s) = \int d^2 \vec{\sigma} \frac{\bar{z}}{(s\bar{z} - 1)}, \quad \bar{I}(s) = \int d^2 \vec{\sigma} \frac{z}{(s\bar{z} - 1)}, \quad f(z) = \frac{z}{(s\bar{z} - 1)} - \text{analit. u/m } |z| < 1,$$

r.k. nemo $z_0 = \sqrt{s} = \frac{s}{|s|^2}$ bne k/uz (det). $f(z) = u(x, y) + i v(x, y)$,
u, v - rapymyrenne k/uz $|z| < 1$.

$$f(z) = \frac{1}{2\pi} \int_0^{2\pi} d\varphi f(z + s e^{i\varphi}), \quad z = z + s e^{i\varphi}, \quad \text{u/m } |z| = R, \quad s = R$$

$$f(z) = \frac{1}{\pi R^2} \int d^2 \vec{\sigma} f(z), \quad \text{b racnom } \frac{1}{\pi R^2} \int d^2 \vec{\sigma} f(s e^{i\varphi}) = f(0), \quad \text{cam } f(z) = \frac{z}{(s\bar{z} - 1)}$$

$$\int d^2 \vec{\sigma} f(z) = \pi R^2 f(0) = \pi R^2 \cdot 0 = 0, \quad \bar{I}(s) = 0.$$

$$\int d^2 \vec{\sigma} \frac{\partial f}{\partial s} = \frac{i}{2} \int d^2 \vec{\sigma} \left[\frac{1}{(z-s)} + \frac{\bar{z}}{(s\bar{z} - 1)} \right] = \frac{i}{2} [-\bar{s} \pi \bar{I}(s)] = -\bar{s} \frac{i}{2} \pi.$$

u/moqno remno que ufid v. model $f(z) = i \frac{C}{2} (z-s), \quad \bar{f}(z) = -i \frac{C}{2} (\bar{z}-\bar{s})$

$$\frac{\partial f}{\partial s} = \frac{i}{2} \frac{\partial}{\partial s} [\ln \bar{f} - \ln f] = \frac{i}{2} \frac{\partial}{\partial s} [\ln(\bar{z}-\bar{s}) - \ln(z-s)] = -\frac{i}{2} \frac{\partial}{\partial s} \ln(z-s) =$$

$$= -\frac{i}{2} \frac{1}{(z-s)} (-1) = \frac{i}{2} \frac{1}{(z-s)}, \quad \int d^2 \vec{\sigma} \frac{\partial f}{\partial s} = \frac{i}{2} \int d^2 \vec{\sigma} \frac{1}{(z-s)} = -\frac{i}{2} \bar{s} \pi$$

$$\text{Due 2-vortex model } \int d^2 \vec{\sigma} \frac{\partial f}{\partial s} = \frac{i}{2} \int d^2 \vec{\sigma} (1 - z\bar{z})^6 \left[\frac{1}{(z-s)} + \frac{\bar{z}}{(s\bar{z} - 1)} \right]$$

$$\text{Popuzna Bopend: } \frac{1}{2\pi i} \int_D \frac{f(z) dz}{(z-z)} = \frac{1}{\pi} \iint_D \frac{\partial f}{\partial \bar{z}} \frac{d\bar{z} dy}{(z-z)} = \left\{ f(z), z \in D \right\} \quad z = x + iy$$

cam $\frac{\partial f}{\partial \bar{z}} = 0$, r.e. $f(z)$ - analytic, no naryzu. op. komu. $\int_D \frac{d\bar{z}}{(z-z)} = 2\pi i, \quad \int_D \frac{d\bar{z}}{(z-z)} (z \in D)$

$$\Phi(z) = \int_D \frac{\mu(t) dt}{(t-z)} \quad \text{u/m } z = t_0 \text{ remno na kontype } \Gamma = \partial D.$$

$$\text{P-m avaykoro-nemane: } \lim_{z \rightarrow t_0, z \in D} \Phi(z) = \Phi_+(t_0) = \int_D \frac{\mu(t) dt}{(t-t_0)} + \pi i \mu(t_0)$$

$$\lim_{z \rightarrow t_0, z \notin D} \Phi(z) = \int_D \frac{\mu(t) dt}{(t-t_0)} - \pi i \mu(t_0). \quad \Phi_+(t_0) - \Phi_-(t_0) = 2\pi i \mu(t_0) - \text{cheron } \Phi(z)$$

Asteazkena • Miércoles

Сам $D = \pi R_c^2$, R_c - radius core,

$$\frac{\partial \mathcal{P}_{rv}}{\partial s} = \frac{i}{2} \frac{1}{(z-s)} \quad F_{sr}^{(-)}(\omega) = a \int_{(core)} d^2 \vec{q} \sin^2 \theta \frac{\partial \mathcal{P}_{rv}}{\partial s} = \frac{i}{2} \int_{(core)} d^2 \vec{q} \frac{4|s|^2}{(1+|s|^2)^2} \frac{1}{(z-s)} =$$

$$= \frac{i}{2} a 4 \int_{(core)} d^2 \vec{q} \frac{\frac{1}{2} |z-s|^2}{\left[1 + \frac{1}{z^2} |z-s|^2\right]^2} \frac{1}{(z-s)} = \left| z-s = z' \right| = \frac{2ia}{c^2} \int_{(core)} d^2 \vec{q} \frac{|z'|^2}{\left[1 + \frac{|z'|^2}{z'^2}\right]^2} \frac{1}{|z'|^2}$$

$$|z'| = g' \quad \bar{z}' = g' (\cos \varphi' + i \sin \varphi') \quad \int d\varphi' \bar{z}' = g' \int d\varphi' e^{-i\varphi'} = 0$$

$$F_{ST}(\text{core}) = 0 \quad \text{rigid v. model} \quad F_{ST}(\text{blue core}) \sim \int d^2\vec{s} \frac{\partial \Phi}{\partial \vec{s}} = 0$$

→ T. e. rigid v. model u/puogurk $\vec{F}_{ST} = 0$. (One core)
 Page: c Dec. 0 ub. u nex

B) wie zuvor 9/III $\int d\vec{s} \frac{\partial \Phi}{\partial s} = -i\pi \frac{s}{2}$. Kann man $\int d\vec{s} \frac{\partial \Phi}{\partial s}$?

$$\oint_{(core)} dz \vec{g} \frac{\partial \varphi}{\partial s} = \frac{i}{2} \oint_{(core)} dz \vec{g} \left[\frac{1}{(z-s)} + \frac{\bar{z}}{(s\bar{z}-1)} \right]$$


 - v. core - некрывовая область
 где $s = z$, где $f(z) = 0$

$$15 \quad \oint_{\text{Circ}} \frac{1}{(z-s)} = \int_0^{2\pi} \frac{1}{z-s} dz = (s \in D) = -\pi i$$

$I_c(s) = \frac{1}{s} \left(\frac{d \log}{d \log} \right) \frac{z}{(z - 1/s)}$, т.ч. в окрестности не нулевых, т.к. область
в core не к/м. По $f(z) = \frac{z}{(z - 1/s)}$ аналитична.

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$$-f(z) = \frac{1}{2\pi i} \int_{\gamma} \frac{\overline{z\bar{z}} + \varphi(z)}{\bar{z}-z} dz - |z|^2 - \varphi(z) = \frac{1}{2\pi i} \int_{\gamma} \frac{\overline{z\bar{z}}}{\bar{z}-z} dz - |z|^2$$

$$u = \frac{1}{2\pi} \oint_D \frac{dz}{z - z_0} = \left| z_0 = \frac{1}{5} \right| = \frac{1}{2\pi i} \oint \frac{|z|^2}{z - z_0} dz = |z_0|^2, \quad z_0 = \frac{1}{5} \text{ - bne } \text{ (2)}$$

$$19 \frac{z}{(sz-1)} = \frac{1}{s} \frac{z - \frac{1}{s} + \frac{1}{s}}{(z - \frac{1}{s})} = \frac{1}{s} \left[1 + \frac{1}{s} \frac{1}{(z - \frac{1}{s})} \right] \rightarrow \frac{1}{2\pi i} \oint \frac{dz}{z} \frac{1}{z - \frac{1}{s}} = \left| \frac{\partial f}{\partial z} = 1, f = \frac{1}{z} \right|$$

$$= \frac{1}{2\pi i} \int_{\partial D} \frac{\bar{z}}{z-z_0} dz, \quad \frac{1}{\pi} \int_D dx dy \frac{1}{z-z_0} = \frac{1}{2\pi i} \int_{\partial D} \frac{\bar{z}}{z-z_0} dz$$

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 $\Rightarrow z_0 = 1/\sqrt{5}$ ne w fungen. $D(v. \text{core}) \Rightarrow \frac{1}{\pi} \int dx dy \frac{1}{(z-z_0)} = \frac{1}{2-\pi i} \int dz \frac{\bar{z}}{(z-z_0)} -$

то мы можем выразить из ф. Гурона

$$\int_{\gamma} dx dy \frac{\partial f}{\partial \bar{z}} = \frac{1}{2i} \oint_{\gamma} dz f(z), \quad f(z) = \frac{\bar{z}}{(z-z_0)}$$

$$z-s = z', \quad \frac{1}{c^2} |z'|^2 |1 - \bar{s} z' - s \bar{s}|^2 = (1 + |s|^2)^2 - \text{normu k } \mathbb{H}^2 \quad |z'|^2 = (1 + |s|^2)^2 c^2$$

24 Aste • Semana

$$R = c \sqrt{1 + |z|^2}$$

$$\oint_D \frac{dz}{z - z_0} = \pi (R^2 - |z_0|^2)$$

Escaneado con CamScanner

$$u_2 = \frac{\partial}{\partial z} \cos^2 \theta \frac{(1-z\bar{z})}{(z\bar{z}-1)} = \frac{i}{(z\bar{z}-1)} \left[-2 \cos \theta \sin \theta \frac{\partial \theta}{\partial z} (1-z\bar{z}) + \cos^2 \theta (-\bar{z}) \right]_{z=s} =$$

15 $I_c(s) = \int_{\text{core}} d^2 \vec{\rho} F_z|_{z=s} = \int_{\text{core}} d^2 \vec{\rho} \frac{1}{(2i)} \frac{\bar{S}}{(1-|S|^2)} = \frac{1}{2} \frac{\int_{\text{core}} d^2 \vec{\rho} \frac{S}{(1-|S|^2)}}{A_c(s)}$
 $F_{ST} = -a \int d^2 \vec{\rho} \cos^2 \theta \frac{\partial \varphi}{\partial s} = -a I_c(s) = -\frac{i}{2} a \frac{\bar{S}}{(1-|S|^2)} A_c(s)$

Fluxo: 750 W $F_{ST}^-(s) \sim c^2$, logo $c = R_c/R \ll 1$. Torção $F_{ST}^- = -aL\sqrt{2}$ (pelo 2º eq)
 $F_{ST}^- = \frac{1}{\sqrt{2}} (F_{ST}^x - iF_{ST}^y) = \frac{1}{2} i a \pi c^2 \frac{(1+s^2)^2}{(1-s^2)} L\sqrt{2} = (\dots) i (s_x - i s_y) \sqrt{2} = (\dots) (s_y + i s_x)$
 $F_{ST}^x = 2(\dots) s_y$, $F_{ST}^y = -2(\dots) s_x$, $(\dots) = \frac{1}{2} a \pi c^2 \frac{(1+s^2)^2}{(1-s^2)} L$
 $\vec{F}_{ST} = -a \pi c^2 L \frac{(1+s^2)^2}{(1-s^2)} (\hat{z} \times \vec{s})$, B Gus-IPCM 11 logo $\vec{F}_{ST} = \pi a L (\hat{z} \times \vec{X})$

12/III Обсужд. с Окс. Ч. вычисление $\vec{F}_{ST}$. посылка в запрос на выр. $\int_{\gamma} \frac{f(z)}{(z-s)}$
 посылка Окс. вычисление посылка в Core A(s).
 Обсужд. с Julian контракта, office и мульт. "que Virginia (arrives today)
 Находим ном. $\frac{1}{z}$ в разложении $\vec{F}_{ST}$ от 10/III. $f(z) = -i \frac{1}{z} \frac{1}{(z-s)(z-\frac{1}{s})}$

$\frac{\partial \Phi}{\partial s_x} = m_0(s) \sin \varphi$, $\frac{\partial \Phi}{\partial s_y} = -m_0(s) \cos \varphi$ и $\frac{\partial \Phi}{\partial s^2} = m_0(s) [\hat{x} \sin \varphi - \hat{y} \cos \varphi]$ -
иногда также $\frac{\partial \Phi}{\partial s}$ используется в литературе $\xrightarrow{\text{FST}}$ от Nov. 2009 - также
разноимение $\frac{\partial \Phi}{\partial s}$ плохо; т.к. это разноимение по $\frac{s}{24}$ или $s > |s|$, т.е. one core.

A_{FST} on hedgehog state vanishes by vortex core. $m_z(\vec{r}, s) = m_z^0(\vec{r}) + g(\vec{r})(\vec{S} \cdot \vec{r})$
 произвед. $g(\vec{r})m_0(\vec{r}) \sim 1/r^2$ и интегрируем $\vec{r} = \int_0^{\infty} ds m_z^0 g(\vec{r}) m_0(\vec{r})$ и $g_{FST} \sim 1$
 Сама $g(\vec{r})$ была получена из $m_z(\vec{r}, s)$ разном. по s - $\sim 1/s^2$. т.е. две core.

Larunbata • Sábado
 Oke, brumabata mui, zabucumob m.v. core A(s)
 pases upu $S \approx 0.5 - 0.7$ u eob monobono pasesane F(s), 

→ Визит - оаисотр 2-х домов "Illare" (или "Ilare") мн. нм. ~150 м², дом площадью ~300
торфяной дом 930 т.€, визит. дом - 860 т.€ (оаив горного, и двенадцать цен).
расположен. Вою - Idara, идара от моря.
примекала Vigaina: Беаегг а неи и Julian of office, рас. времени, кемингс,
имме etc. (нона - в hostel, с 1 мая в 15 March - 30 April)

(13/III) Noastră Virginia a Arantxe. Băsega a Virginia o research : noua m. a ei că
 vrea să facă un grup de m. a ei F-3. Băsega a Virginia o research : noua m. a ei că
 vrea să facă un grup de m. a ei F-3. Băsega a Virginia o research : noua m. a ei că

1) nozrac. inv. talk u 2 posters (magnon. M. u F/MF-MPD) b. chandry
 2) nozrac. Abstracts JEMS - go 30/III
 3) nozrac. inv. talk u 2 posters (magnon. M. u F/MF-MPD) b. chandry
 4) nozrac. Abstracts JEMS - go 30/III
 5) nozrac. v. notes in dot chain c. acc.
 6) File to de laubens.

18

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 6) File to de laubens.

APEX 11: $\cos \theta = \frac{1}{2} \left(\frac{w_1 + w_2}{w_0} \right)$ $(w_1, 2)^2 = w_0 (1 \pm a)(1 \pm p\beta)$
 $p = p_1 p_2$, $a, \beta = \frac{\delta M_S C_1 C_2}{4\pi \beta w_0} \frac{I_x, y}{I_x}$, $I_y < 0 \Rightarrow |I_y|/I_x \approx 2.3$
 $w_1^2 w_2^2 = (1+a)(1+p\beta)(1-a^2) \beta w_0 \times (1-p\beta) = (1-a^2)(1-\beta^2)$
 $[w_1 - w_2]^2 = w_1^2 + w_2^2 - 2w_1 w_2 = 2 + 2pab$
 $= 2 \left[1 + pab - (1 - \frac{a^2}{2})(1 - \frac{\beta^2}{2}) \right] = 2 \left[1 + pab - (1 - \frac{a^2}{2} - \frac{\beta^2}{2} + \frac{a^2 \beta^2}{2}) \right]$
 $= (a + \beta p)^2 + O(a^4)$, assuming $|w_1 - w_2| = |a + \beta p| [1 + O(a^2)]$ - splitting norm. go. go.

$w_1^2 - w_2^2 = 2(a + \beta p)$ same as eq. w_0
 $\rightarrow |w_1^p - w_2^p| = w_0 \frac{\delta M_S}{4\pi \beta w_0} |I_x + p I_y| = \frac{\delta M_S}{4\pi \beta} |I_x + p I_y|$, $I_{x,y} \sim 0.01 - 0.1$
 $I_y = -|I_y|$, assuming $|w_1^p - w_2^p|$ become same $p = -1$, then same $p = +1$.
 Correct APEX, Eq. (7) & Fig. 3, 4 in the Multipole MS. $|a w| = |a + \beta p| + O(a^3)$

$|I_x + p I_y| = |I_y + p I_x| = |-|I_y| + p I_x| = ||I_y| - p I_x| = |I_y| - p I_x$
 $+ \dots |I_y|/I_x \gg 2$. Freq. splitting of v. dot pair $(w_1^p - w_2^p) = \frac{\delta M_S}{4\pi \beta} [|I_y| - p I_x]$
 $(w_1^p)^2 - (w_2^p)^2 = 2(a + \beta p) = 2(a - p\beta) = -2p[|a| - p|a|] = -\text{sign}(p) \cdot |\dots|$
 t.e. when $p = +1$, $w_1^p < w_2^p$, a when $p = -1$, $w_1^p > w_2^p$

// hypothesis eq. give multipole decomposition of $W_{int}(1,2)$ dots.

$\rightarrow W_{int} = \sum_{\ell \ell' m m'} T_{\ell m \ell' m'} Q_{\ell}^m Q_{\ell'}^{m'}$, $Q_{\ell}^m = \int d^3 r \rho(\vec{r}) R_{\ell}^m(\vec{r})$ - def. Q_{ℓ}^m
 $R_{\ell}^m(\vec{r}) = \sqrt{\frac{4\pi}{2\ell+1}} r^{\ell} Y_{\ell}^m(\hat{r})$ - regular solid harmonics

$T_{\ell m \ell' m'} = (-1)^{\ell} \sqrt{\frac{(2\ell+2\ell'+1)!}{(2\ell)!(2\ell')!}} \begin{pmatrix} \ell & \ell' & \ell+\ell' \\ m & m' & -(m+m') \end{pmatrix} I_{\ell+\ell', -(m+m')}(\vec{R})$

- see also P.L.A. Popelier et al. J. Chem. Ph. 114 6539 (2001) definition.

Irregular harmonics $I_{\ell}^m(\vec{R}) = \sqrt{\frac{4\pi}{(2\ell+1)}} \frac{1}{R^{\ell+1}} Y_{\ell}^m(\theta, \phi)$, Y_{ℓ}^m reg. comp. Y_{ℓ}^m

$\begin{pmatrix} \ell & \ell' & \ell+\ell' \\ m & m' & -(m+m') \end{pmatrix}$ - 3j - Wigner symbol & irreducible Varskalarich.

$\begin{pmatrix} \ell & \ell' & \ell+\ell' \\ m & m' & -(m+m') \end{pmatrix} = \frac{(-1)^{\ell-\ell'+m+m'}}{\sqrt{2\ell+2\ell'+1}} \begin{pmatrix} \ell+\ell' & m+m' \\ \ell m & \ell' m' \end{pmatrix}$ - Kozp. Kuescha-Г.

$\vec{r}_1 = \vec{r} - \vec{r}'$ - tensorial coordinate: $\langle \ell \ell' \ell+\ell', m+m' | \ell m \ell' m' \rangle = C_{\ell m \ell' m'}^{\ell+\ell', m+m'}$

$r_1^{\ell} Y_{\ell m}(\hat{r}_1) = \sqrt{4\pi(2\ell+1)!} \sum_{\ell' \ell''} (-1)^{\ell'} \frac{r^{\ell+\ell'}}{\sqrt{(2\ell+1)!(2\ell'+1)!}} [\vec{Y}_{\ell} \otimes \vec{Y}_{\ell'}]_{\ell m} =$

$= \sqrt{4\pi(2\ell+1)!} \sum_{\ell' \ell'' m' m''} (-1)^{\ell'} \frac{r^{\ell+\ell'}}{\sqrt{(2\ell+1)!(2\ell'+1)!}} C_{\ell m \ell' m'}^{L M} Y_{\ell}^m(\hat{r}) Y_{\ell'}^{m'}(\hat{r}')$, $L = \ell + \ell'$, $M = m + m'$

$\left(C_{\ell m \ell' m'}^{L M} \right)^2 = \frac{(2\ell_1)!(2\ell_2)!}{(2\ell_1+2\ell_2)!} \begin{pmatrix} \ell+\ell'+m+m' \\ \ell+m \end{pmatrix} \begin{pmatrix} \ell+\ell'-m-m' \\ \ell-m \end{pmatrix}$, $\begin{pmatrix} h \\ k \end{pmatrix} = \frac{h!}{k!(h-k)!}$

$T_{\ell m \ell' m'} = (-1)^{\ell} \sqrt{\frac{(2\ell+2\ell'+1)!}{(2\ell)!(2\ell')!}} \frac{(-1)^{\ell-\ell'+m+m'}}{\sqrt{2\ell+2\ell'+1}} \frac{\sqrt{(2\ell)!} \sqrt{(2\ell')!}}{\sqrt{(2\ell+2\ell')!}} \begin{pmatrix} \ell & \ell' & \ell+\ell' \\ m & m' & -(m+m') \end{pmatrix}^2 I_{\ell+\ell', -(m+m')}(\vec{R})$
 $= (-1)^{\ell'+m+m'} \begin{pmatrix} \ell+\ell'+m+m' \\ \ell+m \end{pmatrix}^{\frac{1}{2}} \begin{pmatrix} \ell+\ell'-m-m' \\ \ell-m \end{pmatrix}^{\frac{1}{2}} I_{\ell+\ell', -(m+m')}(\vec{R})$

$T_{\ell \ell' m m'} = (-1)^{\ell'+m+m'} \begin{pmatrix} \ell+\ell'+m+m' \\ \ell+m \end{pmatrix}^{\frac{1}{2}} \begin{pmatrix} \ell+\ell'-m-m' \\ \ell-m \end{pmatrix}^{\frac{1}{2}} I_{\ell+\ell', -(m+m')}(\vec{R})$

- Gbunagbe & Bugum & Eq. (3) w3 Multipole paper. Ok.

$$\frac{1}{|\vec{r}-\vec{r}'|} = \frac{1}{R} \sum_{\ell m} \frac{(2\ell+1)}{(2\ell+1)} \left(\frac{r'}{R}\right)^\ell Y_\ell^{m*}(\theta_r, \varphi_r) Y_\ell^m(\hat{r}_i) = \sum_{\ell m} I_\ell^{m*}(\hat{R}) R_\ell^m(\hat{r}_i)$$

$$Y_\ell^{m*}(\vec{r}) Y_\ell^m(\vec{r}') = (-1)^m Y_\ell^{-m}(\vec{r}) Y_\ell^m(\vec{r}') = \sum_m (-1)^m Y_\ell^{-m}(\vec{r}) Y_\ell^m(\vec{r}') = \sum_m Y_\ell^m(\vec{r}) (-1)^m Y_\ell^{-m}(\vec{r}') = \sum_m Y_\ell^m(\vec{r}) (-1)^m Y_\ell^{-m}(\vec{r}')$$

Wikipedia eqs. u neprejemna Multipole paper.
 Brumman abno $Q_\ell^m = \int d^3\vec{r} \text{div} \vec{m}(\vec{r}) R_\ell^m(\vec{r})$, $R_\ell^m(\vec{r}) = \sqrt{\frac{4\pi}{(2\ell+1)}} r^\ell Y_\ell^m(\hat{r})$

6 pole-free model $\text{div} \vec{m} = 2\pi (S_x \sin \varphi - S_y \cos \varphi) = -(\vec{a} \cdot \vec{g})$. auz $f(z)$.

$$z^2 = s^2 + z^2, \int d\varphi \text{ gaer } m = \pm 1 \text{ nomus.}$$

$$f(z) = \int_0^\beta ds \int_{-1}^1 dz (s^2 + z^2)^{\ell/2} P_\ell^{\pm 1} \left(\frac{z}{\sqrt{s^2 + z^2}} \right), \int dz \text{ no } (0, \beta) \text{ um } (-\frac{\beta}{2}, \frac{\beta}{2})$$

$$\cos \theta = \frac{z}{r} = \frac{z}{\sqrt{s^2 + z^2}}, \sin \theta = \frac{s}{\sqrt{s^2 + z^2}}$$

$$d\theta = \frac{z}{s}, -\frac{d\theta}{\sin^2 \theta} = \frac{1}{s} dz, dz = -\frac{s}{\sin^2 \theta} d\theta, s^2 + z^2 = s^2 (1 + \tan^2 \theta) = \frac{s^2}{\sin^2 \theta}$$

$$P_\ell^m(\cos \theta) = (-1)^m (\sin \theta)^m \frac{d^m}{d(\cos \theta)^m} P_\ell(\cos \theta), P_\ell^1(\cos \theta) = -\sin \theta \frac{d}{dx} P_\ell(x)$$

$$R_\ell^{\pm 1}, Y_\ell^{\pm 1}(\theta, \varphi) = \mp \frac{e^{\pm i\varphi}}{\sin \theta} \sqrt{\frac{\ell(\ell+1)}{4\pi(2\ell+1)}} [P_{\ell-1}(\cos \theta) - P_{\ell+1}(\cos \theta)]$$

$$P_\ell^{\pm 1}(\cos \theta) \sim \mp \frac{1}{\sin \theta} [P_{\ell-1}(\cos \theta) - P_{\ell+1}(\cos \theta)]$$

$$d(\cos \theta) = -\sin \theta d\theta, d\theta = -\frac{d(\cos \theta)}{\sin \theta}, \int \frac{d(\cos \theta)}{\sin^{\ell+2} \theta} \frac{1}{\sin \theta} P_n(\cos \theta) =$$

$$= \int \frac{dx}{(1-x^2)^{\frac{\ell}{2}+2}} P_n(x) - \text{au. tp. Pbm. - ne name. } \cos \theta \in (0, \frac{\beta}{\sqrt{s^2 + \beta^2}})$$

$$P_\ell^1(z) = P_{\ell-2}^1(z) + (2\ell-1)(z^2-1)^{1/2} P_{\ell-1}^0(z) - \text{tp. Pbm.}$$

$$\rightarrow P_\ell^1(x) = P_{\ell-2}^1(x) - (2\ell-1)\sqrt{1-x^2} P_{\ell-1}^0(x), x\text{-real}, x \in [-1, 1]$$

$$\ell(\ell+1) P_{\ell+1}^1(x) = \ell(\ell+1) P_{\ell-1}^1(x) + (2\ell+1)\sqrt{1-x^2} P_\ell^0(x), \ell \rightarrow \ell$$

$$P_\ell^1(x) = \frac{\ell(\ell+1)}{(2\ell+1)} \frac{1}{\sqrt{1-x^2}} [P_{\ell+1}^0(x) - P_{\ell-1}^0(x)], x = \cos \theta$$

$$P_\ell^1(x) = \frac{\ell(\ell+1)}{\sqrt{1-x^2}} [P_{\ell+1}^0(x) - x P_\ell^0(x)] = \frac{\ell}{\sqrt{1-x^2}} [x P_\ell^0(x) - P_{\ell-1}^0(x)]$$

$$P_\ell^m(x) = (-1)^m (1-x^2)^{m/2} \frac{d^m}{dx^m} P_\ell(x)$$

$$\int \frac{1}{\sin^2 \theta} \frac{1}{\sin^\ell \theta} P_\ell^1(\cos \theta) = \frac{\ell(\ell+1)}{(2\ell+1)} \int \frac{1}{\sin^{\ell+2} \theta} \frac{1}{\sin \theta} [P_{\ell+1}^0(x) - P_{\ell-1}^0(x)] = 171/194$$

$$= \frac{\ell(\ell+1)}{(2\ell+1)} \int \frac{d(\cos \theta)}{\sin^{\ell+4} \theta} [P_{\ell+1}^0 - P_{\ell-1}^0] = -\frac{\ell(\ell+1)}{(2\ell+1)} \int_a^b \frac{dx}{(1-x^2)^{\frac{\ell}{2}+2}} [P_{\ell+1}^0(x) - P_{\ell-1}^0(x)]$$

$$a, b) = (0, \frac{\beta}{\sqrt{s^2 + \beta^2}}) \text{ um cum. } (-\frac{\beta}{2\sqrt{s^2 + \beta^2}}, +\frac{\beta}{2\sqrt{s^2 + \beta^2}}), \text{ B cunrae } \int_{-\beta/2}^{\beta/2} dx \neq 0$$

to work erum $P_{\ell+1} - P_{\ell-1}$ - same no x, $P_{\ell+1}(x) - P_{\ell-1}(x)$ - no x, $(\ell+1)$ - res. usual - here.
 t.e. Bqer $\int dz(\dots)$ Bqer $\times Q_\ell^m = 0$ wum $\ell = \text{res. Quadrup. } Q_2^m = 0$ B umm. wum. no "S".

$$\lambda = 1, P_1(x) = \frac{1}{\sqrt{1-x^2}} [x P_0(x) - P_0] = \frac{1}{\sqrt{1-x^2}} [x^2 - 1] = -\sqrt{1-x^2} = -\sin\theta$$

$$l=3, P_3(x) = -\frac{3}{2} (1-x^2)^{1/2} (5x^2-1) = -\frac{3}{2} \sin\theta (5\cos^2\theta - 1)$$

$$l=5, P_5(x) = P_3(x) - 9\sqrt{1-x^2} P_4(x) = -\frac{3}{2} \sin\theta (5\cos^2\theta - 1) - 9\sin\theta \left[\frac{4}{3} (5x^2-1) + 35x^4 - 30x^2 + 3 \right]$$

$$Ostegun, 9.5 \text{ ves } (21x^4 - 14x^2 + 1)_{\sin\theta} = -\frac{15}{8} (21x^4 - 14x^2 + 1)_{\sin\theta} = P_5^1(x)$$

2007	J	F	M	M	J	V	S	D
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31					

$$l=7, P_7^1(x) = P_5^1(x) - 13\sqrt{1-x^2} P_6(x) = -\frac{15}{8} \sin\theta (21x^4 - 14x^2 + 1) - 13 \sin\theta \frac{1}{48} (63 \cdot 11x^6 - 35 \cdot 27x^4 + 9 \cdot 35x^2 - 15)$$

$$= -\frac{1}{48} \sin\theta [90(21x^4 - 14x^2 + 1) + 13(63 \cdot 11x^6 - 35 \cdot 27x^4 + 9 \cdot 35x^2 - 15)]$$

$$= -\frac{1}{48} \sin\theta [13 \cdot 63 \cdot 11x^6 - 27 \cdot 385x^4 + 5 \cdot 7 \cdot 9 \cdot 9x^2 + 90 - 13 \cdot 15]$$

$$= -\frac{21}{48} \sin\theta [13 \cdot 33x^6 - 9 \cdot 55x^4 + 9 \cdot 15x^2 - 5] = P_7^1(x)$$

$$J_1(\beta) = \int_0^1 dg \int_{-g/2}^{g/2} dz (g^2 + z^2)^{1/2} (-1) \frac{g}{\sqrt{z^2 + g^2}} = (-1) \int_0^1 dg g^2 \int_{-g/2}^{g/2} dz = -\beta \cdot \frac{1}{3}$$

$$J_3(\beta) = \int_0^1 dg \int_{-g/2}^{g/2} dz (g^2 + z^2)^{3/2} (-\frac{3}{2}) \frac{g}{\sqrt{z^2 + g^2}} (5 \frac{z^2}{z^2 + g^2} - 1) = -\frac{3}{2} \int_0^1 dg g^2 \int_{-g/2}^{g/2} dz [5z^2 - (z^2 + g^2)]$$

$$= -\frac{3}{2} \int_0^1 dg g^2 \int_{-g/2}^{g/2} dz [4z^2 - g^2] = +\frac{3}{2} \int_0^1 dg g^4 \beta = +\frac{3}{10} \beta$$

$$J_5(\beta) = \int_0^1 dg \int_{-g/2}^{g/2} dz (g^2 + z^2)^{5/2} (-\frac{15}{8}) \frac{g}{\sqrt{z^2 + g^2}} (21x^4 - 14x^2 + 1) \Big|_{x=z/\sqrt{g^2+z^2}}$$

$$= -\frac{15}{8} \int_0^1 dg g^2 \int_{-g/2}^{g/2} dz (g^2 + z^2)^2 [21 \frac{z^4}{(g^2 + z^2)^2} - 14 \frac{z^2}{(g^2 + z^2)} + 1] = \int_0^1 dg g^2 \int_{-g/2}^{g/2} dz [21z^4 - 14z^2(g^2 + z^2) + (g^2 + z^2)^3]$$

$$= -\frac{15}{8} \int_0^1 dg g^2 \int_{-g/2}^{g/2} dz g^4 = -\frac{15}{8} \beta \int_0^1 dg g^6 = -\frac{15}{8 \cdot 7} \beta$$

$$J_7(\beta) = \frac{\beta}{9} \cdot \frac{21 \cdot 5}{48}$$

$$J_l(\beta) = \beta \int_0^1 dg g^{l+1} P_l^1(x=0) = \frac{\beta}{(l+2)} P_l^1(x=0), \quad l = \text{even}$$

$$P_l^1(x=0) = -l P_{l-1}(0) = -l (-\frac{1}{2}) \frac{\sin(l-1)\pi/2}{\pi^{3/2}} \Gamma(\frac{l}{2}) \Gamma(-\frac{l-1}{2})$$

$$P_2(0) = -\frac{1}{2}, P_4(0) = \frac{1 \cdot 3}{2 \cdot 4}, P_6(0) = -\frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6}, P_{2n}(0) = (-1)^n \frac{(2n-1)!!}{(2n)!!}$$

$$P_l^1(0) = -l P_{l-1}(0) = -l (-1)^{(l-1)/2} \frac{(l-1)!!}{(l-1)!!} = -(-1)^{1/2(l-1)} \frac{(l-2)!!}{(l-1)!!}, \quad l \geq 3$$

$$J_l(\beta) = -l \frac{(-1)^{(l-1)/2} (l-2)!!}{(l+2) (l-1)!!} \beta$$

$$Q_l^m = \int d^3r 2\pi i \frac{1}{2} (se^{-i\varphi} - \bar{s}e^{i\varphi}) \sqrt{\frac{4\pi}{2l+1}} r^l e^{im\varphi} \sqrt{\frac{2l+1}{4\pi}} \sqrt{\frac{(l-m)!}{(l+m)!}} P_l^m(\cos\theta)$$

$$= i\pi \sqrt{\frac{(l-m)!}{(l+m)!}} \int_0^{2\pi} d\varphi (se^{-i\varphi} - \bar{s}e^{i\varphi}) e^{im\varphi} \int dg \int dz (g^2 + z^2)^{l/2} P_l^m(\cos\theta)$$

$$= 2\pi i \sqrt{\frac{(l-m)!}{(l+m)!}} (s\delta_{m1} - \bar{s}\delta_{m,-1}) \int dg \int dz (g^2 + z^2)^{l/2} P_l^m(\cos\theta)$$

$$Q_l^{-m} = (-1)^m Q_l^{m*}, \quad Y_l^{m*} = (-1)^m Y_l^{-m}, \quad \text{Docarados } Q_l^1, \text{ Zume } P_l^1 \text{ uger } b^2$$

$$Q_l^1 = 2\pi i \cos \sqrt{\frac{(l-1)!}{(l+1)!}} \int dg \int dz (g^2 + z^2)^{l/2} P_l^1(z/\sqrt{z^2 + g^2}) = 2\pi i \cos \frac{1}{\sqrt{l(l+1)}} J_l(\beta)$$

$$Q_l^1 = i\cos \frac{2\pi}{\sqrt{l(l+1)}} (-1)^{(l+1)/2} \frac{(l-2)!!}{(l-1)!!} \frac{\beta l}{(l+2)}, \quad l \geq 3, \quad Q_1^1 = 2\pi i \cos \frac{1}{\sqrt{2}} (-\frac{1}{3}) \beta = -\frac{\sqrt{2}\pi l \beta}{3}$$

$$Q_1^1 = i\cos \frac{2\pi}{2\sqrt{3}} (-1)^2 \frac{1}{2} \frac{\beta}{5} = i\cos \frac{\pi \cdot 3 \beta}{10\sqrt{3}}, \quad l \text{ cuere } Q_{10}^1, \quad \frac{\sqrt{3}}{10} (?), \quad \frac{3}{10\sqrt{3}} = \frac{\sqrt{3}}{10}$$

$$Q'_5 = iCs \frac{2\pi}{\sqrt{5.6}} (-1) \frac{3}{2.4} \frac{\beta}{7} = -\frac{3}{4\sqrt{5.2.3.7}} \pi i Cs \beta = -\frac{1}{28} \sqrt{\frac{3}{10}} \pi i Cs \beta$$

$$P_n(x) = \frac{(-1)^n n!}{2^n n!} {}_2F_1 \left(\begin{matrix} -n \\ -n \end{matrix} ; \begin{matrix} 1 \\ 1 \end{matrix} ; -x \right) = \frac{(-1)^n n!}{2^n n!} \sum_{k=0}^n \frac{(-n)_k}{k!} \frac{x^k}{k!}$$

$$P_n(x) = \frac{(-1)^n n!}{2^n n!} \sum_{k=0}^n \frac{(-n)_k}{k!} \frac{x^k}{k!} = \frac{(-1)^n n!}{2^n n!} \sum_{k=0}^n \frac{(-n)_k}{k!} \frac{x^k}{k!}$$

$$P'_n(x) = \frac{(-1)^{n-1} n!}{2^{n-1} (n-1)!} \sum_{k=0}^{n-1} \frac{(-n+1)_k}{k!} \frac{x^k}{k!} = \frac{(-1)^{n-1} n!}{2^{n-1} (n-1)!} \sum_{k=0}^{n-1} \frac{(-n+1)_k}{k!} \frac{x^k}{k!}$$

$$P'_n(0) = \frac{(-1)^{n-1} n!}{2^{n-1} (n-1)!} \sum_{k=0}^{n-1} \frac{(-n+1)_k}{k!} \frac{0^k}{k!} = \frac{(-1)^{n-1} n!}{2^{n-1} (n-1)!} \sum_{k=0}^{n-1} \frac{(-n+1)_k}{k!} \frac{0^k}{k!}$$

$$P'_n(0) = \frac{(-1)^{n-1} n!}{2^{n-1} (n-1)!} \sum_{k=0}^{n-1} \frac{(-n+1)_k}{k!} \frac{0^k}{k!} = \frac{(-1)^{n-1} n!}{2^{n-1} (n-1)!} \sum_{k=0}^{n-1} \frac{(-n+1)_k}{k!} \frac{0^k}{k!}$$

$$P'_n(0) = \frac{(-1)^{n-1} n!}{2^{n-1} (n-1)!} \sum_{k=0}^{n-1} \frac{(-n+1)_k}{k!} \frac{0^k}{k!} = \frac{(-1)^{n-1} n!}{2^{n-1} (n-1)!} \sum_{k=0}^{n-1} \frac{(-n+1)_k}{k!} \frac{0^k}{k!}$$

$$Q'_3 = iCs \pi \beta \frac{\sqrt{3}}{10} \text{ cobn. } Q'_5 = -\frac{5}{28} \sqrt{\frac{3}{10}} \pi i Cs \beta$$

$$Q'_7 = iCs \frac{2\pi}{\sqrt{7.8}} \frac{3.5}{2.4.6} \frac{\beta}{9} = (iCs \pi \beta) \frac{1}{\sqrt{7.8}} \frac{5.7}{3.4.6} = (iCs \pi \beta) \frac{5\sqrt{7}}{2\sqrt{2.3.4.6}} = (iCs \pi \beta) \frac{\sqrt{7}}{\sqrt{2}} \frac{5}{144}$$

$$Q'_5 = iCs \frac{2\pi}{\sqrt{5.6}} \frac{3}{2.4} \frac{\beta}{7} = -\frac{3}{4\sqrt{5.2.3.7}} \pi i Cs \beta$$

$$Q'_5 = iCs \frac{2\pi}{\sqrt{5.6}} \frac{3}{2.4} \frac{\beta}{7} = -\frac{3}{4\sqrt{5.2.3.7}} \pi i Cs \beta$$

$$T_{lm} \sim I^{-M}_L(\vec{R}) = \sqrt{\frac{4\pi}{2L+1}} \frac{1}{R^{L+1}} Y^{-M}_L(\theta_R, \phi_R)$$

$$P^M_L(\cos \theta) = P^M_L(0) = P^M_L(0)$$

$$Y^M_L(\frac{\pi}{2}, \varphi) = (-1)^{\frac{L+M}{2}} e^{iM\varphi} \left[\frac{2L+1}{4\pi} \frac{(L+M-1)!! (L-M-1)!!}{(L+M)!! (L-M)!!} \right]^{\frac{1}{2}}$$

$$I^{-M}_L(\vec{R}) = \frac{1}{R^{L+1}} (-1)^{\frac{L-M}{2}} e^{-iM\varphi} \left[\frac{(L+M-1)!! (L-M-1)!!}{(L+M)!! (L-M)!!} \right]^{\frac{1}{2}}$$

$$T_{lm} \sim I^{-M}_L(\vec{R}) = \frac{1}{R^{L+1}} (-1)^{\frac{L-M}{2}} e^{-iM\varphi} \left[\frac{(L+M-1)!! (L-M-1)!!}{(L+M)!! (L-M)!!} \right]^{\frac{1}{2}}$$

$$T_{lm} \sim I^{-M}_L(\vec{R}) = \frac{1}{R^{L+1}} (-1)^{\frac{L-M}{2}} e^{-iM\varphi} \left[\frac{(L+M-1)!! (L-M-1)!!}{(L+M)!! (L-M)!!} \right]^{\frac{1}{2}}$$

$$T_{lm} \sim I^{-M}_L(\vec{R}) = \frac{1}{R^{L+1}} (-1)^{\frac{L-M}{2}} e^{-iM\varphi} \left[\frac{(L+M-1)!! (L-M-1)!!}{(L+M)!! (L-M)!!} \right]^{\frac{1}{2}}$$

$$T_{lm} \sim I^{-M}_L(\vec{R}) = \frac{1}{R^{L+1}} (-1)^{\frac{L-M}{2}} e^{-iM\varphi} \left[\frac{(L+M-1)!! (L-M-1)!!}{(L+M)!! (L-M)!!} \right]^{\frac{1}{2}}$$

$$T_{lm} \sim I^{-M}_L(\vec{R}) = \frac{1}{R^{L+1}} (-1)^{\frac{L-M}{2}} e^{-iM\varphi} \left[\frac{(L+M-1)!! (L-M-1)!!}{(L+M)!! (L-M)!!} \right]^{\frac{1}{2}}$$

$$W_{int} = \sum_{lm} T_{lm} Q^m_l Q^m_l = \sum_{lm} W_{lm} W_{lm} = \sum_{lm} (-1)^{M+L} \frac{1}{\sqrt{L(L+1)}} \tilde{I}^{-M}_L C^{LM}_{lm} \tilde{I}^{-M}_L C^{LM}_{lm}$$

$W_{int} = \sum_L \frac{W_L}{R^{L+1}}, \quad W_L = \sum_{l,m} (-1)^{M+L-l} \sqrt{\frac{(2L)!}{(2l)! (2L-2l)!}} \bar{I}_{-M}^{LM} \bar{C}_{l,m,L-l,M-m} Q_l^m Q_{L-l}^{M-m}$
 $\bar{I}_{-M}^{LM} = (-1)^{\frac{L-M}{2}} e^{-iM\varphi} [\dots]^{1/2}$

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$W_L = \sum_{l,m} (-1)^l S_{LM} \binom{L+M}{l+m}^{1/2} \binom{L-M}{l-m}^{1/2} Q_l^m Q_{L-l}^{M-m}$
 $S_{LM} = (-1)^{(L+M)/2} e^{-iM\varphi} \frac{(L+M)!}{(L-M)!} \frac{(L-1)!}{(L-1-M)!}$
 $Q_l^m = F_l \delta_{l,m} + \bar{S}_l \delta_{l,-m}$
 $Q_l^m Q_{L-l}^{M-m} = F_l F_{L-l} (\delta_{l,m} \delta_{L-l,M-m} + \bar{S}_l \bar{S}_{L-l} \delta_{l,-m} \delta_{L-l,M+m}) = S_1 S_2 \delta_{m,2} + \bar{S}_1 \bar{S}_2 \delta_{m,0} + \dots$
 $W_L = \sum_l (-1)^l F_l F_{L-l} \left[\binom{L+2}{l+1}^{1/2} \binom{L-2}{l-1}^{1/2} \{ \bar{S}_1 S_2 + \bar{S}_{L-2} S_2 \} + \binom{L}{l}^{1/2} \binom{L}{l-1}^{1/2} \{ \bar{S}_1 \bar{S}_2 + \bar{S}_{L-2} \bar{S}_2 \} \right]$
 $S_{LM} = e^{-iM\varphi} \mathcal{D}_{LM}, \quad \mathcal{D}_{LM} = \dots$
 $W_L = \sum_l (-1)^l F_l F_{L-l} \left[\binom{L+2}{l+1}^{1/2} \binom{L-2}{l-1}^{1/2} \mathcal{D}_{L2} (S_1 S_2 e^{-2i\varphi} + \bar{S}_1 \bar{S}_2 e^{2i\varphi}) + \mathcal{D}_{L0} \binom{L}{l}^{1/2} \binom{L}{l-1}^{1/2} (\bar{S}_1 \bar{S}_2 + S_1 S_2) \right]$
 $\frac{\binom{L+2}{l+1} \binom{L-2}{l-1}}{(l+1)! (l-1)!} = \frac{(L+2)! (L-2)!}{(l+1)! (L-l+1)! (l-1)! (L-l-1)!}, \quad \frac{\binom{L}{l} \binom{L}{l-1}}{(l+1)! (l-1)!} = \frac{(L!)^2}{(l+1)! (L-l-1)! (L-l+1)! (l-1)!}$
 $W_L = \sum_l (-1)^l \frac{F_l F_{L-l}}{\sqrt{(l+1)! (l-1)! (L-l+1)! (L-l-1)!}} \left[\sqrt{(L+2)! (L-2)!} \mathcal{D}_{L2} (\cdot) + L! (S_1 \bar{S}_2 + \bar{S}_1 S_2) \mathcal{D}_{L0} \right]$
 $= \sum_l (-1)^l F_l F_{L-l} \frac{1}{l! \sqrt{l+1} \sqrt{l-1}} \frac{1}{\sqrt{L-l+1} \sqrt{L-l-1}} L! \left[\sqrt{\frac{(L+1)(L+2)}{L(L-1)}} \mathcal{D}_{L2} (\cdot) + \mathcal{D}_{L0} (S_1 \bar{S}_2 + \bar{S}_1 S_2) \right]$
 $\mathcal{D}_{L2} = (-1)^{\frac{L}{2}-1} \left[\frac{(L+1)! (L-3)!}{(L+2)! (L-2)!} \right]^{1/2} = (-1)^{\frac{L}{2}-1} (L-1)! \sqrt{\frac{L+1}{L-1}} \frac{1}{(L+2)!}$
 $\mathcal{D}_{L0} = (-1)^{L/2} \left[\frac{(L-1)!^2}{(L!)^2} \right]^{1/2} = (-1)^{L/2} \frac{(L-1)!}{L!}$
 $W_L = \sum_l (-1)^l F_l F_{L-l} \binom{L}{l} \sqrt{\frac{l(L-l)}{(l+1)(L-l+1)}} (-1)^{\frac{L}{2}} \frac{(L-1)!}{L!} \left[\sqrt{\frac{(L+1)(L+2)}{L(L-1)}} (-1) \sqrt{\frac{L(L+1)}{(L+2)(L-1)}} (\cdot) + (S_1 \bar{S}_2 + \bar{S}_1 S_2) \right]$
 $= (-1)^{L/2} \frac{(L-1)!}{L!} \sum_l (-1)^l F_l F_{L-l} \binom{L}{l} \sqrt{\frac{l(L-l)}{(l+1)(L-l+1)}} \left[-\frac{(L+1)}{(L-1)} (S_1 S_2 e^{-2i\varphi} + \bar{S}_1 \bar{S}_2 e^{2i\varphi}) + S_1 \bar{S}_2 + \bar{S}_1 S_2 \right]$
 $S_1 S_2 e^{-2i\varphi} + \bar{S}_1 \bar{S}_2 e^{2i\varphi} = 2 \operatorname{Re} S_1 S_2 e^{-2i\varphi} = 2 \operatorname{Re} (S_{1x} + i S_{1y})(S_{2x} + i S_{2y}) e^{-2i\varphi} = 2 \operatorname{Re} (S_{1x} S_{2x} - S_{1y} S_{2y} + i S_{1y} S_{2x} + i S_{1x} S_{2y})$
 $\times (\cos 2\varphi - i \sin 2\varphi) = 2 (S_{1x} S_{2x} - S_{1y} S_{2y}) \cos 2\varphi + 2 (S_{1y} S_{2x} + S_{1x} S_{2y}) \sin 2\varphi$
 $S_1 \bar{S}_2 + \bar{S}_1 S_2 = 2 \operatorname{Re} (S_1 \bar{S}_2) = 2 \vec{S}_1 \cdot \vec{S}_2$
 $W_L = 2(-1)^{L/2} \frac{(L-1)!}{L!} \sum_l (-1)^l F_l F_{L-l} \binom{L}{l} \sqrt{\frac{l(L-l)}{(l+1)(L-l+1)}} \left[-(L+1) \{ (S_{1x} S_{2x} - S_{1y} S_{2y}) \cos 2\varphi + (S_{1y} S_{2x} + S_{1x} S_{2y}) \sin 2\varphi \} + (L-1) \vec{S}_1 \cdot \vec{S}_2 \right]$
 $= 2(-1)^{L/2} \frac{(L-3)!}{L!} \sum_l (-1)^l F_l F_{L-l} \binom{L}{l} \sqrt{\frac{l(L-l)}{(l+1)(L-l+1)}} \left[(L+1) \mathcal{B} + (L-1) \mathcal{A} \right]$
 $\mathcal{B} = (S_{1y} S_{2y} - S_{1x} S_{2x}) \cos 2\varphi - (S_{1y} S_{2x} + S_{1x} S_{2y}) \sin 2\varphi, \quad \mathcal{A} = \vec{S}_1 \cdot \vec{S}_2$

$Q_m^m = F_e (5\delta_{m1} + 5\delta_{m-1})$ crabn. c $Q_e^1 = \frac{2\pi i a s}{\sqrt{e(e+1)}} (-1)^{\frac{e+1}{2}} \frac{(e-2)!!}{(e-1)!!} \frac{\beta^e}{(e-1)!!} \delta_{m1}$
 $F_e = \frac{2\pi i a}{\sqrt{e(e+1)}} \frac{(-1)^{\frac{e+1}{2}} e!!}{(e-1)!!} \frac{\beta}{(e+2)} = \frac{1}{\sqrt{e(e+1)}} \beta e$
 $\frac{1}{\sqrt{e(e+1)}} \beta e = \frac{\beta e}{\sqrt{e(e+1)}} = \frac{\beta e}{\sqrt{e+1}}$
 $F_{L-e} \sqrt{\frac{L-e}{L-e+1}} = \frac{\beta e}{\sqrt{L-e+1}}$

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$W_L = 2(-1)^{\frac{L-3}{2}} \frac{L!!}{L!!} \sum_e \frac{(-1)^e \beta e \sqrt{L-e}}{(e+1)(L-e+1)} \binom{L}{e} [(L+1)b + (L-1)a]$
 $\beta e = 2\pi i a (-1)^{\frac{e+1}{2}} \frac{e!!}{(e-1)!!} \frac{\beta}{(e+2)}$
 $\beta e = (-1)^{\frac{e+1}{2}} \frac{e!!}{(e-1)!!} \frac{1}{(e+2)}$
 $\Pi(L) = \sum_e \frac{(-1)^e \beta e \sqrt{L-e}}{(e+1)(L-e+1)} \binom{L}{e} = \frac{L!}{e!(L-e)!}$
 $W_L = -8\pi^2 C_1 C_2 \beta^2 (-1)^{\frac{L-3}{2}} \frac{L!!}{L!!} [(L-1)a + (L+1)b] \Pi(L)$
 $W_{int}(R) = \sum_L \frac{W_L}{R^{L+1}}$

for gaussian eigenvalue Table 2.

$Dip-dip. \ell = \ell' = 1, L = 2, \Pi(2) = (-1) \frac{g_1^2}{4} \frac{2}{1 \cdot 1} = -\frac{1}{2} g_1^2, g_1 = (-1)^{\frac{1}{2}} \frac{1}{3}$
 $\Pi(2) = -\frac{1}{2} \cdot \frac{1}{9} \cdot \frac{(L-3)!!}{L!!} = \frac{(L-1)!!}{L!!} = |L=2| = \frac{1}{1 \cdot 2}$
 $W_{(2)} = -8\pi^2 C_1 C_2 \beta^2 (-1) \frac{1}{2} \left(-\frac{1}{3}\right) [a + 3b] = -\frac{9}{2} \pi^2 C_1 C_2 \beta^2 [a + 3b]$
 $L=4, \ell = 1, 3, \ell' = 1, 3, \Pi(4) = \sum_e \frac{(-1)^e \beta e \beta e'}{(e+1)(e'+1)} \frac{L!}{e!e'!} = (-1) g_1 g_3 \frac{4!}{2 \cdot 4 \cdot 3!} =$
 $\Pi(4) = -g_1 g_3 = -\left(-\frac{1}{3}\right) \frac{3}{2} \frac{1}{5} = \frac{1}{10}$
 $W(L=4) = -8\pi^2 C_1 C_2 \beta^2 \frac{1}{2 \cdot 4} [3a + 5b] \frac{1}{10} = -\frac{\pi^2}{10} C_1 C_2 \beta^2 [3a + 5b]$
 $W(L=2) \cup W(L=4)$ Table 2 Bepure.

$\frac{L!}{(L-e)!e!}, L! \text{ bñacem uz } \Pi(L) \cup (L+1)L! = (L+1)!, (L'+1)L'! = (L'+1)!$

$W_L = -8\pi^2 C_1 C_2 \beta^2 (-1)^{\frac{L-3}{2}} \frac{L!!}{L!!} [(L-1)a + (L+1)b] \Pi(L), \Pi(L) = \sum_e \frac{(-1)^e \beta e \beta e'}{(e+1)(e'+1)} \frac{L!}{e!e'!}$

W_L → q_q w_q 1/R^{L+1} b paguonemur W_{int}(R). 3^{max} $\beta e \beta e' = (-1)^{\frac{e+1}{2}} \frac{e!!}{(e-1)!!} \frac{e'+1}{2} = (-1)^{\frac{e+1}{2}} \frac{e'+1}{2}$

$\Pi(L) = \sum_e \frac{(-1)^e (-1)^{\frac{e+1}{2}} \beta e \beta e'}{(e+1)(e'+1)} \frac{L!}{e!e'!} \rightarrow \beta e = \frac{e!!}{(e-1)!!} \frac{1}{(e+2)}$
 $(-1)^{\frac{e+1}{2}} \text{ bñacem uz } \Pi(L) \rightarrow \text{gaur } (-1)^L = 1 \text{ wñm } L = e + e' - \text{ret.}, e, e' \text{ heren.}$

$W_L = -8\pi^2 C_1 C_2 \beta^2 L! \frac{(L-3)!!}{L!!} [(L-1)a + (L+1)b] \Pi(L), \Pi(L) = \sum_e \frac{(-1)^e \beta e \beta e'}{(e+1)(e'+1)} \frac{L!}{e!e'!}$

20 superges. multipole decomposition $W_{int} = \sum_L \frac{W_L}{R^{L+1}}$ of det pair in pole-free model

(25/m) Due rigid v. model $\text{div } \vec{m} \rightarrow \text{Div } \vec{m} = (\vec{m} \cdot \vec{n}) \delta(g-1)$. B corob. $\vec{m} \cdot \vec{n} = \vec{m} \cdot \vec{n}$

$(\vec{m} \cdot \vec{n}) = m_g = m_x \cos \varphi + m_y \sin \varphi = \text{Re}(m \bar{n}), m = m_x + i m_y = w = \frac{f}{|f|}, n = n_x + i n_y = \frac{f}{|f|} e^{i\varphi}$

$m_g = \text{Re} \left(\frac{f}{|f|} e^{-i\varphi} \right) = \frac{1}{|f|} \text{Re} \left[i \frac{C}{c} (z-s) e^{-i\varphi} \right] = |z-s| e^{i\varphi} = \frac{1}{|f|} (-i) \frac{C}{c} \text{Re}(i s e^{-i\varphi}) =$

$= -\frac{1}{|f|} \frac{C}{c} [s_x \sin \varphi - s_y \cos \varphi] = -\frac{C}{|z-s|} (s_x \sin \varphi - s_y \cos \varphi) \approx -C (s_x \sin \varphi - s_y \cos \varphi), |z|=1, |s| \ll 1$

Note: B pole free model $\text{div } \vec{m} = 2C (s_x \sin \varphi - s_y \cos \varphi) \delta(g-1)$ - bñacem c wñm. go unrespon

$\text{rigid v. div } \vec{m} = -C (s_x \sin \varphi - s_y \cos \varphi) \delta(g-1), Q_e^m(z, v) = \int d^3 \vec{r} [\text{pole free m.}] (-\frac{1}{2}) \delta(g-1)$

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$$J_e(\beta) = \int_0^1 \log \int_0^{\beta} (s^2 + z^2)^{l/2} P_l' \left(\frac{z}{\sqrt{z^2 + s^2}} \right) dz \approx \beta P_l'(x=0) \int_0^1 \log t + 1$$

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Bugno

$P'_l(x;0) = P'_l(x;0) \left(-\frac{1}{2}\right) \int_0^1 ds e^{(1-s)} \delta(s-1) = |s=1-0| = L$

$Q'_l(r.v.) = Q'_l(P.f.X-1) \frac{(L+2)}{2}$, $Q'_l = Fe_{L-kago}$ uzguburo

$F_e F_{L-l}(r.v.) = \left(\frac{L}{2} + 1\right)^2 F_e F_{L-l}(P.f.)$, Eqs. (23/III)

Astcazka • Miércoles

$\frac{F_F}{2} \cdot (r.v.) = \left(\frac{P}{2} + 1\right)^2 FeF_{L-l} (P.f.), Egs, (23/III)$

Dip. - dip $l=l'=1$, $\Pi(l=2) = -\frac{1}{2}g_1^2 = 1g_1 - \left(-\frac{1}{3}\right)\left(\frac{1+2}{2}\right) = -\frac{1}{2}g_1 = -\frac{1}{2}g_1$

$\text{Bem: } \Pi(2)^{p.f.} = -\frac{1}{18} \quad \Pi(2)^{z.v.} = \frac{18}{8} = \frac{9}{4} = \left(\frac{3}{2}\right)^2$

zigzag v model $\frac{1}{8}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{\sqrt{2}}$ $\frac{1}{\sqrt{4}}$ $\frac{1}{\sqrt{8}}$ $\frac{1}{\sqrt{16}}$ $\frac{1}{\sqrt{32}}$ $\frac{1}{\sqrt{64}}$ $\frac{1}{\sqrt{128}}$ $\frac{1}{\sqrt{256}}$ $\frac{1}{\sqrt{512}}$ $\frac{1}{\sqrt{1024}}$ $\frac{1}{\sqrt{2048}}$ $\frac{1}{\sqrt{4096}}$ $\frac{1}{\sqrt{8192}}$ $\frac{1}{\sqrt{16384}}$ $\frac{1}{\sqrt{32768}}$ $\frac{1}{\sqrt{65536}}$ $\frac{1}{\sqrt{131072}}$ $\frac{1}{\sqrt{262144}}$ $\frac{1}{\sqrt{524288}}$ $\frac{1}{\sqrt{1048576}}$ $\frac{1}{\sqrt{2097152}}$ $\frac{1}{\sqrt{4194304}}$ $\frac{1}{\sqrt{8388608}}$ $\frac{1}{\sqrt{16777216}}$ $\frac{1}{\sqrt{33554432}}$ $\frac{1}{\sqrt{67108864}}$ $\frac{1}{\sqrt{134217728}}$ $\frac{1}{\sqrt{268435456}}$ $\frac{1}{\sqrt{536870912}}$ $\frac{1}{\sqrt{1073741824}}$ $\frac{1}{\sqrt{2147483648}}$ $\frac{1}{\sqrt{4294967296}}$ $\frac{1}{\sqrt{8589934592}}$ $\frac{1}{\sqrt{17179869184}}$ $\frac{1}{\sqrt{34359738368}}$ $\frac{1}{\sqrt{68719476736}}$ $\frac{1}{\sqrt{137438953472}}$ $\frac{1}{\sqrt{274877906944}}$ $\frac{1}{\sqrt{549755813888}}$ $\frac{1}{\sqrt{1099511627776}}$ $\frac{1}{\sqrt{2199023255552}}$ $\frac{1}{\sqrt{4398046511104}}$ $\frac{1}{\sqrt{8796093022208}}$ $\frac{1}{\sqrt{17592186044416}}$ $\frac{1}{\sqrt{35184372088832}}$ $\frac{1}{\sqrt{70368744177664}}$ $\frac{1}{\sqrt{140737488355328}}$ $\frac{1}{\sqrt{281474976710656}}$ $\frac{1}{\sqrt{562949953421312}}$ $\frac{1}{\sqrt{1125899906842624}}$ $\frac{1}{\sqrt{2251799813685248}}$ $\frac{1}{\sqrt{4503599627370496}}$ $\frac{1}{\sqrt{9007199254740992}}$ $\frac{1}{\sqrt{18014398509481984}}$ $\frac{1}{\sqrt{36028797018963968}}$ $\frac{1}{\sqrt{72057594037927936}}$ $\frac{1}{\sqrt{144115188075855872}}$ $\frac{1}{\sqrt{288230376151711744}}$ $\frac{1}{\sqrt{576460752303423488}}$ $\frac{1}{\sqrt{1152921504606846976}}$ $\frac{1}{\sqrt{2305843009213693952}}$ $\frac{1}{\sqrt{4611686018427387904}}$ $\frac{1}{\sqrt{9223372036854775808}}$ $\frac{1}{\sqrt{18446744073709551616}}$ $\frac{1}{\sqrt{36893488147419103232}}$ $\frac{1}{\sqrt{73786976294838206464}}$ $\frac{1}{\sqrt{147573952589676412928}}$ $\frac{1}{\sqrt{295147905179352825856}}$ $\frac{1}{\sqrt{590295810358705651712}}$ $\frac{1}{\sqrt{1180591620717411303424}}$ $\frac{1}{\sqrt{2361183241434822606848}}$ $\frac{1}{\sqrt{4722366482869645213696}}$ $\frac{1}{\sqrt{9444732965739290427392}}$ $\frac{1}{\sqrt{18889465931478580854784}}$ $\frac{1}{\sqrt{37778931862957161709568}}$ $\frac{1}{\sqrt{75557863725914323419136}}$ $\frac{1}{\sqrt{151115727451828646838272}}$ $\frac{1}{\sqrt{302231454903657293676544}}$ $\frac{1}{\sqrt{604462909807314587353088}}$ $\frac{1}{\sqrt{1208925819614629174706176}}$ $\frac{1}{\sqrt{2417851639229258349412352}}$ $\frac{1}{\sqrt{4835703278458516698824704}}$ $\frac{1}{\sqrt{9671406556917033397649408}}$ $\frac{1}{\sqrt{19342813113834066795298816}}$ $\frac{1}{\sqrt{38685626227668133590597632}}$ $\frac{1}{\sqrt{77371252455336267181195264}}$ $\frac{1}{\sqrt{154742504910672534362390528}}$ $\frac{1}{\sqrt{309485009821345068724781056}}$ $\frac{1}{\sqrt{618970019642690137449562112}}$ $\frac{1}{\sqrt{1237940039285380274899124224}}$ $\frac{1}{\sqrt{2475880078570760549798248448}}$ $\frac{1}{\sqrt{4951760157141521099596496896}}$ $\frac{1}{\sqrt{9903520314283042199192993792}}$ $\frac{1}{\sqrt{19807040628566084398385987584}}$ $\frac{1}{\sqrt{39614081257132168796771975168}}$ $\frac{1}{\sqrt{79228162514264337593543950336}}$ $\frac{1}{\sqrt{158456325028528675187087900672}}$ $\frac{1}{\sqrt{316912650057057350374175801344}}$ $\frac{1}{\sqrt{633825300114114700748351602688}}$ $\frac{1}{\sqrt{1267650600228229401496703205376}}$ $\frac{1}{\sqrt{2535301200456458802993406410752}}$ $\frac{1}{\sqrt{5070602400912917605986812821504}}$ $\frac{1}{\sqrt{10141204801825835211973625643008}}$ $\frac{1}{\sqrt{20282409603651670423947251286016}}$ $\frac{1}{\sqrt{40564819207303340847894502572032}}$ $\frac{1}{\sqrt{81129638414606681695789005144064}}$ $\frac{1}{\sqrt{162259276829213363391578010288128}}$ $\frac{1}{\sqrt{324518553658426726783156020576256}}$ $\frac{1}{\sqrt{649037107316853453566312041152512}}$ $\frac{1}{\sqrt{1298074214633706907132624082305024}}$ $\frac{1}{\sqrt{2596148429267413814265248164610048}}$ $\frac{1}{\sqrt{5192296858534827628530496329220096}}$ $\frac{1}{\sqrt{10384593717069655257060992658440192}}$ $\frac{1}{\sqrt{20769187434139310514121985316880384}}$ $\frac{1}{\sqrt{41538374868278621028243970633760768}}$ $\frac{1}{\sqrt{83076749736557242056487941267521536}}$ $\frac{1}{\sqrt{166153499473114484112975882535043072}}$ $\frac{1}{\sqrt{332306998946228968225951765070086144}}$ $\frac{1}{\sqrt{664613997892457936451903530140172288}}$ $\frac{1}{\sqrt{1329227995784915872903807060280344576}}$ $\frac{1}{\sqrt{2658455991569831745807614120560689152}}$ $\frac{1}{\sqrt{5316911983139663491615228241121378304}}$ $\frac{1}{\sqrt{10633823966279326983230456482242756608}}$ $\frac{1}{\sqrt{21267647932558653966460912964485513216}}$ $\frac{1}{\sqrt{42535295865117307932921825928971026432}}</$

$|w_1^p - w_2^p| \sim |I_y| - p I_x$. Can observe $|w_1^p - w_2^p|$ & dip. v. μ & μ_{imp} .

$$\frac{d}{dt} \ln(a+3b) = \frac{1}{a+3b} \left(\frac{da}{dt} + 3 \frac{db}{dt} \right) = \frac{1}{a+3b} (S_{x1} S_{x2} + S_{y1} S_{y2} + 3(S_{y1} S_{y2} - S_{x1} S_{x2})) = \frac{-2S_{x1} S_{x2} + 4S_{y1} S_{y2}}{a+3b}$$

$$|w_1^p - w_2^p| = \frac{\gamma M_s}{4\pi} \beta \frac{4}{9} (2-p) \frac{1}{13} \cdot \frac{9}{4} = |w_1^p - w_2^p|_{0,1} \cdot 9$$

$$\Gamma(4)^{TV} = -g_1 g_3 = \frac{1}{(l+2)(l+1)} = \frac{1}{3 \cdot 5} = \frac{1}{15}$$

$$d \log - \frac{1}{10} \left(\frac{c+2}{2} \right)_{l=1}^{\infty} = \frac{1}{10} \cdot \frac{3}{2} \cdot \frac{3}{2} = \frac{1}{10} \cdot \frac{15}{4} = \frac{15}{4} \cdot \frac{1}{10}$$

Splitting. 2nd v. model. $1/P = (P) - X M$ (dip. octant)

Typical $\lambda = 2 \text{ nm}$ $\Rightarrow 10^{12} \text{ cm}^{-1}$

$$A_{fp} = 3 \frac{\text{MHz}}{\text{oe}} \frac{8 \cdot 10^2 \text{ oe}}{12} \cdot 0.1 \frac{(2-p)}{2^3} = 2.5 (2-p) \text{ MHz} = \sqrt{7.5 \text{ MHz}} \quad p=-1 \quad \times \sqrt{2}$$

$\rightarrow$ Полезна само ед. гл. $\Delta W_p - !$
 $(L=4) - \text{всички } 4 \text{ гл.}$

$(L=4)$ -поправка для мном. $\left[1 + \frac{3}{4} \frac{(4-p)}{(2-p)} \frac{1}{d^2}\right] \approx \left[1 + \frac{3}{4} \frac{1}{4} \frac{(4-p)}{(2-p)}\right] = \sqrt{24/6}, p=-1$
т.е. поправка для мном. ≈ 1.115

T. e. Racina splitting $\Delta f_p = \begin{cases} 10 \text{ MHz}, & p = -1 \\ 5 \text{ MHz}, & p = +1 \end{cases} \times \pi^2$

26/III А. А. назван за нлв Тарjetas, планка вписана впервой 2-х

Час пачыну. асрэд MICINN - Окс.4. Складзе Окс.

rigid v. models, problems & open. Sugimoto, Araki, no. 5, p. 107, (1) in-phase

¹⁷ Square array с черными "A". Обознач: Мана и сын Multipole paper.

27/III Беседа с ученик о поезде ICSM'12 в туниса и Juan Jo о поез

18 FMR - Spectrometer grant (working (U-updated)).
Splitting $|W, P\rangle - |W, P\rangle$ - pole free model of the spin doublet in the EPR

splitting $|w_1 - w_2|$ - pole free model of the pair game or exp. Sugimoto, Arai, Etc. in Japan. Current rigid v. pole free models. No current

genera, Verige $f(z) \rightarrow m, my$, remigoro $v^2 f(z) = 0$ u $\frac{fmg}{\partial z} + dmy|_{z=R} = 0$.
finite d. Nurosoy. MZINA - Crabur u - Crenay u - de al

III) дан H=26 на 26 Jan. 2010 г. срезан MICIAN - projects почва на высоте

178, 187 - H-31 Mr 26 Feb 2011. Updated a woman to Juanjo, to Arantxa.
non c furnish - standard CV que noque FMR - 4 extra copies 9 sent.

Объясн. с дес. $W_{1,2}^P(d)$ - vortex pair radius calc. по грабн. с дескн. Superconductivity

Submitted on-line Informe Annual over no MISC and project FT\$200 c. Dec.

Ugda: ecm give vector dot array $fl = \sum_{i=1}^n J_{vec}(\vec{x}_i, \vec{x}_i), J_{vec}(z_i)$

→ keine Erpinne geht model Heisenberg $\frac{h^2}{2m} \nabla^2 \psi = E \psi$ mit $E_n = \text{const}$ und möglich
mit Braguerem. Osmene (Spiegelglas), ein χ^2 $\chi^2 = \chi^2_{\text{min}} + \chi^2_{\text{stat}}$ $\chi^2_{\text{stat}} = \sum \frac{(\chi^2 - \chi^2_{\text{min}})^2}{\chi^2_{\text{min}}}$

9/11/11 Capra submitted online offer no MICINN-NSF grant. B. de la Cueva & A. de la Cueva

(1) Obeying the Arndtson's simulation of int. dot response
 e person Ho Z bo de N(1) transducer yfz shchit...
 At (1) - sampling time. V reversed...
 no moment diffraction zone. De coll size v M. reversed...
 Ho... 200 M... u none are with...
 (2) phase mode (on=const, pn=const) to track had (Amst' DPL' 10). (Dec. 4006...)
 Multipole moments - paper. $G \times X = \frac{\partial W}{\partial X} \rightarrow iZG_z = 2 \frac{\partial W}{\partial z}$
 $W = \frac{e^2}{2} |X|^2 = \frac{e^2}{2} Z\bar{Z}$, $iG_z Z = 2 \frac{\partial}{\partial Z} (\frac{e^2}{2} Z\bar{Z}) = e^2 \bar{Z}$.
 $-pi \dot{Z} = w_0 Z$, $w_0 = e^2 / |G|$. $Z(t) = Z_0 \exp(iw t)$ gave perm.
 $(ipn) Z = w_0 Z$, $w = w_0$. No van dyke (oscillator give Z) even $W = W(|X|)$ -
 spherical symmetry for potential.
 One square array $W_{int} = \sum_{nn'} J_{nn'} (X_n \cdot X_{n'}) = \frac{1}{2} \sum_{nn'} J_{nn'} (Z_n \bar{Z}_{n'} + \bar{Z}_n Z_{n'})$
 $iG_n Z_n = 2 \frac{\partial W}{\partial Z_n}$. $W = \frac{1}{2} \sum_n G_n Z_n \bar{Z}_n + \frac{1}{2} \sum_{nn'} J_{nn'} (Z_n \bar{Z}_{n'} + \bar{Z}_n Z_{n'})$
 $iG_n Z_n = Z_n Z_n + \sum_{nn'} J_{nn'} Z_{n'}$. $Z_n = x$, $G_n = -pn / |G|$, $\frac{1}{|G|} J_{nn'} = J_{nn'}$
 $-ipn \dot{Z}_n = w_0 Z_n + \sum_{nn'} J_{nn'} Z_{n'}$ - where YD give Z_n as Z_n com. q.p.m. W.
 $Z_n(t) = Z_0 e^{i\omega t}$ - Fourier transf. $\rightarrow \omega p_n Z_n = w_0 Z_n + \sum_{nn'} J_{nn'} Z_{n'}$
 $A_{nn'} = p_n w_0 \delta_{nn'} + p_n J_{nn'}$, so $\sum_{nn'} A_{nn'} Z_{n'} = \omega Z_n$ $\hat{A} Z = \omega Z$,
 Cor. yp. det $(A_{nn'} - \delta_{nn'} \omega) = 0$ gave $\omega = F(p_n)$ gave k-mag
 maps of p_n - graph. $J_{nn'} \sim C_n C_{n'}$ - but it's essential way C_n .
 Due cluster N dots: $N=2$ - dots pair. $W_{int} \sim \cos 2\varphi \sin 2\varphi$, $\varphi \rightarrow \varphi + \pi$
 $N=3$ J_1, J_2 - cum. con. $\varphi \rightarrow \varphi + \frac{\pi}{3}$ - higher $W_{int} \sim (X_n \cdot X_{n'})$ van square array.
 $N=4$ J_1, J_2, J_3 - J_1 & J_2 diagonal.
 Cov. yp. det $R(\omega) = \det [(p_n w_0 - \omega) \delta_{nn'} + p_n J_{nn'}] =$
 $= \det [(w_0 - p_n \omega) \delta_{nn'} + J_{nn'}] = 0$ governs where, represent from mag.
 Now N-dot cluster secular yp. give Z_n as determinant $N \times N$.
 One value $\leq N$ being s. k.p.m. give k-mag zero nodes $\{p_n\}, n=1,2,\dots,N$.
 $J_{nn'} \sim C_n C_{n'}$, normally ecc. represent (to define pure geometrical
 antiferro $J_{nn'}$) gives $\vec{S}_n = C_n \vec{s}_n$. $\langle \vec{m} \rangle_v = \frac{\vec{a}}{3} = -\frac{2}{3} C \hat{z} \times \vec{S}$ - pole-free model.
 now $\langle \vec{m} \rangle_v = -C \hat{z} \times \vec{S}$ - rigid v. model. $\langle \vec{m} \rangle_v = -\frac{2}{3} C \hat{z} \times \vec{S}$, $\frac{2}{3} = 1-2.v.$
 $\vec{M} = \langle \vec{m} \rangle_v = -\frac{2}{3} C \hat{z} \times \vec{S} \rightarrow \frac{2}{3} C \vec{S} = \hat{z} \times \vec{M}$ u $C_n C_{n'} \vec{S}_n \cdot \vec{S}_{n'} = \frac{1}{32} (\hat{z} \times \mu_n) \cdot (\hat{z} \times \mu_{n'})$
 $= (\vec{\mu}_n \cdot \vec{\mu}_{n'}) \frac{1}{32} (1)$. Unreduced, too eq. Thiele moment same as
 like $\vec{x} = a \hat{z} \times \frac{\partial W}{\partial \vec{x}}$, $W(\vec{x}) \sim \frac{1}{2x} \vec{x}^2$, r.e. $\langle \vec{m} \rangle_v = \vec{x} = \langle \vec{m} \times \frac{\partial W}{\partial \vec{m}} \rangle = a \hat{z} \times \frac{\partial W}{\partial \vec{x}}$
 yp. a long-range. X-ray y-pegmenter give vortex. $a \sim G_z \sim m_z(0)$. $\vec{x} = \langle \vec{m} \rangle_v$
 Accor. YD $(\omega p_n - w_0) Z_n = \sum_{nn'} J_{nn'} Z_{n'}$ u oblige $Z_n = Z_k e^{ikR_n}$
 $(\omega p_n - w_0) Z_k = \sum_{nn'} J_{nn'} (R_{nn'}) e^{ik(R_{n'} - R_n)} Z_k$, so $J_{nn'} \sim C_n C_{n'} f(|R_{nn'}|)$
 lyce $C_n = const, C_n^2 = 1$. $J(k) = \sum_n J(R_n) e^{ikR_n}$ u $[\omega p_n - w_0] Z_k = J(k) Z_k$
 p_n - number.

Един атома у $p_n = \text{const}$, $\omega(k) = \omega_0 + J(k)$ - меморија
 Reproduction of quanta (Ch = const, $p_n = \text{const}$) vortex dots.
 29 $J(k) = -|J(k)|$ $J(k) = -\sum_{nn'} |J_{nn'}| \hat{S}_n \cdot \hat{S}_{n'}$
 of the dots, $J_{nn'}(R) < 0$ u $W_{int} = -\sum_{nn'} |J_{nn'}| \hat{S}_n \cdot \hat{S}_{n'}$.
 Defining $\hat{J}_{nn'} = \langle \hat{J}_{nn'} \rangle$, a no general c p_n - v. core polarization?

$J(k)$ u $k \ll 1$: $J(k) = \sum_{nn'} J(R_n) e^{ik \cdot R_n} = \sum_{nn'} J(R_n) [1 + ik \cdot R_n + \dots]$
 $= J(0) - \frac{1}{2} \sum_{nn'} J(R_n) (k \cdot R_n)^2$, $(k \cdot R_n)^2 = (k_x R_n^x + k_y R_n^y)^2 = k_x^2 R_n^x^2 + k_y^2 R_n^y^2 + 2k_x k_y R_n^x R_n^y$
 $J(k) = J(0) - \frac{1}{2} \sum_{nn'} J(R_n) [k_x^2 X_n^2 + k_y^2 Y_n^2 + 0] = J(0) - \frac{1}{2} k^2 \sum_{nn'} J(R_n) X_n^2$
 - xopomo ecm van yproco. $J(k) \sim \sum_{nn'} \frac{e^{ik \cdot R_n}}{R_n^{L+1}}$, a vanne cyman nory
 sbro non-analytic no k , + i.k. $\sum_{nn'} J(R_n) X_n^2 \sim \sum_{nn'} \frac{1}{R_n^3} R_n^2 = \sum_{nn'} \frac{1}{R_n}$
 s.c. b vanotpor nonphab. R.

(2/iv) Nany'na e-mals os Chabuna (Nashin St), Berpa u Memora (visek San. Sob).
 Obogusac u interact. energy $W_{int} = \sum_{nn'} J(R_{nn'}) (\hat{J}_{nn'} \cdot \hat{J}_{nn'})$
 $J(R_{nn'})$ coepmure dip-dip bnaag? Tge anisotropic zero dip-dip interact.
 $W_{int} \sim \frac{1}{R_{nn'}^3} [(\hat{J}_{nn'} \cdot \hat{J}_{nn'}) - 3(\hat{J}_{nn'} \cdot \hat{R}_{nn'})(\hat{J}_{nn'} \cdot \hat{R}_{nn'})] = \frac{\mu_n \mu_{n'}}{R^3} [\cos(\varphi_n - \varphi_{n'}) -$
 $- 3 \{ \cos \varphi_n \cos \varphi_{n'} + \sin \varphi_n \sin \varphi_{n'} \} \{ \cos \varphi_n \cos \varphi_{n'} + \sin \varphi_n \sin \varphi_{n'} \}] =$
 $= \frac{\mu_n \mu_{n'}}{R^3} [\cos(\varphi_n - \varphi_{n'}) - 3 \{ \cos \varphi_n \cos \varphi_{n'} \frac{1}{2}(1 + \cos 2\varphi_R) + \sin \varphi_n \sin \varphi_{n'} \frac{1}{2}(1 - \cos 2\varphi_R) +$
 $+ \sin(\varphi_n + \varphi_{n'}) \sin 2\varphi_R \}] = \frac{1}{2} \frac{\mu_n \mu_{n'}}{R^3} [-\cos(\varphi_n - \varphi_{n'}) - 3 \cos(\varphi_n + \varphi_{n'}) \cos 2\varphi_R +$
 $- 3 \sin(\varphi_n + \varphi_{n'}) \sin 2\varphi_R]$, $\varphi_n = (\hat{J}_n \cdot \hat{x})$, W_{int} obogusac u (a+3b)-Tabl.2.
 $W_{int}^{d-d} = -\frac{1}{2} \sum_{nn'} \frac{\mu_n \mu_{n'}}{R_{nn'}^3} [\cos(\varphi_n - \varphi_{n'}) + 3 \cos(\varphi_n + \varphi_{n'}) \cos 2\varphi_{R_{nn'}} + 3 \sin(\varphi_n + \varphi_{n'}) \sin 2\varphi_{R_{nn'}}]$
 3a ucm. Brance $\alpha = 5/3$

Myco $n'=0$ u meco gozob b array = $N \cdot \sum f(n, n') = N \sum f(n, 0)$?
 $\cos 2\varphi_{R_{nn'}} = \cos^2 \varphi_{R_{nn'}} - \sin^2 \varphi_{R_{nn'}}$, $\hat{R}_{nn'} = (n_1 - n'_1) \hat{x} + (n_2 - n'_2) \hat{y} = \hat{R}_n - \hat{R}_{n'}$
 W_{int}^{d-d} (bry yzob c yzann'=0) = $-\frac{1}{2} \sum_{nn'} \frac{\mu_n \mu_0}{R_n^3} [\cos(\varphi_n - \varphi_0) + 3 \cos(\varphi_n + \varphi_0) \cos 2\varphi_{R_n} +$
 $3 \sin(\varphi_n + \varphi_0) \sin 2\varphi_{R_n}] = -\frac{1}{2} \sum_{nn'} \frac{\mu_n \mu_0}{R_n^3} [\cos(\varphi_n - \varphi_0) + 3 \cos(\varphi_n + \varphi_0 - 2\varphi_{R_n})]$
 nny b fany. Cuccum keo gumar na $\pi/2$, $\varphi_n \rightarrow \varphi_n + \frac{\pi}{2}$, $\varphi_{R_n} \rightarrow \varphi_{R_n} + \frac{\pi}{2}$
 u $\varphi_n + \varphi_0 - 2\varphi_{R_n} \rightarrow (\varphi_n + \varphi_0 + \pi/2 + \pi/2) - 2(\varphi_{R_n} + \pi/2) = \varphi_n + \varphi_0 - 2\varphi_{R_n}$
 ne memera. Pzgo $W_{int}^{d-d} \sim [\hat{J}_n \cdot \hat{J}_n - 3(\hat{R} \cdot \hat{J}_n)(\hat{R} \cdot \hat{J}_n)]$ invariant orn. fany. W_{int}
 Larumbata Sabado absolute in-phase mode $\hat{J}_n = \hat{J} \neq f(n)$, $\varphi_n = \varphi_n$ Domingo Igandea
 $W_{int}^{d-d} = -\frac{1}{2} \mu^2 \sum_{nn'} \frac{1}{R_{nn'}^3} [1 + 3 \cos 2\varphi \cos 2\varphi_{R_{nn'}} + 3 \sin 2\varphi \sin 2\varphi_{R_{nn'}}]$
 $= -\frac{1}{2} \mu^2 \sum_{nn'} \frac{1}{R_{nn'}^3}$, zuent c $\cos 2\varphi_R$, $\sin 2\varphi_R = 0$, t.e. zuent c b = 0

(3-5/iv) Vozzyna c N. b Madrid, ykr. nocovetco. Madrid - Ukr. Embassy
 nuzamco hozob na nze nnyu b Spain, bany. ob boz. wabax u Paraga de bocho.
 nago bzob nory. zabepenne chabun na bex zuent cment 1-20 kpyra,
 nzo no memera nory. nplezqui ko nze, n. poyzmenet nnyu nnyu, a nnyu coz.
 26 Aste Semana bzob navor. chabun (nnyu nnyu n.) b kuche, xoz nnyu u ne ecm ykr
 nnyu. poyzmenet za 2009-2012. na yzepmure poy. 1-20 kpyra - bzog. chabun. nnyu.

Yur. Kharoz. Kogel'ka (inib. Jan 1, 2011) : def. resident, U.S. ...
 Belanovsky' PRB'12 na com. e usom uz J.Phys'11? ...
 Min-lin. ST-vortex ...
 2

Lunes. Astelehena

Eq. (4) J.Phys.'11 : ...
 Nordin. defining $d_1(R)$ - ...
 Non-linear ST nanowire paper (J. Ph. Conf. Ser. '11) ...

field of CPP current to vortex frequency, Zeman et al.
 $\omega_0(B, J) = \omega_0(B) + \omega_c J$, $\omega_c = \frac{8\pi}{15} \frac{R}{c} \{C\}$, $\{C\} = 1 + \frac{15}{8} (\ln 2 - \frac{1}{2}) \frac{R_c}{R}$
 $\oint \vec{H} \cdot d\vec{l} = I_s$, $\oint \vec{H} \cdot d\vec{l} = I$, $\vec{H} = H_\phi \hat{\phi}$

$\vec{H} = \vec{\nabla} \cdot (\hat{\phi} g d\phi + \hat{z} \psi) = g d\phi$, $\oint H_\phi g d\phi = 2\pi H_\phi g = J \cdot \pi g^2$
 $H_\phi(g) = \frac{1}{2} g J$ ecm $g \leq R$. $J = I/\pi R^2 \rightarrow H_\phi(g) = \frac{1}{2\pi} \frac{g}{R^2} I$, $g \leq R$
 $H_\phi(CGS) = \frac{4\pi}{c} H_\phi(SI)$ - b amperes korr. upu nos. voka J.

$\nabla \times \vec{H} = \frac{4\pi}{c} \vec{J}$ (maecur.), $\int \nabla \times \vec{H} \cdot d\vec{s} = \oint \vec{H} \cdot d\vec{l} = \frac{4\pi}{c} \int d\phi J$, $J = \text{const}$
 $H_\phi \cdot 2\pi g = \frac{4\pi}{c} J \cdot \pi g^2 \rightarrow H_\phi(g) = \frac{2\pi}{c} g J = \frac{2\pi}{c} g \frac{I}{\pi R^2} = \frac{2}{c} \frac{g}{R^2} I$, $g \leq R$
 $H_0 g = H_\phi \rightarrow H_0(CGS) = \frac{2}{c} \frac{1}{R^2} I = \frac{4\pi}{c} H_0(SI)$. $H_0 H_\phi(CGS) = C$, $H_\phi(SI) = A/m$.

SI: $\nabla \times \vec{H} = \vec{J}$ (b SI); CGS: $\nabla \times \vec{H} = \frac{4\pi}{c} \vec{J}$ (b CGS).
 $H(A/m)$ (A/m²) $H(G)$ (cg. ruka)/cm²
 Yagobov (21/III 091.) $H_I = \frac{4}{3} \frac{I}{c R} (b CGS)$. $\omega_0(I) = \omega_0(0) + \frac{2}{5} \gamma H_I C(\frac{L_c}{R}) = \omega_0(0) + \Delta\omega$
 $\Delta\omega = \frac{2}{5} \gamma \frac{4}{3} \frac{I}{c R} \frac{L_c}{R} C = \frac{8}{15} \gamma \frac{I}{c R} C$ (CGS) - kan 17/IV 2009.

SI: $\Delta\omega(I) = \frac{2}{15\pi} \gamma C \frac{I}{R} = \frac{2}{15} \gamma C R J$, $[J] = A/m^2$, $[I/R] = A/m = [H]$ b SI.
 CGS: $\Delta\omega(I) = \frac{8\pi}{15c} \gamma C R J$, $(\frac{4\pi}{c} J)$ CGS co- b. $[J]_{SI}$, ceneb zamany
 $(R) = H(b A/m)$. $(RJ)_{CGS} = \frac{4\pi}{10^3} (RJ) A/m = \frac{4\pi}{10^3} R(m) J(A/m^2) = \frac{4\pi}{10^3} R(m) J(\frac{A}{cm^2}) \cdot 10^4$

$= \frac{4\pi}{10^3} 10^{-9} R(nm) J(A/cm^2) 10^4 = 4\pi \cdot 10^{-8} R(nm) J(A/cm^2)$, $(RJ)_{CGS} = 4\pi \cdot 10^{-8} R(nm) J$
 Tunur $R = 100 nm$ u $J = 10^7 A/cm^2$ Eyye co- b. $H(CG) = (RJ)_{CGS} = 4\pi \cdot 10^{-8} 10^2 10^7 = 4\pi \cdot 10^2$
 $\frac{\Delta\omega(J)}{2\pi} = \frac{2}{15} \gamma \frac{(RJ)_{CGS}}{2\pi} = \frac{2}{15} \cdot 3 \frac{MHz}{\text{oe}} \cdot 120 \text{ oe} \approx 50 MHz$ ($R = 100 nm$, $J = 10^7 A/cm^2$)

$\Delta\omega(J) = \frac{2}{15} \gamma R J = \frac{2}{15} \gamma \cdot [4\pi \cdot 10^{-8} R(nm) J(A/cm^2)]_{CGS}$
 26/II 091. Ecm upu paxere $W_{ce}(J)$: $m_\phi = C \sin \theta_0 (1 - \frac{1}{2} \epsilon^2 - \frac{1}{2} \delta \theta^2) + C_0 \cos \theta_0 \delta \theta$
 $\epsilon \sim \delta \theta$ a yren go S_x - mik. znenov, ϵ^2 u $\delta \theta^2 \sim S^2$. Ho znen $\sim S^2$ bunge-
 uz klagrasur. no S_x znenov b $\delta \theta$, zo ne yren. $W_{ce} \sim \delta^2 g^2 m_\phi$.

Power game zena $(\delta^2 g^2 \delta \theta^2)$ nayo upobepur. ek. van $\int d\phi \rightarrow \int d\theta$. Semana. Aste 27.
 Yoporus, zo znen. ϵ^2 znen $\approx$ nozu covnagac - Khvalk' PRB - 09. Nos sula No. EMS

Escaneado con CamScanner

$\int_{\text{core}} \left| \frac{\partial \Phi}{\partial s} \right|^2 = \frac{1}{4} \int_{\text{core}} d^2 g \left[1 - 12|z|^2 + 3|z|^4 \right]^2$
 $\int_{\text{core}} \left| \frac{\partial \Phi}{\partial s} \right|^2 = \int_{\text{core}} d^2 g \left| \frac{\partial \Phi}{\partial s} \right|^2 = \int_{\text{core}} d^2 g \left| \frac{\partial \Phi}{\partial s} \right|^2$
 $\int_{\text{core}} \left| \frac{\partial \Phi}{\partial s} \right|^2 = \frac{1}{2} \int_{\text{core}} d^2 g \left(1 - 3\bar{z}z \right)^{-1} = \frac{1}{2} \int_{\text{core}} d^2 g \left(1 + \frac{3}{2} + \frac{9}{2^2} + \dots \right) \left(1 + 3\bar{z}z + 9\bar{z}^2 z^2 + \dots \right) =$

$= \frac{1}{2} \int_{\text{core}} d^2 g \left[1 + \frac{3}{2} + \frac{9}{2^2} + 3\bar{z}z + 5\bar{z}^2 z^2 + 5\bar{z}z \right] = \frac{1}{2} \int_{\text{core}} d^2 g \left(1 + \frac{3}{2} + \frac{9}{2^2} + \dots \right) \left(1 + 3\bar{z}z + 9\bar{z}^2 z^2 + \dots \right) =$
 $= \frac{1}{2} \int_{\text{core}} d^2 g \left(1 + \frac{3}{2} + \frac{9}{2^2} + 3\bar{z}z + 5\bar{z}^2 z^2 + 5\bar{z}z \right) = \frac{1}{2} \int_{\text{core}} d^2 g \left(1 + \frac{3}{2} + \frac{9}{2^2} + 3\bar{z}z + 5\bar{z}^2 z^2 + 5\bar{z}z \right) =$
 $= \frac{1}{2} \int_{\text{core}} d^2 g \left(1 + \frac{3}{2} + \frac{9}{2^2} + 3\bar{z}z + 5\bar{z}^2 z^2 + 5\bar{z}z \right) = \frac{1}{2} \int_{\text{core}} d^2 g \left(1 + \frac{3}{2} + \frac{9}{2^2} + 3\bar{z}z + 5\bar{z}^2 z^2 + 5\bar{z}z \right) =$

$\int_{\text{core}} \left| \frac{\partial \Phi}{\partial s} \right|^2 = \frac{1}{4} \int_{\text{core}} d^2 g (1 - g^2)^2 P(z, \bar{z}) = \frac{1}{4} \int_{\text{core}} d^2 g (1 - g^2)^2 \int_0^{2\pi} d\varphi P(z, \bar{z}) =$
 $= \frac{1}{4} \int_{\text{core}} d^2 g (1 - g^2)^2 \int_0^{2\pi} d\varphi \left[1 + \bar{z}z \left(\frac{1}{g^2} + g^2 \right) \right] = \frac{2\pi}{4} \int_{\text{core}} d^2 g (1 - g^2)^2 \left[1 + \left(\frac{1}{g^2} + g^2 \right) \bar{z}z \right] =$
 $= \frac{2\pi}{4} \int_{\text{core}} d^2 g \left[(1 - g^2)^2 + \frac{1}{g^2} (1 - g^4)^2 \bar{z}z \right] = \frac{\pi}{2} \int_{\text{core}} d^2 g (1 - g^2)^2 + \frac{\pi}{2} \bar{z}z \int_{\text{core}} d^2 g (1 - g^4)^2 =$
 $= \frac{\pi}{2} \int_{\text{core}} d^2 g [1 - 2g^2 + g^4] + O(s^2) = \frac{\pi}{2} \left(\ln \frac{1}{2} - \frac{3}{4} \right) + O(s^2) = \text{const.} \sim 13/\pi \log.$

$\int_{\text{core}} \left| \frac{\partial \Phi}{\partial s} \right|^2 = \frac{1}{4} \int_{\text{core}} d^2 g (1 - g^2)^2 P(z, \bar{z}) = \frac{1}{4} \int_{\text{core}} d^2 g (1 - g^2)^2 \left[a_0 + a_1 s + \bar{a}_1 \bar{s} + a_2 s^2 + \bar{a}_2 \bar{s}^2 + b(s) s \bar{s} \right] =$
 $= \frac{1}{4} \int_{\text{core}} d^2 g (1 - g^2)^2 \left[1 + a_1 s + \bar{a}_1 \bar{s} + a_2 s^2 + \bar{a}_2 \bar{s}^2 + b(s) s \bar{s} \right] = \left[a_1 \sim e^{i\varphi} e^{-i\varphi}, a_2 \sim e^{2i\varphi} e^{-2i\varphi} \right]$

Ponee, 13/11/07, a ymomban mbo mome $\sim s^0$, mbo mome $\sim s\bar{s}$, gema
 gma $\sim s^0$ mpaupubae momep. no non-shifted core, $g_1 = c$.
 u gma $\sim a_2 s^2, a_2 \bar{s}^2, b(s) s \bar{s}$ — tume momep. mome $\sim s^2$ gma $g_1 = c$ —
 momep. mome core, no $(1 + a_1 s + \bar{a}_1 \bar{s})$ mome momep. no mome. v. core.

$J(s) = \int_{\text{core}} \left| \frac{\partial \Phi}{\partial s} \right|^2 = J(0) + \frac{1}{4} \int_{\text{core}} d^2 g \int_0^{2\pi} d\varphi \frac{(1 - g^2)^2}{g^2} [a_2 s^2 + \bar{a}_2 \bar{s}^2 + b(s) s \bar{s}] +$
 $+ \frac{1}{4} \int_{\text{core}} d^2 g \frac{(1 - g^2)^2}{g^2} [1 + a_1 s + \bar{a}_1 \bar{s}] - J(0) = \frac{2\pi}{4} \int_{\text{core}} d^2 g \frac{(1 - g^2)^2}{g^2} b(s) s \bar{s} +$
 $+ \frac{1}{4} \int_{\text{core}} d^2 g \frac{(1 - g^2)^2}{g^2} [1 + a_1 s + \bar{a}_1 \bar{s}] = \left[b(s) = \frac{1}{g^2} + g^2 + 2 = \frac{1}{g^2} (1 + g^2)^2 \right]$

$\int_{\text{core}} d^2 g \frac{(1 - g^2)^2}{g^2} b(s) = \int_{\text{core}} d^2 g \frac{(1 - g^4)^2}{g^3} = \int_{\text{core}} d^2 g [1 - 2g^4 + g^8] = \int_{\text{core}} d^2 g \left[\frac{1}{g^3} - 2g + g^5 \right] =$
 $= -\frac{2}{g^2} - \frac{2}{2} g^2 + \frac{1}{6} g^6 \Big|_c^1 = \left(-\frac{1}{2} - 1 + \frac{1}{6} \right) - \left(-\frac{1}{2} \frac{1}{c^2} - c^2 + \frac{1}{6} c^6 \right) = \frac{1}{2} \frac{1}{c^2} - \frac{4}{3} + O(c^2)$
 $J(s) = \frac{\pi}{2} s \bar{s} \left(\frac{1}{2} \frac{1}{c^2} - \frac{4}{3} \right) + \frac{1}{4} \int_{\text{core}} d^2 g \frac{(1 - g^2)^2}{g^2} [1 + a_1 s + \bar{a}_1 \bar{s}], \quad J_2(s) \sim 4 J(s)$

Ponee, 13/11/07, momep. $J_0(s) = \frac{1}{4} \int_{\text{core}} d^2 g \frac{(1 - g^2)^2}{g^2} [1 + a_1 s + \bar{a}_1 \bar{s}]$, momep
 gma $s=0$ u $g_1 = c$, momep. mome $\sim s$ u $\sim s^2$ u $J_0(s)$.
 t.e. ponee $J_0(s) \rightarrow J_0(0)$. $a_1 = \frac{1}{2} + \bar{z} = \frac{1}{g} e^{-i\varphi} + g e^{i\varphi} = \bar{z} e^{-i\varphi} (1 + g^2)$
 momep. $s = s_x$. tuma $a_1 s + \bar{a}_1 \bar{s} = s_x (a_1 + \bar{a}_1) = s_x \frac{(1 + g^2)}{g} (e^{-i\varphi} + e^{i\varphi}) =$
 $= 2s_x \frac{(1 + g^2)}{g} \cos \varphi, \quad J_0(s) = \frac{1}{4} \int_{\text{core}} d^2 g \frac{(1 - g^2)^2}{g^2} [1 + 2s_x \frac{(1 + g^2)}{g} \cos \varphi]$

27. Aste - Semana $\ln \frac{1}{c} + \pi \ln [s^2(1-s^2)] = \int \frac{ds}{(1-s^2)^{3/2}} \rightarrow D_{\frac{3}{2}}^{2v} (s)$ recomanatura no, s', v3-za kuaga bre are.

$J_2(s) = \int_{|f|>1} d^2g \frac{1}{12-s12}$ b rigid v. model (governs $W_X(s)$ or $W(s)$)

Wegen $s = s_*$, $\varphi_s = 0$, $\frac{\partial s}{\partial m}$ an der $g'_m = -3a_3 e' + \sqrt{1 - s^2 \sin^2 \varphi'}$

$$\text{Exam } J_2(s) = \int_{|s|>1} = \int_{\text{ext}} - \int_{\text{core}} \quad \text{to } J_2(s) = 2\pi \ln \frac{1}{c} + \pi \ln(1-s^2) - 2\pi \ln 2$$

депрони ододе $J_2(s) = 2\pi \ln \frac{1}{c} + \pi \ln(1-s^2)$. Дато: 1500 м

v. Core $|f(z)| = 1$ $\Rightarrow$ $\text{norm} \sim S^2$. $f(z') = -i \frac{c}{c(1+SS)} z' (\bar{S}z' + S\bar{S} - 1)$
 $|z'|^2 |z' \bar{S} + S \bar{S} - 1|^2 = c^2 (1+SS)^2 - 2p$ Core

$$(s^2-1)^2 = 1 - 2s^2 + s^4, \quad [\dots] = 1 + 2s(s^2-1)g' \cos \varphi' + s^2 g'^2 - 2s^2 + s^4 \approx |g_0 s^2| =$$

$$= 1 + \frac{1}{2} [-2s g' \cos \varphi' + s^2 (g'^2 - 2)] - \frac{1}{8} 4 s^2 g'^2 \cos^2 \varphi' = 1 - s g' \cos \varphi' + \frac{1}{2} s^2 g'^2 \sin^2 \varphi - s^2$$

Nutzen $g'(q') = c + d_1 S + d_2 S^2$, $(c + d_1 S + d_2 S^2) [1 - \cos \varphi' (c + d_1 S) + \frac{1}{2} S^2 \sin^2 \varphi']$

$$= c(1+s^2); \text{ kosp. s: } d_1 = c^2 \cos e', \text{ kosp. s': } -2c d_1 \cos e' + \frac{1}{2} c^3 \sin^2 e'$$

Значит $d_2 \approx 2C$

Da border $g^2=1 \rightarrow \beta \times \alpha \gamma' \text{ c u e n t r a m } z = s_x \text{ d y } g^1(\psi) = -s \cos \psi + \sqrt{1 - s^2 \sin^2 \psi}$

$$= \frac{1}{2} \left[\frac{1}{(z-s)} + \frac{\bar{z}}{(s\bar{z}-1)} \right] = \frac{1}{2} \left[\frac{1}{z'} + \frac{(\bar{z}' + \bar{s})}{(s\bar{z}' + \bar{s}\bar{s}-1)} \right] = \frac{1}{2} \left[\frac{1}{z'} + \frac{1}{1} + \frac{1}{1} + \frac{1}{\bar{z}' - \bar{s}} \right]$$

$$|Z'|^2 = \frac{(Z' + S')^2}{|S'Z' + S'S - 1|^2} + \frac{(Z' + S')^2}{|S'Z' + S'S - 1|^2} + \frac{1}{Z'} \frac{(Z' + S')}{(S'Z' + S'S - 1)} \quad \text{then}$$

Escaneado con CamScanner

$$J(\varphi) = 4 \int_{\varphi_{\min}}^{\varphi_{\max}} \left| \frac{\partial P}{\partial \varphi} \right|^2 = \int_0^{2\pi} d\varphi' \int_{g_{\min}}^{g_{\max}} dg' g' \frac{(1 - 12' + 512)^2}{g'^2 |52 + 35 - 11|^2}, \quad g_{\min}^{\max} = f(\varphi').$$

$$9 \quad [1 - 12' + 91']^2 = [1 - 9' + 5)(\bar{2} + \bar{5})]^2 = [1 - 9' + 5\bar{2} + 5\bar{5}]^2$$

$$= (1 - 9')^2 - 2(1 - 9')(5\bar{2} + 5\bar{5}) + (5\bar{2} + 5\bar{5})^2 + 0(5\bar{3})$$

$$J_p(s) = \int_0^1 \int_0^1 \frac{[(1-s^2)^2 - 2(1-s^2)2gs \cos \varphi - 2(1-s^2)s^2 + 4s^2g^2 \cos^2 \varphi]}{[1 - 2gs \cos \varphi + s^2(g^2 - 2)]} ds d\varphi$$

$$J_2(s) = \int_0^{2\pi} d\varphi \int_{-1}^1 \frac{dg}{g} \left[-2(1-g^2) + 4g^2 \cos^2 \varphi \right] s^2 = s^2 \cdot 2\pi \int_{-1}^1 \frac{dg}{g} \left[-2(1-g^2) + 2g^2 \right] =$$

$$= 4\pi s^2 \int_c^s \frac{dg}{g^2} [-1 + 2g^2] = 4\pi s^2 [-\ln g + g^2]_c^s = 4\pi s^2 [1 + \ln c - c^2] \approx 4\pi s^2$$

$$Y_1(s) = \int_0^s d\varphi \int \frac{ds}{s} (1-s^2) \frac{[1-s^2-4ss\cos\varphi]}{[1-2ss\cos\varphi+s^2(s^2-2)]} \quad \text{— момент раскл. по } \frac{s}{s}$$

$$J_c(s) = \int_{-\pi}^{\pi} d\varphi \int_0^1 ds (1-s^2) \frac{[-4gs \cos \varphi]}{[1-2sg \cos \varphi]} = -4g \int_{-\pi}^{\pi} d\varphi \int_0^1 ds (1-s^2) \cos \varphi [1+2sg \cos \varphi]$$

$$= -45 \int_0^{\pi} d\varphi \cos \varphi \int_{g_1(\varphi)}^{g_2(\varphi)} dg (1-g^2) [1 + 25g \cos \varphi] = -45 \int_0^{\pi} d\varphi \cos \varphi \int_{g_1(\varphi)}^{g_2(\varphi)} dg (1-g^2) - 95^2 \int_0^{2\pi} d\varphi \cos \varphi \int_1^{\frac{1}{1-\cos \varphi}} dg (1-g^2) g = -45 \int_0^{\pi} d\varphi \cos \varphi (g - \frac{1}{3}g^3) \Big|_1^{\frac{1}{1-\cos \varphi}} -$$

$$-8\pi^2 \left[\frac{1}{2} g^2 - \frac{1}{4} g^4 \right]_c = -45 \int_0^{2\pi} d\varphi \cos \varphi \left[1 - 5 \cos \varphi - \frac{1}{3} (1 - 35 \cos \varphi) - \left(c + c^2 \sin \varphi \right) \right. \\ \left. - g^3 (1 + 3c \sin \varphi) \right] = -8\pi^2 g^2 \left[\frac{1}{2} - \frac{1}{2} - \frac{1}{2} c^2 + \frac{1}{2} c^4 \right] = -45 \int_0^{2\pi} d\varphi \cos \varphi \left[-c^3 \sin \varphi \right]$$

$$-8\pi s^2 \left(\frac{1}{4} + 0(c) \right) = +4s^2 c^2 \pi - 2\pi s^2 \approx -2\pi s^2 = J_c(s)$$

14.
$$J_6(s) = \int d\varphi \frac{\left(\frac{ds}{s}\right)^2}{[1 - 2sg \cos \varphi + s^2(g^2 - 2)]}$$

$$\frac{1}{(1+\epsilon)} = 1 - \epsilon + \epsilon^2 + O(\epsilon^3), \quad \frac{1}{1+\epsilon} = 1 + 2sg\cos\varphi - s^2(g^2-2) + 4s^2g^2\cos^2\varphi$$

$$= \int d\phi \int dg \left(\frac{1}{g} - 2g + g^3 \right) \left[1 + 2s^2 + 2sg \cos\phi + s^2 g^2 (4\cos^2\phi - 1) \right] =$$

$$= \int d\varphi \left[(\ln s - s^2 + \frac{1}{4}s^4)(1+2s^2) \right]_{e(1+2s^2)+e^2 \cos 3\varphi}^{1-\sin 3\varphi - \frac{1}{2}s^2 \sin 2\varphi} + 2s \cos \varphi \left(s - \frac{2}{3}s^3 + \frac{1}{5}s^5 \right) \Big|_{s_1}^{s_2}$$

$$+ S^2 (4 \cos^2 \varphi - 1) \left(\frac{1}{2} S^2 - \frac{1}{2} S^4 + \frac{1}{8} S^6 \right) \Big|_c = (1 + 2S^2) \int d\varphi \left[\ln(1 - S \cos \varphi - \frac{1}{2} S^2 \sin^2 \varphi) - \right.$$

$$+ \frac{1}{5}(1 - \sec \varphi)^5 - (c + c^2 \sec \varphi) + \frac{2}{3}c^3(1 + \csc \varphi)^3 - \frac{1}{4}c^5(1 + \csc \varphi)^5 \Big] + 2s \int d\varphi \csc \varphi \left[1 - \sec \varphi - \frac{2}{3}(1 - \sec \varphi)^3 + \frac{1}{5}(1 - \sec \varphi)^5 - (c + c^2 \sec \varphi) + \frac{2}{3}c^3(1 + \csc \varphi)^3 - \frac{1}{4}c^5(1 + \csc \varphi)^5 \right] +$$

$$+ s^2 \int d\varphi (4 \cos^2 \varphi - 1) \left[\frac{1}{2} - \frac{1}{2} + \frac{1}{8} - \frac{1}{2} c^2 + \frac{1}{2} c^4 - \frac{1}{6} c^6 \right] = (1 + 2s^2) \int d\varphi \left[-s \cos \varphi - \frac{1}{2} s^2 \sin^2 \varphi - \frac{1}{2} s^2 \cos^2 \varphi - (1 + s^2 \cos^2 \varphi - 2s \cos \varphi - s^2 \sin^2 \varphi) + \frac{1}{6} (1 - 4s \cos \varphi - 2s^2 \sin^2 \varphi + \right.$$

$$+ 2s \int dx \cos x \left[1 - s \cos x - \frac{2}{3} (1 - 3s \cos x + 3s^2 \cos^2 x) + \frac{1}{4} (1 - 5s \cos x - 2s^2 \sin^2 x) \right] +$$

$$-c(1 + \cos \phi) + O(c^3)] + S^2 \int d\phi (4 \cos^2 \phi - 1) \frac{1}{6} = (1 + 2S^2) \left[-\frac{1}{2} S^2 \pi - \frac{1}{2} S^2 \pi \right. \\ \left. - 1 \cdot 2\pi + \frac{1}{4} \cdot 2\pi - 2S^2 \pi + 6S^2 \pi - \ln c \cdot 2\pi - 2S^2 \cdot 2\pi \right] + 75(d\phi \cos \phi \times$$

$$x \left[-5 \cos \varphi + 25 \cos \varphi - 5 \cos \varphi - c^2 5 \cos \varphi \right] + 5^2 \frac{1}{6} \pi (4-2) = \pi (1+25^2) x$$

$$= \pi(1+2s^2) \left[-\frac{3}{2} - 2\ln c - s^2 \right] + \frac{\pi}{3} s^2 + O(c^2 s^2) = \mathcal{I}_0(s)$$

$$J_p(s) = J_2(s) + J_c(s) + J_0(s) = 4\pi s^2 (1 + \ln c) - 2\pi s^2 + \pi(1+2s^2) \left[-\frac{3}{2} - 2\ln c - s^2 \right] + \frac{\pi}{3} s^2$$

$$D_{xx} = \left(-\frac{dM_{SL}}{8} \right) \int_{|s|>1} d^2\vec{s} \frac{\partial \vec{m}}{\partial s_x} \cdot \frac{\partial \vec{m}}{\partial s_x} + \frac{\partial \vec{m}}{\partial s_y} \cdot \frac{\partial \vec{m}}{\partial s_y} = (\cdot) 4 \int_{|s|>1} d^2\vec{s} \frac{\partial \vec{m}}{\partial s} \cdot \frac{\partial \vec{m}}{\partial s}$$

$$D_{xx} = \left(-\frac{dM_{SL}}{8} \right) \int_{|s|>1} d^2\vec{s} \left[\frac{\partial}{\partial s_x} \frac{\partial}{\partial s_x} + 8i^2 \frac{\partial \phi}{\partial s_x} \frac{\partial \phi}{\partial s_x} \right] = (\cdot) \int_{|s|>1} d^2\vec{s} \frac{\partial \phi}{\partial s_x} \frac{\partial \phi}{\partial s_x} - \ln c \text{ core}$$

$$T_z(\hat{D})_{\text{free}} = (\cdot) \int_{|s|>1} d^2\vec{s} \frac{\partial \phi}{\partial s_x} \frac{\partial \phi}{\partial s_x} = 4 \int_{|s|>1} d^2\vec{s} \left| \frac{\partial \phi}{\partial s} \right|^2 (\cdot) = (\cdot) \cdot J_p(s), (\cdot) = \left(-\frac{dM_{SL}}{8} \right)$$

$$D_{xx} = \frac{1}{2} [T_z(\hat{D})_{\text{core}} + T_z(\hat{D})_{\text{free}}] = (\cdot) 2\pi(1+2s^2) + (\cdot) \frac{1}{2} J_p(s)$$

$$D_{xx}(s=0) = (\cdot) \left[2\pi - \pi \left(\frac{3}{4} + \ln c \right) \right] = (\cdot) 2\pi \left[1 - \frac{3}{8} - \frac{1}{2} \ln c \right] =$$

$$d(s) = -\frac{D_{xx}}{|G|} = \frac{dM_{SL} \cdot 2\pi}{8 \cdot 2\pi M_{SL}} [\cdot] = d[\cdot] \quad \left(= (\cdot) 2\pi \left[\frac{5}{8} + \frac{1}{2} \ln \frac{1}{c} \right] - \ln c \right)$$

$$[\cdot] = (1+2s^2) + \frac{1}{4\pi} J_p(s) = 1+2s^2 + \frac{1}{4\pi} J_p(s)$$

$$J_p(s) = 4\pi s^2 (1 + \ln c) - 2\pi s^2 + \pi(1+2s^2) \left[-\frac{3}{2} - 2\ln c - s^2 \right] + \frac{\pi}{3} s^2 =$$

$$= J_p(0) + 4\pi s^2 + 4\pi s^2 \ln c - 2\pi s^2 + 2\pi s^2 \left[-\frac{3}{2} - 2\ln c \right] - \pi s^2 + \frac{\pi}{3} s^2 =$$

$$= J_p(0) + \pi s^2 \left[4 + 4\ln c - 2 - 3 - 4\ln c - 1 + \frac{1}{3} \right] = J_p(0) - \frac{5}{3} \pi s^2$$

$$\frac{1}{2} d(s) = 1 + 2s^2 + \frac{1}{4\pi} \left[-2\pi \left(\frac{3}{4} + \ln c \right) - \frac{5}{3} \pi s^2 \right] =$$

$$= 1 - \frac{3}{8} - \frac{1}{2} \ln c + s^2 \left[2 - \frac{5}{3} - \frac{1}{4} \right] = \frac{5}{8} + \frac{1}{2} \ln \frac{1}{c} + \frac{19}{12} s^2$$

Nonlinear damping $d(s) = d \left[\frac{5}{8} + \frac{1}{2} \ln \frac{1}{c} + \frac{19}{12} s^2 \right] = d_0 + d_1 s^2$ pole free model.

$d_0 = d \left(\frac{5}{8} + \frac{1}{2} \ln \frac{1}{c} \right) - \ln c$ b core J.Ph.'11, $d_1 = d \frac{19}{12}$ - core or J.Ph.'11

Rigid v. model (free core) $J_p(s) = 4 \int_{|s|>1} d^2\vec{s} \left| \frac{\partial \phi}{\partial s} \right|^2 = \int_{|s|>1} \frac{d^2\vec{s}}{12-s^2} = 2\pi \ln \frac{1}{c} - \pi s^2$

Pole-free model (free core) $J_p(s) = 4 \int_{|s|>1} d^2\vec{s} \left| \frac{\partial \phi}{\partial s} \right|^2 = J_p(0) - \frac{5}{3} \pi s^2 =$

$$= 2\pi \ln \frac{1}{c} - \frac{3}{2} \pi - \frac{5}{3} \pi s^2$$

Nonlinear damping vortex:

- 1) $\frac{1}{2} d(s) = 1 + \frac{1}{2} \ln \frac{1}{c} - \frac{1}{4} s^2$ - rigid v. (gobabur core s^2 - non core) $- \ln c = 0$
- 2) $\frac{1}{2} d(s) = \frac{5}{8} + \frac{1}{2} \ln \frac{1}{c} + \frac{19}{12} s^2$ - pole free model.

Core-buag v.v. model $T_z(\hat{D})_{\text{core}} = (\cdot) 4 \int_{|s|<1} d^2\vec{s} \frac{\partial \vec{m}}{\partial s} \cdot \frac{\partial \vec{m}}{\partial s} = 8 \int_{|s|<1} \frac{d^2\vec{s}}{(1+s^2)^2} \left[\frac{\partial \phi}{\partial s} \frac{\partial \phi}{\partial s} + \frac{\partial \phi}{\partial s} \frac{\partial \phi}{\partial s} \right]$

$f(z) = \frac{i}{c} C(z-s)$, $\frac{\partial \phi}{\partial s} = -\frac{i}{c} C$, $\frac{\partial \phi}{\partial \bar{s}} = 0$. $T_z(\hat{D}) = 8(\cdot) \int_{|s|<1} \frac{d^2\vec{s}}{(1+s^2)^2} \frac{1}{c^2} =$

$$= 8(\cdot) \int_{\text{core}} \frac{d^2\vec{s}}{(1+\frac{R^2-s^2}{c^2})^2} \frac{1}{c^2} = \frac{8}{c^2} (\cdot) \int_{|s|<1} \frac{d^2\vec{s}}{[1+\frac{s^2}{c^2}]^2} - \ln s^2 \text{ ne zabur}$$

Nonlinear damping vortex: $d(s)$ - pole free model $\ln c$ b core, $\ln c$ a free core.

+Bubog: b rigid v. model damping $d(s)$ nagas $c s^2$ (vortex $s(s)$)

a pole-free model $d(s)$ nagas $c s^2$, + v.vortex $\ln c$ nagas $c s^2$

Peres J.Ph.'11 $\ln c$ $d_1 = d \frac{1}{4} \left(\frac{1}{c^2} - \frac{8}{3} \right)$ - core $\ln c$ d_1

+Bubog, gene v.v. $s^2 \rightarrow 1$ $d_1 s^2$ - nonlin - buag $\ln c$ $\ln c$ - d_0

Hamca Slaviny o $d(s)$ - damping u Anhoa - Zampoc cubebur Iberl, Me. v.v. - v.v. s^2

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Nuan Sums, paper (cu. Oct. 18, 2011):

Asteazkena • Miércoles

EKAINA / JUNIO 2007

L	M	M	J	V	S	D
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

L	M	M	J	V	S	D
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

- 1) Nanotubes - DW papers c Ai Ping - subm. JMMM, positive resp. 14/10/12 - accepted 23/12
- 2) Non-linear vortex St dyn., noise, oscillators - Ouc, Rapa, Slavin
- 3) Curvature, phase lock., dyn. of dot pairs - Zhegum, Cros, Le Loubens
- 4) VC switch. vs. time in H_1 , h_x -pulses, v. barrier - Le Loubens
- 5) Multipole coupl. and vort. dynamics in 1D-, 2D-arrays - Ouc.
- 6) M. dynamics - FMR in F/N/F nanowires - Paprag Subm. APL Apr. 19, 2012
- 7) Review Nature Com. - Shindou, Nat. Sci. Rep. - Oami - op. review, Ph. Lett., JMMM
- 8) FMR + pumping in dot arrays - Menev, Cuabun Subm. Sci. Rep. - accepted
- 9) Julian's paper Conf. WMM'12 no refinement - hefegeu. no one organizes referees pull process

Apr. Bonpasen:

- 1) M. Sums. Menev u Berpa b San. Seb. b Oct. 2012, Cuabun b Nov. 2012
- 2) Conf. b Turkey, Karsel., Ligon, Parma - go July 9 - ~~Ormenio Hotel~~ ~~S. Marg. Magnon~~ ~~Hotels Parma, Milan 2012~~
- 3) Kb./gan, Menev b San. Seb., Konzept. \$ → €
- 4) ~~Corcoran MICINN Travel - Portugal Grant + comp. Ouc. b Porto - ECSE UBA~~ (Julian)
- 5) Mogen gov. na Anton's passport u K/A. u Ant. P. M. b Spain
- 6) Visit na Ant. u Menev b San. Seb. - genap - ~~agarrar appointment~~ May 10
- 7) Mogen. genap na ICSM Turkey (Ant. M. S. F. M. F., v. dot pair u Ouc)
- 8) Gao u. M. Laptop b repair or change it.
- 9) Menev Invt. letters to Melba u Verba u A. Magnon reponz ruf
- 10) Menev za ob. ob. Postdo. Basque Country gene Unai b Menev July 6

dir. moment good $M_d = M_s V_d \hat{j}$, $\hat{j} = \langle \vec{m} \rangle / M_s = \langle \vec{m} \rangle / M_s$. $\frac{1}{4} \pi R^2 L$.
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Lunes • Astellechena

$$U_{int} = \sum_{Lnn'} \frac{1}{R^{L+1}} U_L(\phi_{nn'}) = \sum_{Lnn'} \frac{C_n C_{n'}}{R^{L+1}} (-8\pi^2 M_s^2 \beta^2) (L-1)!! (L-3)!! \Gamma(L) R^{L+1} \times$$
$$\times [(L-1)a_{nn'} + (L+1)b_{nn'}] = (-8\pi^2 M_s^2 \beta^2) \sum_{Lnn'} 2 \frac{R^{L+1}}{R^{L+1}} \frac{C_n C_{n'}}{R^{L+1}} (L-1)!! (L-3)!! \Gamma(L) [\bar{S}_n \bar{S}_{n'} - (L+1) \frac{(\vec{m}_n \cdot \vec{m}_{n'})}{R^2}]$$
$$(\vec{m}_1 \cdot \vec{R})(\vec{m}_2 \cdot \vec{R}) = \frac{1}{2}(\vec{m}_1 \cdot \vec{m}_2) + \theta, \theta=0 \text{ que es in-phase mode } \vec{m}_1 = \vec{m}_2$$
$$[\vec{m}_1 \cdot \vec{m}_2 - (L+1)(\vec{m}_1 \cdot \vec{R})(\vec{m}_2 \cdot \vec{R})] = [\vec{m}_1 \cdot \vec{m}_2 - (L+1) \frac{1}{2} \vec{m}_1 \cdot \vec{m}_2] = \frac{1}{2} \vec{m}_1 \cdot \vec{m}_2 [2 - (L+1)] =$$
$$= -\frac{1}{2} \vec{m}_1 \cdot \vec{m}_2 (L-1), \theta=0. 1,2 \rightarrow n,n'. \text{ W probefun } (L=2) \text{ dip. dip. zero}$$
$$\Gamma(2) = \frac{1}{4} 8! = \frac{1}{4} (3!)^2 = \frac{1}{4} \cdot \frac{1}{9}, (L-3)!! = \frac{(4-1)!!}{(2-1)} \rightarrow (-1)!! = \frac{1!!}{1} = 1$$

$$U_{int}^{dip-dip} = 16\pi^2 M_s^2 R^3 \beta^2 \frac{1}{32} \sum_{nn'} \frac{R^3}{R^3} \frac{1}{4 \cdot 9} [\vec{m}_n \cdot \vec{m}_{n'} - \frac{3}{R^2} (\vec{m}_n \cdot \vec{R})(\vec{m}_{n'} \cdot \vec{R})]$$
$$\frac{16}{32} \frac{1}{4 \cdot 9} = 16 \frac{9}{4} \cdot \frac{1}{4 \cdot 9} = 1 \rightarrow U_{int}^{dip-dip} = \frac{M_s^2 V_d^2}{R^3} \sum_{nn'} \frac{1}{d_{nn'}^3} [\vec{m}_n \cdot \vec{m}_{n'} - 3(\vec{m}_n \cdot \vec{R})(\vec{m}_{n'} \cdot \vec{R})]$$

2D vortex dot array

$$U(\vec{s}) = \frac{1}{2} \sum_n \alpha_n S_n \bar{S}_n + U_{int}(\vec{s}), iG_{zn} \dot{S}_n = 2 \frac{\partial U}{\partial \bar{S}_n}, U \rightarrow U/R^2$$
$$\bar{S}_n \cdot S_{n'} = \frac{1}{2} (S_n \bar{S}_{n'} + \bar{S}_n S_{n'}), (\bar{S}_n \cdot \vec{R}_{nn'}) = \frac{1}{2} (S_n \bar{R}_{nn'} + \bar{S}_n R_{nn'})$$
$$U_{int} = - (16\pi^2 M_s^2 R^3 \beta^2) \sum_{Lnn'} \frac{R^{L+1}}{R^{L+1}} P_L C_n C_{n'} [L \bar{S}_n \cdot \bar{S}_{n'} - (L+1) (\bar{S}_n \cdot \vec{R}_{nn'}) (\bar{S}_{n'} \cdot \vec{R}_{nn'})]$$
$$P_L = \frac{(L-1)!! (L-3)!!}{L!} \Gamma(L), (\bar{S}_n \cdot \vec{R})(\bar{S}_{n'} \cdot \vec{R}) = \frac{1}{4} (S_n \bar{R} + \bar{S}_n R)(S_{n'} \bar{R} + \bar{S}_{n'} R), R = R_x + iR_y$$
$$2 \frac{\partial U_{int}}{\partial \bar{S}_n} = -(-1) \sum_{Lnn'} \frac{R^{L+1}}{R^{L+1}} P_L C_n C_{n'} [L S_{n'} - (L+1) \frac{R_{nn'}}{2} (S_{n'} \bar{R} + \bar{S}_{n'} R)] = iG_{zn} \dot{S}_n$$

3d vortex array, choques $\ll (3\pi/4)$: $-ip_n \dot{Z}_n = \omega_0 Z_n + \frac{1}{|G|} \sum_{n'} J_{nn'} Z_{n'}$

$$iG_{zn} \dot{S}_n = 2 \frac{\partial}{\partial \bar{S}_n} [\frac{1}{2} \sum_n \alpha_n S_n \bar{S}_n + U_{int}] = \alpha_n S_n + 2 \frac{\partial U_{int}}{\partial \bar{S}_n}$$
$$G_{zn} = -pn|G|, iG_{zn} \dot{S}_n = iG_{zn} i\omega S_n = pn|G|\omega S_n = \alpha_n S_n + 2 \frac{\partial U_{int}}{\partial \bar{S}_n}$$
$$(pn\omega = \omega_0) S_n = \frac{2}{|G|} \frac{\partial U_{int}}{\partial \bar{S}_n} \text{ a known comp. } (pn\omega = \omega_0) \bar{S}_n = \frac{2}{|G|} \frac{\partial U_{int}}{\partial S_n}$$
$$S_n(t) = S_n(\omega) e^{i\omega t}, \bar{S}_n(t) = \bar{S}_n(\omega) e^{-i\omega t}. \text{ yD que } S_n(\omega), \bar{S}_n(\omega).$$

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Para $C_n = \text{const}$ nueva.

$$2 \frac{\partial U_{int}}{\partial \bar{S}_n} = -(-1) \sum_{Lnn'} \frac{R^{L+1}}{R^{L+1}} P_L [L S_{n'} - \frac{1}{2} (L+1) R_{nn'} (S_{n'} \bar{R} + \bar{S}_{n'} R)]$$
$$\bar{R}_{nn'} = \bar{R}_{nn'}/|\bar{R}_{nn'}| \text{ -eq. vector, } R \bar{R} = |R|^2 = 1, [\cdot] = \frac{1}{2} (L+1) [(L-1) S_{n'} - (L+1) \bar{S}_{n'} R_{nn'}^2]$$
$$-ipn|G| \dot{S}_n = \alpha_n S_n - (-1) \sum_{Lnn'} \frac{P_L}{2} [L S_{n'} - (L+1) R_{nn'}^2 \bar{S}_{n'}]$$

para ω yD que $(L=2)$ -case, genera ω y k -Fourier transform.

Tranva PRBCC
Semana 29

$$U_{\text{tail}} = \frac{1}{2} \frac{1}{m} \left(\frac{1}{2} \right) = \frac{8}{2\pi m g L} \cdot 16 \pi^2 M_0^2 R^2 \beta^2 = 8 \pi^2 M_0 \beta = 2 \omega_M \beta$$

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$$-i p_n \dot{S}_n = \omega_0 S_n - \omega_M \beta \sum_{L, n'} \frac{P_L}{d_{nn'}^{L+1}} \left[(L+1) \frac{S_{n'}}{d_{nn'}^{L+1}} - (L+1) \frac{S_n}{d_{nn'}^{L+1}} \right]$$

Myer: $P_n = +1$ - aligned dot array, bca v. vore polarizations are parallel
Asteartea: Martes

$$\begin{cases} -i \dot{S}_n = \omega_0 S_n - \omega_M \beta \sum_{n'} \left[J_1(d_{nn'}) S_{n'} - J_2(d_{nn'}) \bar{S}_{n'} \right] \\ +i \dot{\bar{S}}_n = \omega_0 \bar{S}_n - \omega_M \beta \sum_{n'} \left[J_1(d_{nn'}) \bar{S}_{n'} - J_2(d_{nn'}) S_{n'} \right] \end{cases}, R_{nn'} = \frac{R_n^2}{d_{nn'}^2}$$

$$S_n = \sum_{\vec{k}} S_{\vec{k}} e^{i \vec{k} \cdot \vec{R}_n}, \bar{S}_n = \sum_{\vec{k}} S_{\vec{k}}^{\dagger} e^{-i \vec{k} \cdot \vec{R}_n}, S_{\vec{k}}(t) = S_{\vec{k}} e^{i \omega_0 t}$$

$$\sum_{n'} J_1(d_{nn'}) S_{n'} = \sum_{n'} J_1(\vec{R}_n - \vec{R}_{n'}) \sum_{\vec{k}} S_{\vec{k}} e^{i \vec{k} \cdot \vec{R}_{n'}} = \sum_{\vec{k}} \sum_{n'} J_1(\vec{R}_n - \vec{R}_{n'}) e^{i \vec{k} \cdot (\vec{R}_n - \vec{R}_{n'})} S_{\vec{k}}$$

$$\times S_{\vec{k}} e^{i \vec{k} \cdot \vec{R}_n} = \sum_{\vec{k}} S_{\vec{k}} e^{i \vec{k} \cdot \vec{R}_n} \sum_{n'} J_1(\vec{R}_n - \vec{R}_{n'}) e^{i \vec{k} \cdot (\vec{R}_n - \vec{R}_{n'})} = \sum_{\vec{k}} S_{\vec{k}} e^{i \vec{k} \cdot \vec{R}_n} J_1(\vec{k})$$

$$J_1(\vec{k}) = \sum_n J_1(\vec{R}_n) e^{i \vec{k} \cdot \vec{R}_n}, \vec{R}_n = a(n_1, n_2) - \text{bepor } 2D - \text{pemasu}$$

$$-i \sum_{\vec{k}} \dot{S}_{\vec{k}} e^{i \vec{k} \cdot \vec{R}_n} = \omega_0 \sum_{\vec{k}} S_{\vec{k}} e^{i \vec{k} \cdot \vec{R}_n} - \omega_M \beta \sum_{\vec{k}} J_1(\vec{k}) S_{\vec{k}} e^{i \vec{k} \cdot \vec{R}_n} + \omega_M \beta \sum_{\vec{k}} J_2(\vec{k}) S_{\vec{k}}^{\dagger} e^{i \vec{k} \cdot \vec{R}_n}$$

$$\sum_{n'} J_2(d_{nn'}) \bar{S}_{n'} = \sum_{n'} J_2(\vec{R}_n - \vec{R}_{n'}) \sum_{\vec{k}} S_{\vec{k}}^{\dagger} e^{-i \vec{k} \cdot \vec{R}_{n'}} = \sum_{\vec{k}} S_{\vec{k}}^{\dagger} e^{-i \vec{k} \cdot \vec{R}_n} \sum_{n'} J_2(\vec{R}_n - \vec{R}_{n'}) e^{i \vec{k} \cdot (\vec{R}_n - \vec{R}_{n'})}$$

$$\sum_n J_2(\vec{R}_n) e^{i \vec{k} \cdot \vec{R}_n} = J_2(-\vec{k}) = J_2(\vec{k}) - ? \quad \text{Ecan } J_2(\vec{R}) = \text{rec. to } J_2(\vec{k}) = J_2(\vec{k})$$

$$\sum_{n'} J_2(d_{nn'}) \bar{S}_{n'} = \sum_{\vec{k}} S_{\vec{k}}^{\dagger} e^{-i \vec{k} \cdot \vec{R}_n} J_2(\vec{k}) = \sum_{\vec{k}} S_{\vec{k}}^{\dagger} e^{i \vec{k} \cdot \vec{R}_n} J_2(\vec{k})$$

$$\begin{cases} -i \dot{S}_{\vec{k}} = \omega_0 S_{\vec{k}} - \omega_M \beta J_1(\vec{k}) S_{\vec{k}} + \omega_M \beta S_{-\vec{k}}^{\dagger} J_2(\vec{k}) \\ i \dot{S}_{-\vec{k}}^{\dagger} = \omega_0 S_{-\vec{k}}^{\dagger} - \omega_M \beta J_1(\vec{k}) S_{-\vec{k}}^{\dagger} + \omega_M \beta S_{\vec{k}} J_2(\vec{k}) \end{cases}$$

$$\begin{cases} \omega S_{\vec{k}} = \omega_0 S_{\vec{k}} - \omega_M \beta J_1(\vec{k}) S_{\vec{k}} + \omega_M \beta S_{-\vec{k}}^{\dagger} J_2(\vec{k}) \\ -\omega S_{-\vec{k}}^{\dagger} = \omega_0 S_{-\vec{k}}^{\dagger} - \omega_M \beta J_1(\vec{k}) S_{-\vec{k}}^{\dagger} + \omega_M \beta J_2(\vec{k}) S_{\vec{k}} \end{cases}$$

$$\begin{pmatrix} \omega - \omega_0 + \omega_M \beta J_1 & -\omega_M \beta J_2 \\ -\omega_M \beta \bar{J}_2 & -\omega - \omega_0 + \omega_M \beta \bar{J}_1 \end{pmatrix} \begin{pmatrix} S_{\vec{k}} \\ S_{-\vec{k}}^{\dagger} \end{pmatrix} = 0$$

$$-(\omega - \omega_0 + J_1)(\omega + \omega_0 - \bar{J}_1) - |J_2|^2 = 0, J_1(\vec{k}) = \text{beng.}$$

$$0 = -\omega^2 + (J_1 - \omega_0)^2 - |J_2|^2, \omega_{\vec{k}}^2 = [J_1(\vec{k}) - \omega_0]^2 - |J_2(\vec{k})|^2$$

$$\omega^2(\vec{k}) = [\omega_0 - \omega_M \beta J_1(\vec{k})]^2 - [\omega_M \beta |J_2(\vec{k})|]^2, J_2 \text{ cheng c } M=12 \text{ (2nd)}$$

$$\omega^2(\vec{k}) = [\omega_0 + \omega_M \beta \sum_{-}(\vec{k})][\omega_0 + \omega_M \beta \sum_{+}(\vec{k})] \quad \text{Zucuprime SK e pambaku wady d}$$

$$\sum_{\pm}(\vec{k}) = \pm J_1(\vec{k}) \pm |J_2(\vec{k})| - \text{npumun u eqs, b papme Galkin PRB}$$

$$\text{to y mame } J_1(\vec{k}) \text{ u } J_2(\vec{k}) \text{ cogermer ne torono dip. (L=2)}$$

$$\text{bunag, no u bunagu v/pouz. L.}$$

$$12/10 \text{ C.A. u A. b police : nanyzmen cupabun o Spanish Residence, genib. 3. m.}$$

$$J_1(\vec{k}) = \sum_n J_1(\vec{R}_n) e^{-i \vec{k} \cdot \vec{R}_n}, J_1(\vec{R}_n) = \sum_L \frac{P_L(L-1)}{d_{nn}^{L+1}}$$

$$J_2(\vec{k}) = \sum_n J_2(\vec{R}_n) e^{i \vec{k} \cdot \vec{R}_n}, J_2(\vec{R}_n) = \sum_L \frac{P_L(L+1)}{d_{nn}^{L+1}} R_n^2, \vec{R}_n = \frac{d_n}{H_n} = \frac{d_n}{H_n}$$

$$\text{Ecan (L=2) quadrup. bca gousuno cbeccue u Galkin PRB-06, } J_1(\vec{R}_n) = \frac{P_2}{d_n^3}$$

$$J_2(\vec{R}_n) = 3 \frac{P_2}{d_n^3} R_n^2, P_2 = P_2(L=2) = (L-1)!! \frac{L-1}{2}!! \prod(2) = \prod(2)$$

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$$\sum_{\vec{k}} (\vec{k}) = -J_1(\vec{k}) + |J_2(\vec{k})|, \quad J_1(\vec{k}_n) = \frac{\pi(2)}{d_n^3}, \quad J_2(\vec{k}_n) = 3\pi(2) \frac{R_n^2}{d_n^3}$$

$$J_1(\vec{k}) = \frac{\pi(2)}{d_n^3} \sum_{\vec{k}} e^{i\vec{k}\vec{Q}_n} = \pi(2) \delta(\vec{k}) d_n^{-3}, \quad J_2(\vec{k}) = 3\pi(2) \sum_n \frac{R_n^2}{d_n^3} e^{i\vec{k}\vec{Q}_n}$$

$$J_2(\vec{k}) = 3\pi(2) \sum_n \frac{(\vec{Q}_n + i d_n^2 \vec{k})^2}{d_n^5} e^{i\vec{k}\vec{Q}_n}, \quad \vec{Q}_n = d\vec{k}(n_1, n_2), \quad d - \text{непосредственная квадратная}$$

$$\sum_{\vec{k}} (\vec{k}) = -J_1(\vec{k}) + |J_2(\vec{k})|, \quad J_1(\vec{k}_n) = \frac{\pi(2)}{d_n^3}, \quad J_2(\vec{k}_n) = 3\pi(2) \frac{R_n^2}{d_n^3}$$

$$J_1(\vec{k}) = \frac{\pi(2)}{d_n^3} \sum_{\vec{k}} e^{i\vec{k}\vec{Q}_n} = \pi(2) \delta(\vec{k}) d_n^{-3}, \quad J_2(\vec{k}) = 3\pi(2) \sum_n \frac{R_n^2}{d_n^3} e^{i\vec{k}\vec{Q}_n}$$

$$J_2(\vec{k}) = 3\pi(2) \sum_n \frac{(\vec{Q}_n + i d_n^2 \vec{k})^2}{d_n^5} e^{i\vec{k}\vec{Q}_n}, \quad \vec{Q}_n = d\vec{k}(n_1, n_2), \quad d - \text{непосредственная квадратная}$$

$z(k) = 3n(2) \partial_c(k) d^{-3} \partial_c(k), \partial_c(k) - \text{Jof. Galkin, P.K. Zuck. Astazkena}$

~~$$\xi_+(k) = -\pi(2) \partial(k) d^{\frac{3}{2}} \pm 3\pi(2) |\partial_c(k)| d^{\frac{3}{2}} = \pi(2) [-\partial(k) \pm 3|\partial_c(k)|] d^{\frac{3}{2}}$$~~

$$= -\pi(2) \mathcal{B}(0) \frac{1}{d^3} + \pi(2) [\mathcal{B}(0) - \mathcal{B}(k) \pm 3|\mathcal{B}_c(k)|] \frac{1}{d^3} = \frac{\pi(2)}{d^3} [-\mathcal{B}(0) + \mathcal{B}(0) - \mathcal{B}(k) \pm 3|\mathcal{B}_c(k)|]$$

тогда $\omega_{\text{мр}}(-1) \frac{\pi(2)}{d^3} z(0)$ включаем в ω_0 . $\omega_G = \omega_0 - \omega_{\text{мр}} \frac{\pi(2)}{d^3} z(0)$

$$q_{\text{int}} = \omega_{\text{MP}} \frac{\pi(2)}{d^3} = \frac{1}{36} \omega_{\text{MP}} \frac{1}{d^3} = \frac{1}{36} \omega_{\text{M}} \frac{R_L^2}{d^3} - \text{8 normen van } d^3 \text{ Gallin' PRP}$$

Briefing: $\Gamma(2) = 1/36$ Gaer Coenageme Wint c Galkin, t.e. Galkin'06
Dale-free model. $w_i = v_i(t)$ $\vec{r}_n = d(n_1, n_2)$.

$$\omega^2(k^2) = [\omega_G + \beta \omega_M \sum_-(k^2)] [\omega_G + \beta \omega_M \sum_+(k^2)]$$

Bsp. v. mod. uniaxial $\omega_G = \omega_0 - \omega_{int} z(0)$, $\Sigma_+(k) = \frac{\pi(2)}{2} [z(0) - z(k) \pm j|z_c(k)|]$

$$\zeta(0)=0, \quad \sum_{\pm} \zeta(\vec{k}=0) = 0 \quad \text{u} \quad \omega^2(\vec{k}=0) = \omega_G^2(d).$$

Но я номер gave me Galkin' PRB'06 y imobane arbitrary $L = l + l'$ - ar.
 $\rightarrow \dots \rightarrow (\vec{\sigma}_n) = i\vec{k} \cdot \vec{P}_n \rightarrow i\vec{k} \cdot \vec{P}_n = 11 \cdot 10$ $\frac{l, l'}{l, l'}$ - never.

$$y(\vec{k}) = \sum_n y_1(\vec{q}_n) e^{i\vec{k} \cdot \vec{q}_n} = \sum_n e^{i\vec{k} \cdot \vec{q}_n} \sum_L \frac{(L-1)\rho_L}{d_n^{L+1}} = \sum_L \frac{(L-1)\rho_L}{d_n^{L+1}} \sum_n \frac{e^{i\vec{k} \cdot \vec{q}_n}}{(n_1^2 + n_2^2)^{\frac{L+1}{2}}}$$

$$\text{Def. } \underline{\partial_{L/2}(\vec{k})} = \sum_n \frac{e^{ikR_n}}{(n_x^2 + n_y^2)^{\frac{L+1}{2}}} \quad \text{and} \quad \underline{\partial_1(\vec{k})} = \sum (L-1) \rho_L \underline{\partial_{L/2}(\vec{k})}$$

$$J_2(\vec{k}) = \sum_n J_2(\vec{Q}_n) e^{i\vec{k} \cdot \vec{Q}_n} = \sum_n e^{i\vec{k} \cdot \vec{Q}_n} \sum_{L+1} \frac{P_L}{L+1} R_n^2 = \sum_{L+1} \frac{P_L}{L+1} \sum_n R_n^2 e^{i\vec{k} \cdot \vec{Q}_n}$$

$$\text{Def. } \psi_{1/2}^c(\vec{k}) = \sum_n \frac{Q_n e^{i\vec{k}\vec{r}_n}}{\sqrt{L}} = \sum_n \frac{d_n^{L+1}}{\sqrt{L}} \frac{1}{n} [n_1^2 + n_2^2]^{\frac{L+1}{2}} e^{i\vec{k}\vec{r}_n}$$

$$\frac{1}{n} \frac{(n_1^2 + n_2^2)^{\frac{L+1}{2}}}{(n_1^2 + n_2^2)^{\frac{L+3}{2}}} = \frac{1}{n} \frac{(n_1^2 + n_2^2)^{\frac{L+1}{2}}}{(n_1^2 + n_2^2)^{\frac{L+3}{2}}} e^{i \vec{k} \cdot \vec{r}_{12}}$$

$$\sum_{k=0}^L \gamma_k(k) = -\gamma_1(0) + [\gamma_1(0) - \gamma_1(k) \pm |\gamma_2(k)|], \quad [\dots]_{k=0}^L = 0.$$

Given two-wave $k=0$ no spin up-down interaction coupling $= -J_1(0)$, and

$$\omega_G(d) = \omega_0 - \omega_M \beta J_1(0), \quad \omega_G(d) = \omega_0 - \beta \omega_M \sum_L (L-1) \rho_L \frac{\partial \omega_2(0)}{\partial L+1}, \quad d_1 = 2$$

$\omega(\vec{k}=0) = \omega_{\vec{k}} - \text{gno Zonen vortex excitations.}$

B) 1st approximation (a one variable if $\mu \rightarrow 0$) $\omega(\vec{k}) = \omega_G + v_F |\vec{k}|, \vec{k} \rightarrow 0$.

$$v = \omega_m L \frac{\pi}{18 d^2} \quad v_{\max} (2R=D, d=2) = \omega_m L \frac{\pi}{18 \cdot 4} = 0,044 \omega_m L$$

$v_{\text{max}} = 4.4 \cdot 10^{-2} \cdot 30 \text{ GHz} \cdot 20 \text{ nm} \cdot 2\pi \approx 26 \text{ m/s} (2\pi) \text{ fine structure, hyperfine prob.}$
 - slow waves (small group velocity)

slow waves (small group velocity). $\chi_{\pm}(\vec{k}) = [\chi_1(\omega) - \chi_2(k) \pm |\chi_2(\vec{k})|]$
 $\omega = \omega_0$ because ω_0 : $\omega_{\pm} = \omega_0 - \omega_{AB} \chi_1(\omega)$

Then $\vec{k} = \frac{1}{R}(\frac{\pi}{2}, 0)$ - corresponds 1st Brill. zone (maine dn) high multipole

moments are important. $(kR_n)_{B.Z.} = k_1 R_n^* = \frac{\pi}{d} d n_1 = \pi n_1$, $e^{i\pi n_1} = (-1)^{n_1}$
 $\beta(0) = 9.034$ con. Galkin 'PRB' 06.

$$\omega_G(d) - \omega_c = -\omega_{mp} \frac{1}{36} \frac{2(0)}{13} \approx -30 \text{ GHz} \cdot 0.1 \frac{9}{26 \cdot 13} = \left| d = \frac{2}{\min} \right| = 30 \text{ GHz} \frac{1}{\min} \approx 100 \text{ MHz}$$

Edited the Multinational Water Table in 1990. Over 100 countries participated in the project. Semana • Aste 29

the multipole paper file is now, etc., copy it in now $\omega(k)$
 $k \parallel (1,0), (1,1)$ and give Bragg at $L=2,4,6$

Pol-free model $\Pi(2) = \frac{1}{36}$. Liquid v. model $g_1 = \frac{1}{2}$, $\Pi(2) = \frac{1}{4} g_1^2 = \frac{1}{4}$.
 $\sum_{\pm}(\vec{k}) = -J_1(\vec{k}) \pm |J_2(\vec{k})|$, $J_1(\vec{R}_n) = \frac{\Pi(2)}{d^3}$, $J_2(\vec{R}_n) = 3\Pi(2) \frac{R_n^2}{d^3}$
 $J_1(\vec{k}) \pm \Pi(2) \sum_n \frac{e^{i\vec{k}\vec{R}_n}}{d^3} = \Pi(2) \delta(\vec{k}) d^{-3}$, $J_2(\vec{k}) = 3\Pi(2) \sum_n \frac{R_n^2}{d^3} e^{i\vec{k}\vec{R}_n}$
 $J_2(\vec{k}) = 3\Pi(2) \sum_n \frac{(d^2(n_1^2 + n_2^2))^2}{d^3} e^{i\vec{k}\vec{R}_n}$, $\vec{R}_n = d\vec{R}(n_1, n_2)$, d - nearest square lattice

$J_2(\vec{k}) = 3\Pi(2) \delta_c(\vec{k}) d^{-3}$, $\delta_c(\vec{k})$ - def. Galkin, PRB '06. Asteazkena
 $\sum_{\pm}(\vec{k}) = -\Pi(2) \delta(\vec{k}) d^{-3} \pm 3\Pi(2) |\delta_c(\vec{k})| d^{-3} = \Pi(2) [-\delta(\vec{k}) \pm 3|\delta_c(\vec{k})|] d^{-3}$
 $= -\Pi(2) \delta(0) d^{-3} + \Pi(2) [\delta(0) - \delta(\vec{k}) \pm 3|\delta_c(\vec{k})|] d^{-3} = \frac{\Pi(2)}{d^3} [-\delta(0) + \delta(0) - \delta(\vec{k}) \pm 3|\delta_c(\vec{k})|]$

then $\omega_{MP}(-1) \frac{\Pi(2)}{d^3} \delta(0)$ known as ω_0 . $\omega_c = \omega_0 - \omega_{MP} \frac{\Pi(2)}{d^3} \delta(0)$
 $\omega_{int} = \omega_{MP} \frac{\Pi(2)}{d^3} = \frac{1}{36} \omega_{MP} \frac{1}{d^3} = \frac{1}{36} \omega_M \frac{R_L^2}{d^3}$ - known as ω_{Galkin} PRB '06

But of: $\Pi(2) = \frac{1}{36}$ gas cube approximation ω_{int} c Galkin, +.e. Galkin '06
nearest neighbor pole-free model. $\omega_c = \omega_c(d)$, $\vec{R}_n = d(n_1, n_2)$.

$\omega^2(\vec{k}) = [\omega_c + \beta \omega_M \sum_{-}(\vec{k})][\omega_c + \beta \omega_M \sum_{+}(\vec{k})]$
b.d.p. approximation $\omega_c = \omega_0 - \omega_{int} \delta(0)$, $\sum_{\pm}(\vec{k}) = \frac{\Pi(2)}{d^3} [\delta(0) - \delta(\vec{k}) \pm 3|\delta_c(\vec{k})|]$
 $\delta(0) = 0$, $\sum_{\pm}(\vec{k}=0) = 0$ u $\omega^2(\vec{k}=0) = \omega_c^2(d)$.

to a more general Galkin PRB '06 y arbitrary $L = l + l'$ - ver. l, l' - even
 $J_1(\vec{k}) = \sum_n J_1(\vec{R}_n) e^{i\vec{k}\vec{R}_n} = \sum_n e^{i\vec{k}\vec{R}_n} \sum_L \frac{(L-1) \rho_L}{d_n^{L+1}} = \sum_L \frac{(L-1) \rho_L}{d^{L+1}} \sum_n \frac{e^{i\vec{k}\vec{R}_n}}{(n_1^2 + n_2^2)^{\frac{L+1}{2}}}$

Def. $\delta_{L/2}(\vec{k}) = \sum_n \frac{e^{i\vec{k}\vec{R}_n}}{(n_1^2 + n_2^2)^{\frac{L+1}{2}}}$ u $J_1(\vec{k}) = \sum_L (L-1) \rho_L \delta_{L/2}(\vec{k})$
 $J_2(\vec{k}) = \sum_n J_2(\vec{R}_n) e^{i\vec{k}\vec{R}_n} = \sum_n e^{i\vec{k}\vec{R}_n} \sum_L \frac{(L+1) \rho_L}{d_n^{L+1}} R_n^2 = \sum_L \frac{(L+1) \rho_L}{d^{L+1}} \sum_n \frac{R_n^2 e^{i\vec{k}\vec{R}_n}}{(n_1^2 + n_2^2)^{\frac{L+1}{2}}}$

Def. $\delta_{L/2}^c(\vec{k}) = \sum_n \frac{R_n^2 e^{i\vec{k}\vec{R}_n}}{(n_1^2 + n_2^2)^{\frac{L+1}{2}}} = \sum_n \frac{(n_1 + i n_2)^2}{(n_1^2 + n_2^2)^{\frac{L+3}{2}}} e^{i\vec{k}\vec{R}_n}$
 $J_2(\vec{k}) = \sum_L (L+1) \rho_L \delta_{L/2}^c(\vec{k})$
 $\sum_{\pm}(\vec{k}) = -J_1(0) + [J_1(0) - J_1(\vec{k}) \pm |J_2(\vec{k})|]$, $[...]_{\vec{k}=0} = 0$.

then known $\vec{k}=0$ known as ω -ga interdet coupling $= -J_1(0)$, u
 $\omega_c(d) = \omega_0 - \omega_{MP} J_1(0)$, $\omega_c(d) = \omega_0 - \beta \omega_M \sum_L (L-1) \rho_L \frac{\delta_{L/2}(0)}{d^{L+1}}$, $\delta_{L/2}(0) = \delta$
 $(L-1) \rho_L = (L-1)(L-1)!!(L-3)!! \Pi(L) = [(L-1)!!]^2 \Pi(L)$. u known $\omega_c(d)$ u known as ω_{Galkin}
 $\omega(\vec{k}=0) = \omega_c$ - gno zone vertex excitations.

b.d.p. approximation (a one nearest neighbor $\vec{k} \rightarrow 0$) $\omega(\vec{k}) = \omega_c + v|\vec{k}|$, $\vec{k} \rightarrow 0$,
 $v = \omega_M L \frac{\pi}{18 d^2}$, $v_{max} (2R=2, d=2) = \omega_M L \frac{\pi}{18 \cdot 4} = 0.044 \omega_M L$
 $v_{max} = 4.4 \cdot 10^{-2} 30 \text{ GHz} \cdot 20 \text{ nm} \approx 26 \text{ m/s}$ (just number, no physics)

- slow waves (small group velocity). $\sum_{\pm}(\vec{k}) = [J_1(0) - J_1(\vec{k}) \pm |J_2(\vec{k})|]$,
a - $J_1(0)$ known as ω_0 : $\omega_c = \omega_0 - \omega_{MP} J_1(0)$.
then $\vec{k} = \frac{1}{R}(\frac{\pi}{d}, 0)$ - 1st Brill. zone (nearest d_n) high multipole moments are important. $(\vec{k}\vec{R}_n)_{B.Z.} = \vec{k} \cdot \vec{R}_n = \frac{\pi}{d} d n_1 = \pi n_1$, $e^{i\pi n_1} = (-1)^{n_1}$
 $\delta(0) = 9.034$ con. Galkin PRB '06.

known $\omega_c(d) - \omega_c = -\omega_{MP} \frac{1}{36} \frac{\delta(0)}{d^3} \approx -30 \text{ GHz} \cdot 0.1 \frac{9}{36 d^3} = |d=2| = 36 \text{ Hz} \frac{1}{4.8} \approx 7.5 \text{ Hz}$
- known as ω_0 , because $\Delta \omega_c(d \rightarrow \infty)$.

Edited the Multipole paper file u now. Ver. no physics u no physics $\omega(\vec{k})$
just $\vec{k} \parallel (1,0), (1,1)$ u just because $L=2, 4, 6$.

...април непосредно, не зависи од...

No в тексте Pinning - PRB а использован символ σ . Мы $\left[\frac{\partial m}{\partial n} + Hm \right] = 0$
us PRB'05 упоминает это к равновесию равновесия m и n . SD-cylinder
 R h θ ϕ Boundary cond., cylinder

B. Given PRB of unknown. $g_{ss}(s, s') = g(s, s') = -4\pi \int dk k f(k\beta) J_1(k\beta) J_1(k\beta')$

Consider $h_v^g(s) = \frac{\partial \log(s)}{\partial s} \int_0^1 ds' s' g(s, s') (s' - s) \quad \text{w/ } s \rightarrow 1-0.$

$$J_0(\beta, s+1, 0) = \int_0^1 ds' s' g(s s') (s' - s) = 4\beta \left(-\ln \frac{8}{\beta} + \frac{1}{2} \right), \quad \text{zero u gas}$$

$$d = \frac{2\pi}{\beta [2(6\ln 2 - 1) + 4\ln \frac{1}{\beta} + (\frac{L_0}{L})^2]} \quad - \text{pinning parameter Guss' ARB's}$$

B⁰ Pinning FMR-PRB $d(\theta_0=0) = \frac{2\pi}{[F(\theta) + \frac{L_0^2}{LR}]} = \frac{2\pi}{\theta [\frac{1}{\theta} F(\theta) + \frac{L_0^2}{L^2}]} , \theta = \frac{L}{R}$

$$F(R) = \int_0^1 ds' g_n(R, s') (s'-1) \quad \text{c} \quad g_n(s, s') = -4\pi \int dk f(k\beta) J_0(k s') \frac{\partial J_1(k s)}{\partial s}$$

$\theta_0 = 0$, $\vec{M}_0 \parallel Oz$, $SD_{\perp}$ gaussian omic. Ges' PRB'05.

Для g -component $-d \frac{\partial \sigma_g}{\partial g} + h_g \Delta g = 0$, у. усе. параметры функций

fine SD in Vortex ground states, $m_g(\vec{\theta}) = m_g(\theta)$ in the absence of ϕ

$m_g(\text{new PRB}) = \text{randomly chosen } m_g[\text{Gus' PRB's}]$ $h_m^g(s) = (d_g^s g(s)) m_g(s')$

logarithm $\frac{1}{\beta} F(\beta) \propto \frac{1}{\beta} F(\beta) = 2(6 \ln 2 - 1) + 4 \ln \frac{1}{\beta} ?$

2. $\vec{p}$ [нормаль] $\vec{m}_y$ - как $\vec{p}_y$, компоненты $\vec{m}$  invariant $\forall \theta_z$.

15. ~~Seja~~ $m_Y(\vec{s}) = m_Y(s)$ e $s \rightarrow y$, para $m_Y(y)$

A ~~even~~ ^{pastez} ~~values~~ ^{my} $g(s)$ ~~no~~ ^{pastez} ~~parameters~~ ^{my} pastez $\parallel \text{box}$, $\frac{\partial}{\partial n} = \frac{\partial}{\partial x}$. ^{my} finishing $\parallel \text{box}$, $\psi = 0$. ^{known} d $\parallel \text{box}$

$$\text{Eq. 2/1: } -q M_s \frac{\partial m_y}{\partial n} - M_s L h_m^y + L m_y H_m^{0z} = 0. \quad \text{Kago } m_y(x), H_m^{0z}(x) \text{ only}$$

$$h_m^{\text{sc}}(s, \varphi=0) = h_m^{\text{sc}}(s) = \int d\vec{s}' m_x(s) \left[\cos \varphi' - \frac{q}{q_0} \sin \varphi' \right] + \int d\vec{s}' m_y(s) \left[\frac{q}{q_0} \sin \varphi' + \cos \varphi' \right]$$

$$= \begin{cases} \text{unr. c sine} \neq 0 \text{ give } 99.99 \\ \text{unr. c cose} \neq 0 \text{ give } 99.99 \end{cases} = \left(2^3 \cdot [g_{99} \cos \phi' - g_{99} \sin \phi'] m_x(0) - \right.$$

18. - u zoren nam m_x - b. g. b. c. g. m_y ?
 $m_x = m_1 \cos \theta_0 + m_2 \sin \theta_0 = m_1 \cos \theta_0$ W. m_x, m_y suzy
 $\rightarrow$ m_y suzy

$$19 \quad m_2 = m_2' \cos \theta_0 - m_x' \sin \theta_0 = -m_x' \sin \theta_0, \quad \vec{m} = (0, m_y', m_x')$$

$$h_m = \int d^3x [G_{yx} m_x + G_{yy} m_y + G_{yz} m_z] = \left| \int d^3x G_{yz} = 0 \right| \rightarrow \text{charge } \propto 21/2$$

Среднее по φ $\overline{h_m(\varphi)} = \langle h_m(\varphi) \rangle = m_y(s)$ и т.д.

$$H_m^{02'} = H_m^{02} \cos \theta_0 + H_m^{0x} \sin \theta_0 \quad H_m^{02}(\theta) = \int d\theta' \rho' \Pi(\theta, \theta') m_y(\theta'), \Pi(\theta\theta') = -2\pi \int dt f(t) J_0(\theta) J_0(\theta')$$

$$N_{\alpha\beta}(\vec{\sigma}) = - \int d^2\vec{\sigma}' G_{\alpha\beta}(\vec{\sigma}, \vec{\sigma}'), \quad \alpha, \beta = x, z.$$

14/1) Hovet var helst pinnig que $m_x(x)$ og broper systemet b.c. torpe
 Observed var for Refere

29. ²⁹ ~~As the~~ ^{As the} ~~refers~~ ^{refers} ~~comments~~ ^{comments}, ~~then~~ ^{then} ~~changes~~ ^{changes} ~~to the text~~ ^{to the text} (as per ~~the~~ ^{the} ~~text~~ ^{text}).

1. c. c. 8861 в Киев 1500 \$ и 55 €. no many objects в Bilbao 17⁵⁰, 25 Apr.

PNR - pinning. Krago nacrtao pinning $m_x(x)$  , t.k. uvenno
 $m_x \perp$ naberzheniu dot u $(\vec{m}, \vec{n})$ - surface charge gne $\vec{n} = \hat{x}$ bgoz x
 $\vec{m} = (m_x, m_y, 0)$, t.k. $Oz' \parallel \vec{M}_0$ - obo kbanobanue. $m_y = m_y$. 201.164
 m_x gae $m_x = m_x \cos \theta_0$ u $m_z = -m_x \sin \theta_0$ - gbe $\vec{m}$ - kamm. ϕ, χ, ψ .
 $\nabla = \hat{x} \frac{\partial}{\partial x} + \hat{y} \frac{1}{\rho} \frac{\partial}{\partial \phi} + \hat{z} \frac{\partial}{\partial z} = (\hat{x} \cos \phi + \hat{y} \sin \phi) \frac{\partial}{\partial \rho} + (-\hat{x} \sin \phi + \hat{y} \cos \phi) \frac{\partial}{\partial \phi} + \hat{z} \frac{\partial}{\partial z}$
 $\nabla = \hat{x} \frac{\partial}{\partial x} + \hat{y} \frac{\partial}{\partial y} = (\hat{\rho} \cos \phi - \hat{\phi} \sin \phi) \frac{\partial}{\partial \rho} + (\hat{\rho} \sin \phi + \hat{\phi} \cos \phi) \frac{\partial}{\partial \phi} = \hat{\rho} (\cos \phi \frac{\partial}{\partial \rho} + \sin \phi \frac{\partial}{\partial \phi}) + \hat{\phi} (\sin \phi \frac{\partial}{\partial \rho} + \cos \phi \frac{\partial}{\partial \phi})$
 $\frac{\partial}{\partial \rho} = \cos \phi \frac{\partial}{\partial x} + \sin \phi \frac{\partial}{\partial y}$, $\frac{1}{\rho} \frac{\partial}{\partial \phi} = -\sin \phi \frac{\partial}{\partial x} + \cos \phi \frac{\partial}{\partial y}$
 $\frac{\partial}{\partial \rho} = \cos \phi \frac{\partial}{\partial x} + \sin \phi \frac{\partial}{\partial y}$. ∇ - kbanue b.c. na Ox' : $-\frac{q}{L} \frac{\partial m_y}{\partial \rho} - h_m' + m_y H_m^{oz'} = 0$
 $\frac{q}{L} \frac{\partial m_x}{\partial \rho} + h_m' - m_x H_m^{oz'} / M_s = 0$
 $m_x' H_m^{oy'} - m_y' H_m^{ox'} = (\vec{m} \times \vec{H}_m^0)_z = 0$. $m_x' = m_x \cos \theta_0 - m_z \sin \theta_0 = m_x / \cos \theta_0$.
 $m_x' = m_z \tan \theta_0$. $m_z / m_x = -\tan \theta_0$.
 $h_m' = h_m^x \cos \theta_0 - h_m^z \sin \theta_0$. $h_m^{x,z}(\phi, \psi)$ kago $\phi = 0$, $\psi = 0$, $\chi = 0$, $\psi = 0$.
 $h_m^x = \int d\vec{g} [g_{xx} m_x + g_{xy} m_y] = h_m^g \cos \phi - h_m^y \sin \phi$. $h_m^y = h_m^g \sin \phi$. 201.164

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h_m^x = h_m^s = ∫ d²ŝ' [g_{ss}m_s + g_{sp}m_p + g_{sz}m_z] = ∫ d²ŝ' [g_{ss}(m_xcosφ' + m_ysinφ') + g_{sp}(-m_xsinφ' + m_ycosφ')] = ∫ d²ŝ' [m_x(g_{ss}cosφ' - g_{sp}sinφ') + m_y(g_{sp}cosφ' + g_{ss}sinφ')] = ∫ d²ŝ' [m_x(g_{ss}cosφ' - g_{sp}sinφ') + m_y(g_{sp}cosφ' + g_{ss}sinφ')]

una cip. no φ': ∫ dφ' g_{sp} sinφ' = ∫ dφ' ∑ g_{sp} e^{iμ(φ-φ')} sinφ' = π (g₁e^{iφ} - g₋₁e^{-iφ}) = π (g₁ - g₋₁) = |g_μ^{ss} = +g_{-μ}^{ss}, g_μ^{sp} = -g_{-μ}^{sp}| = π {0, αβ = ss, pp; 2g₁, αβ = sp, ps}

∫ d²ŝ' g_{sp} cosφ' = ∫ d²ŝ' ∑ g_{sp} e^{iμ(φ-φ')} cosφ' = π (g₁e^{iφ} + g₋₁e^{-iφ}) = π (g₁ + g₋₁) = π (g₁ + g₋₁) = π (g₁ + g₋₁)

h_m^x(ŝ, φ=0) = ∫ d²ŝ' m_x(ŝ') [2πg₁^{ss} - 2πg₁^{sp}] + ∫ d²ŝ' m_y(ŝ') [0 + 0] = 2π ∫ d²ŝ' m_x(ŝ') [g₁^{ss} + ig₁^{sp}] = 2π ∫ d²ŝ' m_x(ŝ') (-2)g̃(ŝŝ') = -4π ∫ d²ŝ' g̃(ŝŝ') m_x(ŝ')

g̃(ŝŝ') = ∂/∂ŝ ∫ dk f(kL) J₁(kŝ) J₀(kŝ') - cobu. comp. 21/π.

h_m^x(ŝ, φ=0) = -4π ∫ d²ŝ' g̃(ŝŝ') m_x(ŝ'), m_x = m_x' cosθ₀.

Com. 21/π garruno h_m^x(ŝ, φ=0) = -2π m_x(R) + O(β) m_x(R) + F(β) ∂m_x/∂ŝ |_{ŝ=R}

h_m^x(ŝ→R-0, φ=0) = -2π m_x(R) + F(β) ∂m_x/∂ŝ |_{ŝ=R}, m_x = m_x' cosθ₀

(L/L) ∂m_x/∂ŝ + h_m^x - m_x H₀⁰²/μ_s = 0. h_m^z(ŝ, φ=0) = ∫ d²ŝ' [g_{zx}m_x + g_{zy}m_y + g_{zz}m_z] = ∫ d²ŝ' g_{zz} m_z(ŝ')

= ∫ d²ŝ' ∑ g_{μν}^{zz} e^{iμ(φ-φ')} = ∑ g_{μν}^{zz} e^{iμφ} 2π (δ_{μ0} + δ_{μ1}) = 2π (g₀₀^{zz} + g₁₁^{zz}) e^{iφ} = 2π (g₀₀^{zz} + g₁₁^{zz}) e^{iφ}

= 2π (g₀₀^{zz} + g₁₁^{zz}) = 2π g₀₀^{zz}. G_{zz}(ŝ, ŝ') = -∂²/∂ŝ² [2 ∫ dk f(kL) J₁(kŝ) J₁(kŝ')] =

= -∂²/∂ŝ² ∫ dk e^{-k|ŝ-ŝ'|} ∑ J_μ(kŝ) J_μ(kŝ') e^{iμ(φ-φ')}, g_{zz}(ŝŝ') = 1/L ∫ d²ŝ' G_{zz}(ŝ, ŝ') =

= -1/L ∫ d²ŝ' ∂²/∂ŝ² ∫ dk e^{-k|ŝ-ŝ'|} ∑ a_μ = -1/L ∫ d²ŝ' ∂²/∂ŝ² ∫ dk ∑ a_μ e^{-k|ŝ-ŝ'|} |_{ŝ=0} =

= -1/L ∫ dk ∑ a_μ ∫ d²ŝ' ∂²/∂ŝ² [e^{-k|ŝ-ŝ'|} - e^{-k|ŝ|}] = -1/L ∫ dk ∑ a_μ [e⁰ - e^{-kL} - e^{-kL} + e⁰] =

= -2/L ∫ dk ∑ a_μ (1 - e^{-kL}), g_{zz}(ŝŝ') = -2/L ∫ dk [1 - e^{-kL}] ∑ J_μ(kŝ) J_μ(kŝ') e^{iμ(φ-φ')}

g_{μν}^{zz} = -2/L ∫ dk (1 - e^{-kL}) J_μ(kŝ) J_μ(kŝ')

∫ d²ŝ' g_{zz}(ŝŝ') = 2π g₀₀^{zz} = -4π/L ∫ dk (1 - e^{-kL}) J₀(kŝ) J₀(kŝ')

h_m^x = h_m^x cosθ₀ - h_m^z sinθ₀ = [-2π m_x + F(β) ∂m_x/∂ŝ] cosθ₀ -

sinθ₀ ∫ d²ŝ' g_{zz}(ŝŝ') m_z(ŝ') = [-2π m_x + F(β) ∂m_x/∂ŝ] cosθ₀ - sinθ₀ ×

× ∫ d²ŝ' m_z(ŝ') · 2π g₀₀^{zz} = |m_z = -m_x' sinθ₀| = [-2π m_x + F(β) ∂m_x/∂ŝ] cosθ₀ +

sinθ₀ 2π ∫ d²ŝ' g₀₀^{zz}(ŝŝ') m_x'(ŝ'), g₀₀^{zz}(ŝŝ') = -2/L ∫ dk (1 - e^{-kL}) J₀(kŝ) J₀(kŝ') = -2/L ∫ dk (1 - e^{-kL}) J₀(kŝ) J₀(kŝ')

h_m^z(ŝ, φ=0) = h_m^z(ŝ) = ∫ d²ŝ' g_{zz}(ŝŝ') m_z(ŝ') = 2π ∫ d²ŝ' g₀₀^{zz}(ŝŝ') m_z(ŝ')

asymmetry give $\theta_0 = \pi/2$. $m_y(\theta, \pi/2) - m_y(\theta, 0) = 2am(0)J_2(kg)$. μ_3 Arrant x's

Asterazkena, Miércoles $\frac{p}{\partial g} \frac{\partial m_y}{\partial g} + d m_y|_p = 0$ u $d \approx 5$ gae $\theta_0 = \pi/2$

$$m_y(\theta, \varphi) = m(0) [J_0(kg) - a \sin \theta_0 J_2(kg) \cos 2\varphi] \quad m_y(\theta, \frac{\pi}{2}) = m(0) [J_0(kg) + 4J_2(kg)]$$

моменты инерции. $W_{FMR} = F [m_1(\vec{q}, a), m_2(\vec{q}, a)] = f(a)$ и определяем $J_2(kg) = \frac{1}{2} (kg)^2 = 1/2 \leq 1$ м. (с)

$J_2(kg) = \frac{1}{8} (kg)^2 = 9/8 \leq 11$. $m_y(9,0) = m(0) [J_0 + a J_2 + J_0 - a J_2] = m(0) 2 J_0(kg)$

10. $\mu_{yc} = 39,5$ - середнє $\mu_{yc}(g, \varphi) = \text{const}$ загалом $g(\varphi) = b + (a-b)\cos\varphi$.
 Спрощ. Паузе $g_c = \frac{1}{2}(a+b) = \frac{1}{2}(48+31) = 79/2 = 39,5 \approx 40$

10 $g_{c/R} = 39.5/125 = 0.316$. Finite d označava $k = d_d/R$ u $d_d < 2.40$, $J_0(kg) = \frac{1}{2}(kg)^2 < 0.037$

11. $\alpha_d = \frac{a_d}{R} = \frac{a_d \omega_c}{R} = 0.316 \alpha_d < 0.76, \Rightarrow J_2(kg) = \frac{1}{8} (kg)^2 < 0.072$
 toiga kax $J_0(kg_c) \approx J_0(2.40 \cdot 0.316) = J_0(0.76) \approx 0.9$
 Notamny $m_y(9, \pi/2) - m_y(9, 0) \approx J_2(kg) \approx 0.072$

12. Hydrogen Simulations Maxima average $a \approx 2.2 \text{ fm}$

Note that Zierler (PRB'06) gets $a = 2$ by trial function $m_y(\varphi)$.

Вместо $\sin \theta_0$, можно $f(\theta_0) \leftarrow f(0) = 0$ и $f(\pi/2) = 1$.

Ans. $\chi_m(g, \pi/2) = -4\pi \int dg' g' \bar{g}(g, g') m_y(g') = -2\pi m_y(R) - 4\pi \int dg' g' \bar{g}(R, g') (g'-R) \frac{m_y(g')}{g'}$

[illegible]

16. dyn. dipolar field $h_m^y(\vec{r})$.
 Wenn nur $m_y = m_y(e)$, so $(\mu_B / \hbar) / (h_m^y(0,0)) = -2 = (1/1)$

16. Unsymmetric, $\langle h_m(\mathbf{q}) \rangle_e = -2\pi i m_y(\mathbf{q}) - \pi \int d\mathbf{q}' m_y(\mathbf{q}') q_z^2(\mathbf{q} - \mathbf{q}')$

$$17 \quad g_{\phi\phi}^{zz}(s, s') = -\frac{2}{\beta} \int_0^{\beta} dk [1 - e^{-\beta k}] J_0(k s) J_0(k s') = \frac{1}{2\pi} \int_0^{2\pi} d\phi' g_{zz}(s, s')$$

18   - from Robert Brantya's Simulations.
 $m_y(y)$ - negative - negative $y \uparrow$ - pinning of OTM
 $m_z(z)$ - positive - positive $z \uparrow$ - pinning of OTM

$m_y(y) = \text{нагрузка на единицу } y \uparrow$ и $m_y(x) = \text{нагрузка на единицу } x$ в $y=0$ на газе свободно и $m_y(r=R) = 0$

19) B. Gus' JAP'00 2006 $H_m^{\text{os}}(\vartheta, \varphi)$, $H_m^{\text{op}}(\vartheta, \varphi)$ give $\vec{n}_0 = M_s \hat{y}$. $H_m^{\text{os}} = H_m^{\text{os}} \sin \varphi + H_m^{\text{op}} \cos \varphi$

$$J_0(kg) J_1(k) + \cos 2\varphi \int dk f(\beta k) \frac{J_1(kg)}{kg} J_1(k) - \cos \varphi \int dk f(\beta k) J_0(kg) J_1(k)$$

$\frac{1}{4\pi} N_{xy}(g, \varphi) = \cos^2 \varphi \int dk J_0(kg) J_1(k) - \cos^2 \varphi \int dk J_1(kg) J_0(k)$

$$\langle N_{xx}(g, \varphi) \rangle_\varphi = 2\pi \int dk f(\beta k) J_0(kg) J_1(k), \text{ since } \langle N_{xx}(g) \rangle = \frac{1}{2\pi} [4\pi - N_{zz}(g)]$$

30. $\int_0^1 \int_0^1 J_0(tg) J_1(t) dt = \begin{cases} 1, & 0 < 1 \\ \frac{1}{2}, & 1 = 1 \end{cases}$. Usando $N_{xx}(g) = \langle N_{xx}(g) \rangle$

30. Asta - Semaia

$$\frac{L}{L} \frac{\partial m_y}{\partial \eta} + h_m^y(\theta, \varphi) - m_y H_{m,2}^{02}(\theta)/M_s = 0$$
 можно брать $\eta = \pi/2$, 0 и $\frac{2\pi}{3}$

On paccece p... $\varphi = \pi/2$ $\beta h_m^y(\varphi, e)$, $m_y(\varphi)$, $N_{xx}(\vec{r})$.
 $H_m^{0z}(\vec{r}) = H_m^{0x} \sin \theta_0 + H_m^{0z} \cos \theta_0 = \dots$
 $H_m^{0x} \sin \theta_0 = -N_{xx}(\vec{r}) M_0^x \sin \theta_0 = -N_{xx}(\vec{r}) M_s \sin 2\theta_0$.

$H_m^{0z}(\vec{r}) = -N_{xx}(\vec{r}) M_s \sin^2 \theta_0$.
 Aramtra nozagana $H_m^{0x}(\varphi, \pi/2) = H_m^{0x}(\varphi)$.
 a zamece bzen $N_{xx}(\varphi = \pi/2) = N_{xx}(\varphi)$.
 $H_m^{0z}(\vec{r}) = \int d^2 \vec{r}' [G_{zx} M_x + G_{zy} M_y + G_{zz} M_z] = |\vec{M} = \vec{M}_0 = M_s \hat{x}| =$

$= M_s \int d^2 \vec{r}' g_{zx}(\vec{r}, \vec{r}') = 0$ ufu $\int d^2(\cdot)$.
 Ho zamecece $N_{xx}(\vec{r}) \rightarrow N_{xx}(\varphi) = \langle N_{xx} \rangle_\varphi$.
 Juso $\varphi = \pi/2$ $\beta h_m^y(\varphi, e)$ u $m_y(\varphi)$ $H_m^{0z}(\varphi, e)$ cnapa, $\dots$

be mece. T.e. oca paccece $\varphi = \pi/2$ u ypegn. no φ (17/1) nego nepogena. $m_y(x)$, $\varphi = 0$ case (13/17) + aume nepogena.

Baoy: $m_y(\varphi)$ kan penume, ufu $m_y(\varphi) = m_0 [J_0(k\varphi) - a \sin \theta_0 J_2(k\varphi)]$.
 1) $\varphi = \pi/2$, pazpey $m_y(\varphi)$ bapue ay $\perp \vec{M}_0$.
 B.c. (*) $\frac{Le^2}{L} \frac{\partial m_y(\vec{r})}{\partial n} + h_m^y(\vec{r}) + m_y(\vec{r}) N_{xx}(\vec{r}) \sin^2 \theta_0 = 0$ | $\varphi = \pi/2$, $\frac{\partial}{\partial n} = \frac{\partial}{\partial \varphi}$

Myce $m_y = m_y(\varphi)$, zo beumo xoc ufu mame θ_0 . Ecce em $H_m^{0z} \neq 0$, ho $\dots$
 $h_m^y(\varphi, \pi/2) = -2\pi m_y(R) + F(\beta) \frac{\partial m_y}{\partial \varphi} |_{\varphi = \pi/2}$.
 $N_{xx}(\varphi = \pi/2) = 4\pi \int dk f(k\beta) J_1^2(k) = \langle N_{xx}(\vec{r}) \rangle_s$ - bot ran ga.

Bezo $\langle N_{xx}(\vec{r}) \rangle_s = \frac{1}{\pi} \int d\varphi \int d\varphi' N_{xx}(\varphi, \varphi') = 2\pi \int dk f(k\beta) J_0(k\varphi) J_1(k) =$
 $\frac{1}{4\pi} N_{xx}(\vec{r}) + \frac{1}{4\pi} N_{yy}(\vec{r}) = \int dk f(k\beta) J_0(k\varphi) J_1(k) = \int dk [1 - \frac{1}{\beta k} (1 - e^{-\beta k})] J_0(k\varphi) J_1(k) =$

$= 1 \cdot (1/2, \beta=1) = \frac{1}{\beta} \int dk (1 - e^{-\beta k}) J_0(k\varphi) J_1(k) = 1 \cdot (1/2, \beta=1) - \frac{1}{4\pi} N_{zz}(\varphi)$
 Def. $\sum_d G_{dd}(\vec{r}, \vec{r}') = -4\pi \delta(\vec{r} - \vec{r}')$, $\sum \int d^2 \vec{r}' g(\vec{r}, \vec{r}') = -4\pi \int d^2 \vec{r}' \frac{1}{s'} \delta(\vec{r} - \vec{r}') \delta(\varphi - \varphi')$

$\int_0^{2\pi} d\varphi' \delta(\varphi - \varphi') = 1$. $\int d^2 \vec{r}' \frac{1}{s'} \delta(\vec{r} - \vec{r}') = \int_0^1 ds' \delta(s' - s) = 1 \cdot (1/2, \beta=1)$.
 Def. $N_{dd}(\vec{r}) = - \int d^2 \vec{r}' g_{dd}(\vec{r}, \vec{r}')$, $\Rightarrow \sum N_{dd}(\vec{r}) = 4\pi \cdot (1/2, \beta=1)$.

Ecce cnapa $\int ds' \delta(s' - s) = \frac{1}{2} \delta(s) = 1/2$ ufu $s=1$.
 Ecce $N_{xx}(\varphi) = \langle N_{xx}(\vec{r}) \rangle_\varphi = 2\pi \int dk f(k\beta) J_0(k\varphi) J_1(k)$, ho $N_{xx}(\varphi=1) = \pi +$

u $N_{xx}(1)$ xopamo con. c $d(0)/d(\pi/2)$ - sem. by Aramtra que $m_y(\varphi)$.
 2) $\varphi=0$, $m_y(\vec{r}) = m_y(\varphi)$. Con. 13/17 $h_m^y(\varphi, 0) \sim m_x$ u cnapa mame m_y u β cond.

3) Ypegn. (x) ho φ , cnapa $m_y(\vec{r}) = m_y(\varphi)$. $\langle h_m^y(\vec{r}) \rangle_\varphi = -2\pi \int d\varphi' \sin \varphi' \int dk f(k\beta) J_0(k\varphi) J_1(k)$
 $\langle N_{xx}(\vec{r}) \rangle_\varphi = 2\pi \int dk f(k\beta) J_0(k\varphi) J_1(k) \rightarrow N_{xx}(\varphi=1) = \langle N_{xx}(\varphi) \rangle_\varphi = \pi + \frac{\beta}{2} (L \frac{\partial}{\partial \beta} + \frac{1}{2})$

$\frac{Le^2}{L} \frac{\partial m_y}{\partial n} - 2\pi m_y(R) + F(\beta) \frac{\partial m_y}{\partial n} + m_y(R) \sin^2 \theta_0 N_{xx}(\varphi=1) = 0$
 $d(0) = [2\pi - N_{xx}(1) \sin^2 \theta_0]$, $F(\beta) = \int d\varphi' \hat{g}(\varphi=1, \varphi') (\varphi'-1)$, $\hat{g}(\varphi, \varphi') = -2\pi \int dk k f(k\beta) J_0(k\varphi) J_1(k)$

$\frac{1}{2} \frac{Le^2}{\beta} + F(\beta)$
 Tame $F(0.1) = -0.223$ u $d(0) = 29.89$, $d(\pi/2) = 13.77$ c cnapa $d(0)/d(\pi/2) = 2.17$

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Ostirala - Viernes

$$d_x(0) = \frac{2\pi}{(L^2/L) + F(\beta)}$$

$$d_y(0) = \frac{2\pi}{[L^2 + F(\beta)]}$$

Arantxa munitua my(x,y)=C Counter plots, uo lugo uak agym metry my(x,y) paces e poreu gnd. Do. Kogoravak - my(t) b time domain - snap shots, 200 upefeno k bozdyang. gdn. mog b lyl(l) usiwat, u pome FMR -

Odyang - FMR - paper c lues: Gpau u lymak xosor durb co-odropemum, r.v. b paper pemum Guu FMR - chenspon ka ux dot arrays (L=40 nm, R=250, 1500)

Odyang eme Multiple paper c Qec. $\delta_L(\vec{k}), \delta_R(\vec{k})$ u uana postez. IC. Now conclusions uz der. paces N=3 u 4 clusters, susunen dyga uoga c max pagspacoa polarization of v. dots pn (checkerboard=?), a bobee ke in-phase mode. pn=const, ka a chuan. Bozomino pn=(-1)ⁿ¹⁺ⁿ² oedacms dcan. And APD

Due FMR-pinning paper monno ucuatyz. $m_n(\vec{s}) \sim e^{i\vec{k}_0 \cdot \vec{s}}$ uocu. bauer que paces uasym. Du. $H_{01}(\vec{s}) \sim h_m(\vec{s})$ b rac-use sw. $H_{01} \sim J_0(k_s), J_2(k_s) \cos 2\phi$, a $\cos k_s$ pazuomum no $J_m(k_s) e^{im\phi}$

Multi-poles

(21/11) Hago y zerb pachuomemue v. core polarizations pn=(-1)ⁿ¹⁺ⁿ² b max. uopieque b square dot array, FMR mode.

Com 11/11, Magn. energy of 2D array: $U(\vec{s}) = \frac{1}{2} \sum_n \alpha_n S_n \bar{S}_n + U_{int}(\vec{s})$

$$U_{int}(\vec{s}) = -(16\pi^2 M_s^2 R^3 \beta^2) \sum_{Lnn'} \frac{R^{L+1}}{R^{L+1}_{nn'}} P_L C_n C_{n'} [L \vec{S}_n \cdot \vec{S}_{n'} - (L+1) (\vec{S}_n \cdot \vec{R}_{nn'}) (\vec{S}_{n'} \cdot \vec{R}_{nn'})]$$

$$[...] = \frac{L}{2} (S_n \bar{S}_{n'} + \bar{S}_n S_{n'}) - \frac{1}{4} (L+1) (S_n \bar{R}_{nn'} + \bar{S}_n R_{nn'}) (S_{n'} \bar{R}_{nn'} + \bar{S}_{n'} R_{nn'})$$

Blegem gbe uogpemesu: $S_{n1} \sim p_n = +1$ u $S_{n2} \sim p_n = -1$, $\phi = 1/2$. Vycaz $C_n = \text{const}$, uuu nepligem k μ_n no exp. $C_n \vec{S}_n = \hat{z} \times \vec{\mu}_n / 3$.

$$U_{int}(\vec{s}) = -(\cdot) \sum_{Lnn' \vec{s}\vec{s}'} \frac{R^{L+1}}{R^{L+1}_{nn'}} P_L \frac{1}{2} [L (S_n^{\vec{s}} \bar{S}_{n'}^{\vec{s}'} + \bar{S}_n^{\vec{s}} S_{n'}^{\vec{s}'} - \frac{1}{2} (L+1) (S_n^{\vec{s}} \bar{R}_{nn'}^{\vec{s}\vec{s}'} + \bar{S}_n^{\vec{s}} R_{nn'}^{\vec{s}\vec{s}'} + S_{n'}^{\vec{s}'} \bar{R}_{nn'}^{\vec{s}\vec{s}} + R_{nn'}^{\vec{s}\vec{s}'} S_{n'}^{\vec{s}})]$$

1-aa uogpenu. (uexp. dot $p_0=+1$) 2-aa uogpenu. (uexp. dot $p_0=-1$)

Larunbata - Sábado Oban dots (p=+1) b Domingo - Igandea Oban dots (p=-1) uauca b

209 156 uogpenux $n_1, n_2 = \text{zer}$, uomee $n_1 + n_2 = \text{zer}$, $\gamma_{\text{zume}} - \text{b uogpenux}$ $n_1 + n_2 = \text{herer}$.

$$2 \frac{\partial U_{int}}{\partial S_n^{\vec{s}}} = -(\cdot) \sum_{Lnn' \vec{s}\vec{s}'} \frac{R^{L+1}}{R^{L+1}_{nn'}} P_L [L S_{n'}^{\vec{s}'} - \frac{1}{2} (L+1) R_{nn'}^{\vec{s}\vec{s}'} (S_n^{\vec{s}} \bar{R}_{nn'}^{\vec{s}\vec{s}'} + \bar{S}_n^{\vec{s}} R_{nn'}^{\vec{s}\vec{s}'} + S_{n'}^{\vec{s}'} \bar{R}_{nn'}^{\vec{s}\vec{s}} + R_{nn'}^{\vec{s}\vec{s}'} S_{n'}^{\vec{s}})]$$

$$2 \frac{\partial U_{int}}{\partial S_n^{\vec{s}}} = -\frac{1}{2} (\cdot) \sum_{Lnn' \vec{s}\vec{s}'} \frac{R^{L+1}}{R^{L+1}_{nn'}} P_L [(L-1) S_{n'}^{\vec{s}'} - (L+1) \bar{S}_{n'}^{\vec{s}'} (R_{nn'}^{\vec{s}\vec{s}'})^2], U_{\text{ad}} = \frac{1}{2} \sum_n \alpha_n S_n^{\vec{s}}$$

$$2 \frac{\partial U_{int}}{\partial S_n^{\vec{s}}} = \frac{1}{2} \sum_n \alpha_n S_n^{\vec{s}} \bar{S}_n^{\vec{s}} = \alpha_n S_n^{\vec{s}}, \text{ yD. } -L p_n |G| \vec{S}_n^{\vec{s}} = 2 \frac{\partial U}{\partial S_n^{\vec{s}}}$$

т.е. иначе, то есть где возмущения ($\delta=1,2$)
 Sunray (E=0) no mymu ne gba yr. a gba se a y-pa
 Uztailla, Juno
 coupling anisotropen (vmmem. δ^2 теорет. δ^2 gba se
 31 $\sum_n J_1(d_n^{11}) = \lambda_{11}$, $\sum_n J_1(d_n^{22}) = \lambda_{22}$, $\sum_n J_1(d_n^{12,21}) = \lambda_{12}$
 $\sum_n J_2(d_n^{12,21}) = \mu_{12,21} = \mu$. $\lambda_{11} = \lambda_{22} = \lambda$, $\lambda_{12} = \lambda_{21} = \lambda'$

Asterger, Marto $\omega_0 s^1 - \beta \omega_M [\lambda s^1 + \lambda' s^2 - \mu \bar{s}^2]$, $\beta \omega_M$ теорет. δ^2
 $-\omega s^2 = \omega_0 s^2 - \beta \omega_M [\lambda' s^1 + \lambda s^2 - \mu \bar{s}^1]$

8 $\omega s^1 = \omega_0 s^1 - \lambda s^1 - \lambda' s^2 + \mu \bar{s}^2$
 9 $\begin{cases} -\omega \bar{s}^1 = \omega_0 \bar{s}^1 - \lambda \bar{s}^1 - \lambda' \bar{s}^2 + \mu s^2 \\ -\omega s^2 = \omega_0 s^2 - \lambda s^2 - \lambda' s^1 + \mu \bar{s}^1 \\ \omega \bar{s}^2 = \omega_0 \bar{s}^2 - \lambda \bar{s}^2 - \lambda' \bar{s}^1 + \mu s^1 \end{cases}$
 10 $\nu = \omega_0 - \lambda$

11 $\det \begin{pmatrix} \nu - \omega & 0 & -\lambda' & \mu \\ 0 & \nu + \omega & \mu & -\lambda' \\ -\lambda' & \mu & \nu + \omega & 0 \\ \mu & -\lambda' & 0 & \nu - \omega \end{pmatrix} = (\nu - \omega) \begin{vmatrix} \nu + \omega & \mu & -\lambda' \\ \mu & \nu + \omega & 0 \\ -\lambda' & 0 & \nu - \omega \end{vmatrix} - \lambda' \begin{vmatrix} \nu + \omega & \mu \\ \mu & \nu - \omega \end{vmatrix} = (\nu - \omega) [(\nu^2 - \omega^2)(\nu + \omega) - \lambda'^2(\nu + \omega) - \mu^2(\nu - \omega)] - \lambda' [\mu(\nu + \omega)^2 + \lambda'^2 \mu - \mu^3]$

12 $- \lambda'^2(\nu + \omega) - \mu^2(\nu - \omega)] -$
 13 $- \lambda' [-\lambda'^3 + \lambda' \mu^2 + \lambda'(\nu^2 - \omega^2)] - \mu [\mu(\nu + \omega)^2 + \lambda'^2 \mu - \mu^3] -$
 14 $= (\nu^2 - \omega^2)^2 - \lambda'^2(\nu^2 - \omega^2) - \mu^2(\nu - \omega)^2 - \lambda'^2[-\lambda'^2 + \mu^2 + \nu^2 - \omega^2] -$
 15 $- \mu^2[(\nu + \omega)^2 + \lambda'^2 - \mu^2] = (\nu^2 - \omega^2)^2 - \lambda'^2(\nu^2 - \omega^2) - \mu^2[2\nu^2 + 2\omega^2 + \lambda'^2 - \mu^2] -$
 16 $- \lambda'^2[-\lambda'^2 + \mu^2 + \nu^2 - \omega^2] = (\nu^2 - \omega^2)^2 + \omega^2 2(\lambda'^2 - \mu^2) - \mu^2[2\nu^2 + \lambda'^2 - \mu^2] -$
 17 $- \lambda'^2[-\lambda'^2 + \mu^2 + 2\nu^2] = (\nu^2 - \omega^2)^2 + 2(\lambda'^2 - \mu^2)\omega^2 + (\lambda'^2 - \mu^2)^2 - 2\nu^2(\lambda'^2 + \mu^2)$
 $(\omega^2 + \lambda'^2 - \mu^2)^2 + \nu^4 - 2\omega^2 \nu^2 - 2\nu^2(\lambda'^2 + \mu^2) = 0$. $\Omega^2 = \omega^2 + \lambda'^2 - \mu^2$
 $\Omega^4 - 2\nu^2[\Omega^2 - \lambda'^2 + \mu^2] + \nu^4 - 2\nu^2(\lambda'^2 + \mu^2) = 0$
 $(\Omega^2 - \nu^2)^2 - 4\nu^2 \mu^2 = 0$, $\Omega^2 - \nu^2 = \pm 2\nu \mu$, $\omega_{\pm}^2 = \nu^2 \pm 2\nu \mu - \lambda'^2 + \mu^2$
 $\omega_{\pm}^2 = (\nu \pm \mu)^2 - \lambda'^2$, $\nu = \omega_0 - \lambda$. $\omega_{\pm}^2 = (\omega_0 - \lambda \pm \mu)^2 - \lambda'^2$

Еще где $p_n = \text{const}$ in-phase resonance δ теорет. δ^2 $\omega = \omega_0 - \lambda$, то
 18 $\begin{matrix} + & - & + & - \\ - & + & - & + \end{matrix} \quad (R_n^{12})^2 = (\chi_n^{12})^2 - (\gamma_n^{12})^2 + 2i\chi_n^{12}\gamma_n^{12}$ - теорет. δ^2
 19 $\begin{matrix} - & + & + & - \\ + & - & + & - \end{matrix} \quad \text{Zanyu. upu } \sum_n \frac{1}{d_{n+1}} (R_n^{12})^2 = 0$, т.е. $\mu = 0$.

$\omega_F^2 = (\omega_0 - \lambda)^2 - \lambda'^2$, то теорет. δ^2 $\omega_F(p_n=1) = \omega_0$
 $\lambda' = \sum_n J_1(d_n^{12})$, $\lambda = \sum_n J_1(d_n^{11})$, d_n^{22}

212/153 d_n^{12} (связи возмущ.) = $d_n(n_1, n_2 - \text{here})$ теорет. δ^2 $\lambda' > \lambda$, т.е. $d_n^{12} < d_n^{11}$
 d_n^{11} (связи возмущ.) = $d_n(n_1, n_2 - \text{ограничен})$ теорет. δ^2 $(-1)^{n_1+n_2} = -1$
 $\lambda = \sum_n J_1(d_n^{11}) = \sum_{n_1, n_2} J_1(d_n^{11}) [1 + (-1)^{n_1+n_2}] \frac{1}{2}$, $\lambda + \lambda' = \sum_n J_1(d_n)$
 $\lambda' = \sum_n J_1(d_n^{12}) = \sum_{n_1, n_2} J_1(d_n^{12}) [(-1)^{n_1+n_2} - 1] \frac{(-1)}{2}$, $\lambda + \lambda' = \lambda(p_n=1)$
 $\lambda = \sum_n J_1(d_n) \frac{1}{2} [1 + p_n]$, $\lambda' = \sum_n J_1(d_n) \frac{1}{2} [1 - p_n]$ ($p_n = (-1)^{n_1+n_2}$)

$\Gamma(L) = \sum_{l=0}^{L-1} g_l g_{L-l}$, $l' = L-l$, L is fixed.
 l, l' - numer. (even)

$2 \quad g_l = \frac{l!!}{(l-1)!!} \frac{1}{(l+2)}$ - pole-free m., $g_l = \frac{1}{2} \frac{l!!}{(l-1)!!} \frac{1}{3}$

$\text{Pole free model: } \Pi(2) = \frac{g_1^2}{2!2!} = \frac{1}{4} \left[\frac{1!!}{1!!} \frac{1}{3} \right]^2 = \frac{1}{4} \frac{1}{9} = \frac{1}{36}$

$\Pi(4) = \frac{g_1 g_3 \cdot 2}{2!4!} = \frac{2}{2 \cdot 2 \cdot 3 \cdot 4} \cdot \frac{1}{3} \cdot \frac{3!!}{2} \cdot \frac{1}{5} = \frac{1}{240}$, $P_4 = 3 \cdot 1 \cdot 1 \cdot \frac{1}{240} = \frac{1}{80}$

$\Pi(6) = 2 \cdot \frac{g_1 g_5}{2!6!} + \frac{g_3^2}{4!4!} = \frac{1}{2 \cdot 3 \cdot 4 \cdot 5 \cdot 6} \left(\frac{1}{3} \right) \left(\frac{5!!}{4 \cdot 2 \cdot 7} \right) + \frac{1}{(2 \cdot 3 \cdot 4)^2} \left(\frac{3}{2 \cdot 5} \right)^2$

$P_6 = 5!! \cdot 3!! \Pi(6) = 5 \cdot 3 \cdot 3 \cdot \frac{1}{(2 \cdot 4)^2} \left[\frac{1}{3 \cdot 6 \cdot 7} + \frac{1}{100} \right] = \frac{1}{(2 \cdot 4)^2} \left[\frac{5}{14} + \frac{9}{20} \right] = \frac{1}{16} \cdot \frac{113}{140} = \frac{113}{2240}$

$\Pi(8) = 2 \cdot \frac{g_1 g_7}{2!8!} + 2 \cdot \frac{g_3 g_5}{4!6!} = \frac{1}{8!} \left(\frac{1}{3} \right) \frac{7 \cdot 5 \cdot 3}{6 \cdot 4 \cdot 2 \cdot 9} + \frac{2}{2 \cdot 3 \cdot 4 \cdot (2 \cdot 3 \cdot 4 \cdot 5 \cdot 6)} \left(\frac{3}{2 \cdot 5} \right) \left(\frac{5 \cdot 3}{4 \cdot 2 \cdot 7} \right)$

$P_8 = 7 \cdot 5 \cdot 3 \cdot 5 \cdot 3 \Pi(8) = 3 \cdot 3 \cdot 5 \cdot 5 \cdot 7 \left[\frac{1}{2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8} + \frac{1}{2 \cdot 4 \cdot 6 \cdot 3 \cdot 3} \cdot \frac{1}{4 \cdot 2 \cdot 4 \cdot 6 \cdot 2 \cdot 5 \cdot 4 \cdot 2 \cdot 7} \right]$

$= \frac{3 \cdot 3 \cdot 5 \cdot 5 \cdot 7}{2 \cdot 4 \cdot 6 \cdot 8 \cdot 2 \cdot 4} \left[\frac{1}{3 \cdot 6 \cdot 3 \cdot 3} + \frac{1}{5 \cdot 7} \right] = \frac{5 \cdot 5 \cdot 7}{6 \cdot 8^3} \left[\frac{1}{18} + \frac{9}{35} \right] = \frac{5 \cdot 5 \cdot 7}{6 \cdot 8^3} \cdot \frac{197}{18 \cdot 3 \cdot 7} = \frac{5 \cdot 197}{3 \cdot 6^2 \cdot 8^3}$

Pole free model: $P_2 = \frac{1}{36}$, $P_4 = \frac{1}{80}$, $P_6 = \frac{113}{2 \cdot 4 \cdot 6 \cdot 70}$, $P_8 = \frac{5 \cdot 197}{3 \cdot 6^2 \cdot 8^3}$

$(2.778 \cdot 10^{-2})$, $(1.25 \cdot 10^{-2})$, $(3.363 \cdot 10^{-2})$, $(1.781 \cdot 10^{-2})$

P_L more const as $f(L)$, bce P_L - probability.

Due 1D-array $J_2(0) \neq 0$, anyme def. $F_{\pm}(k) = -J_1(k) \pm |J_2(k)|$

$\omega^2(k) = [\omega_0 + \beta \omega_M F_-(k)] [\omega_0 + \beta \omega_M F_+(k)]$

pole-free model [Gus' PRL'06] $\omega_0 = 2\omega_M F(\beta) \approx \frac{20}{9} \gamma_M \beta = \frac{20}{9} \omega_M \beta$

$\omega_0(\beta) = \frac{5}{9\pi} \omega_M \beta$, $\beta \frac{\omega_M}{\omega_0} = \frac{\beta \omega_M}{\omega_0} \frac{9\pi}{5} = \frac{9\pi}{5}$

chain: $\omega^2(k)/\omega_0^2 = \left[1 + \frac{9\pi}{5} F_-(k) \right] \times \left[1 + \frac{9\pi}{5} F_+(k) \right]$ - & pole-free mod.

17 $\omega(k)$ noncommens. $\omega(0) = 0.902 \omega_0$, $\omega(\pi/d) = 1.055 \omega_0$

18 g ne min $d=2$

19 Max uniform zone $\omega(\pi/d) - \omega(0) \approx 0.15 \omega_0$ w/m $d=2$.

These dip-dip gap $\omega(0) = 0.942 \omega_0$, $\omega(\pi/d) = 1.03 \omega_0$, t.e. former dip-dip w/m $k=0$ esro $\approx (0.942 - 0.902) / 0.902 \approx 5\%$ w/m $d=2$.

214/151 $v_{gr}(k, d) = \frac{d\omega(k, d)}{dk} = D \frac{d\omega}{dk}$ (k - bezpazn. b.e.g. $\frac{1}{2}$) = $D \omega_0 \left(\frac{d\omega}{dk} \right)_{bezpazn.}$

3 dimensions units ($D\omega_0$) $\frac{d\omega}{dk} = v_{gr}(k)$

w/m $k \times 1$ u $v_{gr}^{max}(k \times 1) \approx 0.08$

B a.e. eg. $v_{gr}^{max} \approx 0.08 \cdot D\omega_0 \approx 0.08 \cdot 1 \mu m \cdot 300 MHz \cdot 2\pi \approx 2\pi \cdot 3 \cdot 8 \frac{m}{s} \approx 90 \frac{m}{s}$

31 Aste - Semane $\frac{v_{gr}^{min}}{v_{gr}^{max}} = \frac{D}{0.08 D\omega_0} = \frac{20}{2\pi \cdot 10} \approx \frac{20 \cdot 5/8}{2\pi \cdot 10 \cdot 3 GHz} \approx 10 \frac{m \cdot s}{8} = 6 \text{ ns}$

Max $V_{gr} (d=2) \sim 140 \text{ m/s}$ - Buena velocidad, falamos de v_{gr}^{max} & stripes. Agosto. Abuztúa

2D del array (square lattice):

$$\cos(\vec{k} \cdot \vec{R}_n) = \cos(k_x n_1) \cos(k_y n_2) - \sin(k_x n_1) \sin(k_y n_2)$$

$$\sum_n f(n_1) \cos(k_x n_1) \cos(k_y n_2) = \sum_n f(n_1) \cos(k_x n_1) \cos(k_y n_2) - \sum_n f(n_1) \sin(k_x n_1) \sin(k_y n_2)$$

$$\cos(k_x n_1) \cos(k_y n_2) = 2 \sum_{n_1=1}^{\infty} \sum_{n_2=0}^{\infty} (\cdot) + 2 \sum_{n_1=0}^{\infty} \sum_{n_2=1}^{\infty} (\cdot) + 4 \sum_{n_1=1}^{\infty} \sum_{n_2=1}^{\infty} (\cdot)$$

$$\cos^2(k) = \sum_{n_1, n_2} \frac{(n_1 + i n_2)^2}{(n_1^2 + n_2^2)^{L+1/2}} \cos^2(k \cdot \vec{R}_n) = \sum_{n_1, n_2} \frac{[n_1^2 - n_2^2 + 2i n_1 n_2]}{(n_1^2 + n_2^2)^{L+3/2}} \times$$

$$[\cos k_x n_1 \cos k_y n_2 - \sin k_x n_1 \sin k_y n_2] = -2i \sum_{n_1, n_2} \frac{n_1 n_2 \sin(k_x n_1) \sin(k_y n_2)}{(n_1^2 + n_2^2)^{L+3/2}}$$

$$\sum_{n_1, n_2} f(n_1) [n_1^2 - n_2^2 + 2i n_1 n_2] [\sin k_x n_1 \cos k_y n_2 + \cos k_x n_1 \sin k_y n_2] = 0$$

$$\cos^2(k) = (-2i) \sum_{n_1, n_2} \frac{n_1 n_2 \sin(k_x n_1) \sin(k_y n_2)}{(n_1^2 + n_2^2)^{L+3/2}} = (-2i) 4 \cdot \sum_{n_1=1}^{\infty} \sum_{n_2=1}^{\infty} (\cdot) \rightarrow Y_2(k)$$

$$F_{\pm}(k) = -Y_1(k) \pm |Y_2(k)|$$

$$\omega^2(k) = \omega_0^2 [1 + \frac{9J}{S} F_-(k)] [1 + \frac{9J}{S} F_+(k)] - \text{pole free model. 2D array}$$

$$\frac{\omega(\pi, 0)}{\omega_0} = 1.025; \frac{\omega(\pi, \pi)}{\omega_0} = 1.106, \frac{\omega(0, 0)}{\omega_0} = 0.751 \text{ para } d=2.$$

$$\text{Die } d=2 \text{ unipolar } \vec{k} \parallel (1, 1) \Delta\omega = 0.355 \omega_0 (!)$$

$$\vec{v}_{gr} = \nabla_{\vec{k}} \omega(\vec{k}) \cdot \text{Vim } \vec{k} \parallel (1, 1). v_{gr}^2 = \left(\frac{\partial \omega}{\partial k_x}\right)^2 + \left(\frac{\partial \omega}{\partial k_y}\right)^2$$

$$\omega(\frac{k}{\sqrt{2}}, \frac{k}{\sqrt{2}}, d), \omega(k_x, k_y) = \omega(k, \varphi_k) \nabla \omega = \hat{k} \frac{\partial \omega}{\partial k} + \hat{\varphi}_k \frac{1}{k} \frac{\partial \omega}{\partial \varphi_k}$$

$$\frac{\partial \omega}{\partial k_x} = \vec{v}_{gr} \cdot \vec{n} = \nabla_k \omega \cdot \vec{n} = n_x \frac{\partial \omega}{\partial k_x} + n_y \frac{\partial \omega}{\partial k_y} = (\vec{n} \cdot \vec{v}_{gr}) \omega, \vec{n} = (n_x, n_y) = \frac{1}{\sqrt{2}} (1, 1)$$

$$\frac{\partial \omega}{\partial k} = \frac{\partial \omega}{\partial k_x} \frac{\partial k_x}{\partial k} + \frac{\partial \omega}{\partial k_y} \frac{\partial k_y}{\partial k} = \frac{1}{\sqrt{2}} \frac{\partial \omega}{\partial k_x} + \frac{1}{\sqrt{2}} \frac{\partial \omega}{\partial k_y}, (\vec{v}_{gr} \cdot \vec{n})^2 = \left(\frac{\partial \omega}{\partial k}\right)^2 \frac{\vec{n} \cdot \vec{n}}{2}$$

$$\text{En } \frac{\partial \omega}{\partial k} \text{ a comp. } (1, 1), \text{ en } v_{gr}^x = \frac{\partial \omega}{\partial k_x} \text{ MathCad barman, grupo}$$

$$\text{En } v_{gr}(k) \text{ u } v_{gr}^x(k_x) \text{ varía un poco en } k, k_x \leq 1$$

$$\text{Ovuna } v_{gr}^x = \frac{\Delta \omega(k_x)}{\Delta k_x} \text{ gaer } v_{gr}^x(d=2) = 0.124, v_{gr}^{(1)}(d=2) = 0.12$$

$$\text{En } v_{gr} = D \omega_c(v_{gr}) \text{ dimensionless. } v_{gr}^{\text{max}} = 0.124 \cdot 1 \mu\text{m} \cdot 2\pi \cdot 300 \text{ THz} \approx 230 \frac{\text{m}}{\text{s}}$$

$$\tau_{\text{min}} = \frac{D}{v_{gr}^{\text{max}}} = \frac{D}{D \omega_c(v_{gr}^{\text{max}})} = \frac{1}{0.124 \cdot 2\pi \cdot 0.36 \text{ THz}} \approx 4.3 \text{ ns} (!)$$

$$v_{gr}^x = 0.126 \text{ grupo } d=2. v_{gr}^{(1)}(d=2) = 0.123 \text{ grupo } d=2.$$

23/07 A. no res. : Super enfriado que non-resident & Havor. unen. Domingo. Igandea

Comunicar by M. Vazquez (ICMM, Madrid): Mag. micron wires. 217/148

Porque DW By d.c. field, a zero occumbent by local field & my own measure (Vazquez PRL'12). Dem. 3p. Döring. in 10 kg. Berry

Gen. appointment & Havor. unen. & Gros na 10 May, 945.

Comunicar by A. Aguella : Nanowires or 3D to nanodots - shape memory alloys - el. calc. of k_1 u no posob pen. Nizhna. Traque: barancu

Comunicar by FMR-pinning - ymen - jagam u Zivern - stamps PRL'06 - Arantxa.

Uman. Kachin. Dne. b Parus oxygus. (Ouc. Verba-APL'12 no SD1
 magnonics. E-mail to Slavin no nebiogy. Verba-APL'12
 ne kopyuwa casbo o cobu padone no Magnonics. Dne. Verba-APL'12
 no b Parus, dno S. Margherita. rge se uoggermet, ko mones zanyu.

1/2) Multipole paper na 2 papers → 1) Dot pair y clusters - EPL
 2) Multipole in u(x) - PRB
 3) Anomalous Fe/Si/Fe dots state give Tapaola P. E-mail emy Martes. Astearte
 4) Multipole paper u editing Tapaola P. C.A. no Oudarreba.
 5) Multipole paper na Nanotubes - JMMH (A. Ring, neprecna eu.
 6) Multipole paper na gbe u coepon.
 7) Multipole paper na Conf. Mirov. magn. in Germany u uonner
 8) Multipole paper na Conf. Mirov. magn. in Germany u uonner
 9) Multipole paper na Conf. Mirov. magn. in Germany u uonner

10) Multipole paper na Conf. Mirov. magn. in Germany u uonner
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 16) Multipole paper na Conf. Mirov. magn. in Germany u uonner
 17) Multipole paper na Conf. Mirov. magn. in Germany u uonner
 18) Multipole paper na Conf. Mirov. magn. in Germany u uonner
 19) Multipole paper na Conf. Mirov. magn. in Germany u uonner
 20) Multipole paper na Conf. Mirov. magn. in Germany u uonner

1) $|s_1^p - s_2^p| = \frac{\delta}{2\pi} M_s \frac{\beta}{4\pi} \left[\frac{4}{9} (2-p) \frac{1}{d^3} + \frac{1}{5} (4-p) \frac{1}{d^5} + O(1/d^7) \right]$ - pole-free
 model, upegnorene (V2) b Wint = $\frac{1}{2} \int d\vec{r} d\vec{r}' \frac{\text{div} \vec{m} \text{div} \vec{m}'}{|\vec{r} - \vec{r}'|}$ of the dot
 pair
 Jung's Si. Rep. 2011: $p = -1, \beta = 1/24, d = 2.1 \text{ u } 2.2$ gaes $\Delta f = 20 \text{ MHz u } (2.1) (2.2)$

2) $|s_1^p - s_2^p| = \frac{\delta}{2\pi} M_s \frac{\beta}{4\pi} \left[\frac{4}{3} \frac{1}{d^3} + \frac{1}{d^5} + O(1/d^7) \right] = 2.95 \text{ MHz}$
 $\times \frac{1}{4\pi \cdot 24} \left[\frac{4}{3} \frac{1}{d^3} + \frac{1}{d^5} \right]_{d=2.1} = 7.05 \text{ MHz} \left[\frac{4}{3} \frac{1}{(2.1)^3} + \frac{1}{(2.1)^5} \right] = 7.05 \cdot 0.168 \text{ MHz} =$
 $= 1.19 \text{ MHz}$

3) $|s_1^p - s_2^p| = \frac{\delta}{2\pi} M_s \frac{\beta}{4\pi} [1 I_y - p I_x]$ b uogner. APEX'11
 $\lambda_x \approx \beta^2 \left[\frac{4}{9} \frac{1}{d^3} + \dots \right] \approx I_x, \lambda_y = -\beta^2 \left[\frac{8}{9} \frac{1}{d^3} + \dots \right] \approx I_y.$
 $|\omega| = \omega_c [1 - p\alpha] = \frac{\delta M_s}{4\pi \beta} [1 I_y - p I_x] \times 2.$

4) $|s_1^p - s_2^p| = \left(\frac{\delta}{2\pi} \right) M_s \frac{\pi}{2} \beta \left[\frac{4}{9} (2-p) \frac{1}{d^3} + \frac{1}{5} (4-p) \frac{1}{d^5} + O(1/d^7) \right]$ b
 pole-free model, rge Wint = $(1) \int d\vec{r} d\vec{r}' \frac{\text{div} \vec{m} \text{div} \vec{m}'}{|\vec{r} - \vec{r}'|} \delta \vec{g} (V_2)^{1/46}$
 no gaes gon. uogner x(2) b freq. splitting Δf .

5) $|s_1^p - s_2^p| = \left(\frac{\delta}{2\pi} \right) M_s \frac{\pi}{2} \beta \left[\frac{4}{9} (2-p) \frac{1}{d^3} + \frac{1}{5} (4-p) \frac{1}{d^5} + O(1/d^7) \right]$ b
 pole-free model, rge Wint = $(1) \int d\vec{r} d\vec{r}' \frac{\text{div} \vec{m} \text{div} \vec{m}'}{|\vec{r} - \vec{r}'|} \delta \vec{g} (V_2)^{1/46}$
 no gaes gon. uogner x(2) b freq. splitting Δf .

6) Multipole paper: 1) abno $|s_2|$ no gaes $Q_e \sim \beta (1 - \text{ker})$
 2) $|s_1|$ no gaes $Q_e \sim \beta (1 - \text{ker})$
 3) $|s_1|$ no gaes $Q_e \sim \beta (1 - \text{ker})$
 4) $|s_1|$ no gaes $Q_e \sim \beta (1 - \text{ker})$
 5) $|s_1|$ no gaes $Q_e \sim \beta (1 - \text{ker})$

8 $P'_\ell(x) = \frac{\ell}{\sqrt{1-x^2}} [P_{\ell-1}(x) - x P_\ell(x)] = \frac{\ell(\ell+1)}{(2\ell+1)} \dots$

$x = \cos\theta = \frac{z}{\sqrt{g^2+z^2}}, \sin\theta = \frac{g}{\sqrt{g^2+z^2}}, x \ll 1, 0 \leq \theta/2, \cos \approx 22/18$

Astazkena - Miércoles

Archen

9 $P'_{2n}(0) = 0, P'_{2n+1}(0) = (-1)^n \frac{(2n+1)!!}{(2n)!!} = (-1)^n \frac{(2n+1)!}{(2n)!!}$

10 $J_\ell(\beta) = - \int_0^\beta dg g^{l+2} \int_{\pi/2}^{\arcsin(z/g)} \frac{1}{\sin^{l+2}\theta} P'_\ell(\cos\theta) d\theta, P'_m(x) = (1-x^2)^{m/2} \frac{d^m}{dx^m} P_n(x)$

9 $P'_n(x) = (1-x^2)^{1/2} \frac{dP_n(x)}{dx}$

10 $P'_\ell(x) = \frac{\ell}{\sqrt{1-x^2}} [P_{\ell-1}(x) - P_\ell(x) \cdot x] = \frac{\ell}{\sqrt{1-x^2}} [\dots]$

10 $P_\ell(x) = (-1)^k \frac{(2\ell-2k)!}{2^\ell k! (n-k)! (n-2k)!} x^{\ell-2k}, k = [\frac{\ell}{2}] = \begin{cases} \ell/2, \ell-\text{res.} \\ \frac{\ell-1}{2}, \ell-\text{nonres.} \end{cases}$

a) $\ell-\text{res. } P'_\ell(x) = \frac{\ell}{\sqrt{1-x^2}} [0 - x(-1)^{\ell/2} \frac{(\ell-1)!!}{(\ell)!!}] \sim x \rightarrow 0$

12 $\text{hacer } P'_\ell(x) = a_\ell x \text{ w/m } x \rightarrow 0 \int_0^\beta dz (g^2+z^2)^{\ell/2} a_\ell \frac{z}{\sqrt{g^2+z^2}} =$
 $\rightarrow = a_\ell \int_0^\beta dz z (g^2+z^2)^{\frac{\ell}{2}-1} \frac{1}{2} \approx |z \ll g| = a_\ell g^{\ell-1} \int_0^\beta dz z = \frac{1}{2} a_\ell g^{\ell-1} \beta^2 \sim \beta^2$

13 no nonzero en $z \ll g$ eum $g \in [0,1]$ uum $g \in [1,1]$?

b) $\ell-\text{nonres. } P'_\ell(x) = \frac{\ell}{\sqrt{1-x^2}} [(-1)^n \frac{(2n-1)!!}{(2n)!!} - x b_\ell x] = \ell(-1)^{\frac{\ell-1}{2}} \frac{(\ell-2)!!}{(\ell-1)!!}$

14 $P'_\ell(x) = (-1)^{\ell-1/2} \frac{\ell!!}{(\ell-1)!!}$ Note 22/III many res $P'_\ell(0) = -(-1)^{\frac{\ell-1}{2}} \frac{\ell!!}{(\ell-1)!!}$

15 $\text{signum } \text{Brenson. } \text{For } (-1) \text{ named } \delta \text{ en } P_\ell^1. \text{ No r.v. } \delta \text{ energy } \text{ne exagance.}$

a) $\ell-\text{res. } J_\ell(\beta) = \int_0^\beta dg g \int_0^\beta dz (g^2+z^2)^{\ell/2} P'_\ell(\frac{z}{\sqrt{g^2+z^2}})$

16 $\ell=2, J_2(\beta) = \int_0^\beta dg g \int_0^\beta dz (g^2+z^2) 3 \frac{z}{\sqrt{g^2+z^2}} (1 - \frac{z^2}{g^2+z^2})^{1/2} = 3 \int_0^\beta dg g \int_0^\beta dz (g^2+z^2) x$

17 $\frac{z}{(g^2+z^2)^{1/2}} \frac{g}{(g^2+z^2)^{1/2}} = 3 \int_0^\beta dg g^2 \int_0^\beta dz z = 3 \cdot \frac{1}{3} \cdot \frac{1}{2} \beta^2, \text{ cuonnocei res.}$

18 $\ell=4 J_4(\beta) = \int_0^\beta dg g \int_0^\beta dz (g^2+z^2)^2 \frac{5}{2} (2\cos^2\theta - 3) \frac{z}{\sqrt{g^2+z^2}} \frac{g}{\sqrt{g^2+z^2}} =$
 $= \frac{5}{2} \int_0^\beta dg g^2 \int_0^\beta dz z (7 \frac{z^2}{2^2+g^2} - 3) \approx -3 \cdot \frac{5}{2} \int_0^\beta dg g^2 \int_0^\beta dz z \sim \beta^2 - \text{cuonnocei res.}$

19 $P_{\ell-1}(x) = | \ell-\text{res. } | = x \cdot (-1)^{\frac{\ell}{2}-1} \frac{(\ell-1)!!}{(\ell-2)!!}, P'_\ell(x \rightarrow 0) = x \ell [(-1)^{\frac{\ell}{2}-1} \frac{(\ell-1)!!}{(\ell-2)!!} - (-1)^{\frac{\ell}{2}} \frac{(\ell-1)!!}{(\ell-1)!!}]$
 $= x \ell (-1)^{\frac{\ell}{2}-1} \frac{(\ell-1)!!}{(\ell-2)!!} [\frac{1}{(\ell-2)!!} + \frac{1}{\ell!!}] = x \ell (-1)^{\frac{\ell}{2}-1} \frac{(\ell-1)!!}{(\ell-1)!!} (\ell+1)$

220/145 $P'_\ell(x) = (-1)^{\ell/2-1} \frac{(\ell-1)!!}{\ell!!} \ell(\ell+1)x = (-1)^{\ell/2-1} \frac{(\ell-1)!!}{(\ell-2)!!} \cdot x$ Cuonnocei res. Table.

$J_\ell(\beta) = \int_0^\beta dg g \int_0^\beta dz (z^2+g^2)^{\ell/2} P'_\ell(x) = (-1)^{\ell/2-1} \frac{(\ell+1)!!}{(\ell-2)!!} \int_0^\beta dg g \int_0^\beta dz (z^2+g^2)^{\ell/2} \frac{z}{\sqrt{z^2+g^2}}$
 $= (-1)^{\ell/2-1} \frac{(\ell+1)!!}{(\ell-2)!!} \int_0^\beta dg g^{\ell-1} \int_0^\beta dz z = (-1)^{\ell/2-1} \frac{(\ell+1)!!}{(\ell-2)!!} \frac{1}{(\ell+1)} \beta^2$

32 Asta 2 Septimo $J_\ell(\beta) = (-1)^{\ell/2-1} \frac{(\ell-1)!!}{(\ell-2)!!} \frac{\beta^2}{2}, \ell-\text{res. } Q_\ell^m \sim \delta m_1 J_\ell(\beta), \text{ pol - free model}$

9

Def: $Z(k)$ и производная скорости $\vec{v}_{gr}(k) = \frac{\partial w(k)}{\partial k}$ где $w(k)$ — энергия.
Note: $Q_c^1(l-zer.)=0$ при условии координат $z \in (-\frac{l}{2}, \frac{l}{2})$. 0 = tot center

$$\frac{\omega^2(k)}{\omega_0^2} = [1 + \lambda F_-(k)] [1 + \lambda F_+(k)], \quad \lambda = \frac{g\sqrt{N}}{5} \text{ - pole free m., } F_{\pm}(k) = -J_1(k) \pm |J_2(k)|$$

... $\omega(k)$... $\pi/4$... $\sqrt{g}$...

$$\omega(k) = \sqrt{(1+\lambda F_-)(1+\lambda F_+)} \quad , \quad \frac{\partial \omega}{\partial k} = \frac{1}{2\sqrt{(\dots)}} \left[\frac{\partial F_-}{\partial k} (1+\lambda F_+) + \frac{\partial F_+}{\partial k} (1+\lambda F_-) \right] =$$

$$F_+ F_- = [-\gamma_1 + |\gamma_2|] [-\gamma_1 - |\gamma_2|] = \gamma_1^2 - |\gamma_2|^2$$

$$\partial_L(\vec{k}) = \sum_n \frac{\cos k_x \vec{R}_n}{(n_1^2 + n_2^2)^{\frac{L+1}{2}}} = \sum_{n_1, n_2} \frac{\cos(k_x n_1) \cos(k_y n_2)}{(n_1^2 + n_2^2)^{\frac{L+1}{2}}}, \quad \text{Eq. 22/17.}$$

$$\delta_{L,1}^c(\vec{k}) = (-2i) \sum_{n_1, n_2} \frac{n_1 n_2 \sin(k_x n_1) \sin(k_y n_2)}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}}, \text{ это верно, см. 22/10.}$$

$$\text{Lago} \quad \left(\delta_L^c(k) \right) = \sum_{n_1, n_2} \frac{(n_1^2 - n_2^2)}{(n_1^2 + n_2^2)^{\frac{L+3}{2}}} \cos(k_x n_1) \cos(k_y n_2) - 2i \sum_{n_1, n_2} \frac{n_1 n_2 \sin(k_x n_1) \sin(k_y n_2)}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}}$$

c gov. real tension $\sim \cos(-)\cos(+)$. New corrected $\partial_L^C(\vec{k})$ agrees w $\omega(\vec{k})$
w/ $\vec{k} \parallel (1,0)$. W/ $\vec{k} \parallel (1,1)$, $k_x = k_y$ & gov. real $\text{tension} = 0$.

Math'ed gaeir $W(\pi, 0)$ ne comac. c Galluain PRB'06 u game $Z(\pi, 0)$,
 $W(\pi, 0)$ ne comac. c Bondarenko PRB'10.

1/2) Прямая перевернута. Инв. левее гра A. Nakhle. Нормальное пересечение у точки. Нормальное пересечение $W(\pi, 0)$ и $Z(\pi, 0)$. $Z_c(\pi, 0)$. У нас $(1/\pi, 0)$.

3.2. Восьмо не Схогелче а Бондаренко 'PRB'10. Аномал $\tau_c = d\omega \frac{\pi}{2}$ где

Tues: 1) FMR-ph. Revised n/papers 21/V; 2) n/papers MEC-appl. travel gran
3) & Kaiser's lantern - FMR - Tour abroad Arantva

E-mail to Slavin: Status FRP-Sci. Rep.? Obcabin. papers - Magnon's in ST-dyn.
Seyong. Multipole papers & dec.: new answers D-array of ...

Prologu a N. na Amara Plaza, bus $\rightarrow$ Bilbao airport.

Frachman JMM 1999 gives that $D(\vec{k}) = \frac{1}{a^3} \mathcal{B}(\vec{k}) = \sum_{n_1, n_2} \frac{e^{-i(\vec{k} \cdot \vec{r}_{n_1, n_2})}}{(n_1^2 + n_2^2)^{3/2}} \frac{1}{a^3}$

$$\sum_{n=1}^{\infty} \sum_{h=1}^{\infty} (-1)^{nh} \frac{h}{n} K_1(\pi nh) , K_1(z) = \text{q. Bessela}$$

$$X_0(\vec{k}) + Y_0(\vec{k}) = \sum_{l_1, l_2} \frac{e^{i\vec{k}\vec{l}}}{(l_1^2 + l_2^2)^{3/2}} = (\vec{k}=0)$$
$$X_c(0) = \sum_{l=1}^k \frac{l^2}{(l_1^2 + l_2^2)^{5/2}} = 5.5470819 \quad 4.5168109, \quad X^{(2)}(0) = 2.5451291$$
$$x_0(0) + y_0(0) = \sum_{\ell_1, \ell_2} \frac{1}{(\ell_1^2 + \ell_2^2)^{3/2}} = 2(0) = 2 \cdot 4.5168109 = 9.0336218$$
$$X_0(k) - Y_0(k) = \sum_{l_1, l_2} \frac{(l_1^2 - l_2^2)}{(l_1^2 + l_2^2)^{5/2}} e^{i k \cdot \vec{l}} = -\frac{2\pi}{3} k \cos 2\theta_k, \quad \cos 2\theta_k = \cos^2 \theta_k - \sin^2 \theta_k$$
$$\sum_{l_1, l_2} \frac{(l_1^2 - l_2^2)}{(l_1^2 + l_2^2)^{5/2}} e^{i\vec{k}\vec{r}} = -\frac{2\pi}{3} k \left(\frac{k_x^2 - k_y^2}{k^2} \right). \quad \text{Bogus } \sum_{l_1, l_2} \frac{l_1 l_2}{(l_1^2 + l_2^2)^{5/2}} e^{i\vec{k}\vec{r}} = -\frac{2\pi}{3} k \left(\frac{k_x k_y}{k^2} \right)$$
$$k = \sum_{l_1, l_2} \frac{(l_1 + il_2)^2}{(l_1^2 + l_2^2)^{5/2}} e^{ik\vec{l}} = -\frac{2\pi}{3} k \cdot \frac{(k_x + ik_y)^2}{k^2}, \quad k = |\vec{k}|. \quad \partial_3^C(\vec{k}) \text{ or } \partial_3^C(\vec{k}) - \text{Coll.}$$
$$\Rightarrow \partial_2(\vec{k}) = \sum_{n_1, n_2} \frac{e^{i\vec{k} \cdot \vec{n}}}{(n_1^2 + n_2^2)^{\frac{L+1}{2}}} \Big|_{L=2} = \partial_2(0) - 2\pi |\vec{k}|, \quad \partial_2^c(\vec{k}) = -\frac{2\pi}{3} \frac{(k_x + i k_y)^2}{k}$$

Due $V_{g2} = \frac{\partial W}{\partial E}$ баруны $\frac{\partial J_1(E)}{\partial E}$ " $\frac{\partial}{\partial E} [J_1^2(E) - |J_2(E)|^2]$. $V_{g2} = 2D$ арав.

$$\frac{\partial \mathcal{J}_1(\vec{k})}{\partial \vec{k}} = \sum_L (L-1) \frac{P_L}{d^{L+1}} \frac{\partial \mathcal{Z}_L(\vec{k})}{\partial \vec{k}} = \left| \begin{array}{l} \text{even } L \rightarrow 0 \\ \text{to } 10 \text{ zero} \\ L=2 \text{ g.c. } \text{b.c. } \text{g.c. } \text{b.c. } \text{g.c. } \text{b.c. } \end{array} \right. \mathcal{Z}_L(\vec{k}) = \mathcal{Z}_L(0) + \mathcal{O}(k^2), L \geq 2$$
$$= \frac{p_2}{d^3} \frac{\partial d}{\partial k} \quad \frac{\partial |k|}{\partial k} = \left(\frac{\partial}{\partial k_x}, \frac{\partial}{\partial k_y} \right) \sqrt{k_x^2 + k_y^2} = \left(\frac{k_x}{k}, \frac{k_y}{k} \right) = \frac{k}{|k|}, \quad \frac{\partial d}{\partial k} = (-2\pi) \frac{1}{k}$$
$$\frac{\partial J_1}{\partial k} = \frac{P_2}{d^3} (-2\pi) \frac{k}{k} \quad \frac{\partial J_2}{\partial k} = \frac{\partial}{\partial k} \sum_L (L+1) \frac{P_L}{L+1} \partial_L^c(k) = \sum_L (L+1) \frac{P_L}{L+1} \frac{\partial \partial_L^c(k)}{\partial k}$$
$$\text{Für } L \geq 2 \quad \partial_L^c(\vec{k}) = \sum_{n_1, n_2} \frac{(n_1 + i n_2)^2}{|\vec{n}|^{L+3}} \cos(\vec{k} \cdot \vec{n}) = \partial_L^c(0) - \frac{1}{2} \sum_{n_1, n_2} \frac{(n_1 + i n_2)^2}{|\vec{n}|^{L+3}} (\vec{k} \cdot \vec{n})^2 + \dots$$

$\frac{\partial \mathcal{L}(\vec{k})}{\partial \vec{k}} \rightarrow \frac{\partial \mathcal{L}_2(\vec{k})}{\partial \vec{k}} = -\frac{2\pi}{3} \frac{\partial}{\partial \vec{k}} \frac{(k_x + i k_y)^2}{k}$

$$\frac{\partial}{\partial k_x} \frac{(k_x + i k_y)^2}{k} = \frac{1}{k} 2(k_x + i k_y) + (k_x + i k_y)^2 \left(-\frac{1}{k^2}\right) \frac{k_x}{k} = \frac{1}{k^3} [k_x^3 + 3k_x k_y^2 - 2i k_y^3]$$
$$\frac{\partial}{\partial k} \left| \psi_2(k) \right|^2 = \psi_2 \frac{\partial \psi_2}{\partial k} + \psi_2^* \frac{\partial \psi_2^*}{\partial k} = \left| \psi_2 \right|^2 \frac{\partial \ln \left| \psi_2 \right|^2}{\partial k} = \left| \psi_2 \right|^2 \frac{\partial}{\partial k} \left(\ln \left| \psi_2 \right|^2 \right)$$
$$= \bar{J}_2(0) \frac{3P_2}{d^3} \frac{\partial \bar{\phi}_2^c}{\partial k^2} + \bar{J}_2 \frac{3P_2}{d^3} \frac{\partial \bar{\phi}_2^c}{\partial k^2} = \frac{3P_2}{d^3} \left[\bar{J}_2(0) \frac{\partial \bar{\phi}_2^c}{\partial k^2} + \bar{J}_2(0) \frac{\partial \bar{\phi}_2^c}{\partial k^2} \right] =$$

$$= \frac{3P_2}{d^3} \left[\sum_{L=3} (L+1) \frac{P_L}{L+1} \bar{\phi}_L^c(0) \cdot \frac{\partial \bar{\phi}_2^c}{\partial k^2} + \sum_{L=3} (L+1) \frac{P_{L-1}}{L-1} \bar{\phi}_{L-1}^c(0) \frac{\partial \bar{\phi}_2^c}{\partial k^2} \right] =$$
$$= \frac{3P_2}{4^3} \sum_L (L+1) \frac{P_L}{4^{L+1}} \left[\bar{\partial}_L^c(0) \frac{\partial \bar{\partial}_2^c}{\partial k^2} + \partial_L^c(0) \frac{\partial \bar{\partial}_2^c}{\partial k^2} \right], \quad \partial_L^c(0) = \sum_{n_1 n_2} \frac{(n_1 + i n_2)^2}{(n_1^2 + n_2^2)^{\frac{L+3}{2}}} =$$
~~$$= \sum_{n_1, n_2} (i\vec{n}_1) [n_1^2 - n_2^2 + 2in_1 n_2] = 0, \text{ not zero} \rightarrow \frac{\partial |\gamma_2(\vec{k})|^2}{\partial \vec{k}} = 0 \text{ n/m } \vec{k} \rightarrow 0.$$~~

Bluyser - Mills' PR 1969: $S(\vec{k}) = \sum_{\vec{l}, \vec{l}_2} \frac{e^{i\vec{k}\vec{l}}}{(l^2 + l_2^2)^{5/2}}$

Abuzitua - Agosto $\delta_2^c(\vec{k}) = \sum_{n_1, n_2} \frac{(n_1 + i n_2)^2}{[n_1^2 + n_2^2]^{L+3/2}} e^{i\vec{k}\vec{n}}$

14^u $S_x(\vec{k}) = \sum_{\vec{l}, \vec{l}_2} \frac{l^2}{[l^2 + l_2^2]^{5/2}} e^{i\vec{k}\vec{l}}$, $S_y(\vec{k}) = \sum_{\vec{l}, \vec{l}_2} \frac{l_2^2}{[l^2 + l_2^2]^{5/2}} e^{i\vec{k}\vec{l}}$

Cooper - Astéarica - Mantes $\delta_2^c(\vec{k}) \in L = 2$.

$\frac{1}{d^{5/2}} = \frac{4}{3\sqrt{\pi}} \int_0^\infty dt t^{3/2} e^{-dt}$, $S_x(\vec{k}) = \sum_{\vec{l}, \vec{l}_2} l^2 e^{i\vec{k}\vec{l}} \frac{4}{3\sqrt{\pi}} \int_0^\infty dt t^{3/2} e^{-t(l^2 + l_2^2)}$

$\sum_{l_1=-\infty}^\infty e^{-t l_1^2} e^{i k_x l_1} = \frac{\sqrt{\pi}}{\sqrt{t}} \sum_{n=-\infty}^\infty \exp\left[-\frac{1}{t} \left(\pi n + \frac{1}{2} k_x\right)^2\right]$, $\text{brn}(l=0)$

$S_x(\vec{k}) = \frac{4}{3\sqrt{\pi}} \sum_{\vec{l}, \vec{l}_2} l^2 e^{i k_x l_1} e^{i k_y l_2} \int_0^\infty dt t^{3/2} e^{-t l_1^2} e^{-t l_2^2} = \frac{4}{3\sqrt{\pi}} \sum_{\vec{l}_2} l_2^2 e^{i k_y l_2} \int_0^\infty dt t^{3/2} e^{-t l_2^2} \sum_{\vec{l}_1} l_1^2 e^{i k_x l_1} \int_0^\infty dt e^{-t l_1^2} \exp\left[-\frac{1}{t} \left(\pi n + \frac{1}{2} k_x\right)^2\right]$

$\times \sum_n \frac{\sqrt{\pi}}{\sqrt{t}} \exp\left[-\frac{1}{t} \left(\pi n + \frac{1}{2} k_x\right)^2\right] = \frac{4}{3} \sum_{\vec{l}_1, n} l_1^2 e^{i k_x l_1} \int_0^\infty dt e^{-t l_1^2} \exp\left[-\frac{1}{t} \left(\pi n + \frac{1}{2} k_x\right)^2\right]$

$= \frac{4}{3} \sum_{\vec{l}_1, n} e^{i k_x l_1} l_1 \frac{d}{d l_1} \int_0^\infty dt e^{-t l_1^2} e^{-\frac{1}{t} \left(\pi n + \frac{1}{2} k_x\right)^2}$

$\int_0^\infty e^{-Bt} e^{-\frac{A}{t}} dt = 2 \left(\frac{A}{B}\right)^{1/2} K_1[2\sqrt{AB}]$, $K_0(x) + \frac{2}{x} K_1(x) = K_2(x)$

$S_x(\vec{k}) = -\frac{2}{3} \sum_{\vec{l}_1, n} e^{i k_x l_1} l_1 \frac{d}{d l_1} \frac{2}{|\pi n + \frac{k_x}{2}|} K_1[2|\vec{l}_1| |\pi n + \frac{k_x}{2}|] =$

$= -\frac{8}{3} \sum_{\vec{l}_1, n} \cos(k_x l_1) \cdot l_1 \frac{d}{d l_1} \frac{1}{|\pi n + \frac{k_x}{2}|} K_1[2|\vec{l}_1| |\pi n + \frac{k_x}{2}|]$, $d = 2|\pi n + \frac{k_x}{2}|$

$x = l_1$, $\frac{d}{dx} \frac{1}{x} K_1(ax) = -\frac{1}{x^2} K_1(ax) + \frac{1}{x} a \left(-\frac{1}{2}\right) [K_0(ax) + K_2(ax)] =$

$= -\frac{1}{x^2} K_1(ax) - \frac{1}{2} \frac{a}{x} K_0(ax) - \frac{1}{2} \frac{a}{x} \left[\frac{2}{ax} K_1(ax) + K_0(ax)\right] = -\frac{2}{x^2} K_1(ax) - \frac{a}{x} K_0(ax)$

$S_x(\vec{k}) = \frac{16}{3} \sum_{\vec{l}_1, n, l_1=1,2,\dots} \cos(k_x l_1) |\pi n + \frac{k_x}{2}| \left[|\pi n + \frac{k_x}{2}| K_0(2l_1 |\pi n + \frac{k_x}{2}|) + \frac{1}{l_1} K_1(2l_1 |\pi n + \frac{k_x}{2}|) \right]$

$S_y(\vec{k}) = \frac{16}{3} \sum_{\vec{l}_2, n, l_2=1,2,\dots} \cos(k_y l_2) |\pi n + \frac{k_y}{2}| \left[|\pi n + \frac{k_y}{2}| K_0(2l_2 |\pi n + \frac{k_y}{2}|) + \frac{1}{l_2} K_1(2l_2 |\pi n + \frac{k_y}{2}|) \right]$

$\rightarrow \delta_2^c(\vec{k}) = S_x(\vec{k}) + S_y(\vec{k})$, $S_x(\vec{k}) - S_y(\vec{k}) = \sum_{\vec{l}_1, \vec{l}_2} \frac{(l_1^2 - l_2^2)}{[l_1^2 + l_2^2]^{5/2}} e^{i\vec{k}\vec{l}} = \text{Re } \delta_2^c(\vec{k})$

Ivan'10 - $D_{11} = S_x(\pi, 0)$, $D_{11} = S_y(\pi, 0)$

$S_x(\pi, 0) = \frac{16}{3} \sum_{\vec{l}_1, n} (-1)^{l_1} \pi |n| \left[|\pi n| K_0(2\pi |n| l_1) + \frac{1}{l_1} K_1(2\pi |n| l_1) \right] =$

$= \frac{16}{3} \pi^2 \sum_{\vec{l}_1, n>0} n^2 K_2(2\pi |n| l_1) (-1)^{l_1} = (n=0) + \frac{32}{3} \pi^2 \sum_{\vec{l}_1, n>0} (-1)^{l_1} n^2 K_2(2\pi n l_1)$

$K_2(2) = \frac{(2-1)! 2^{2-1}}{2^2} = \frac{1}{2}$, $K_2(2) = \frac{2}{2^2}$

$S_x(\pi, 0) = \frac{16}{3} \pi^2 \sum_{\vec{l}_1, n>0} (-1)^{l_1} \frac{2}{(2\pi l_1)^2} + \frac{32}{3} \pi^2 \sum_{\vec{l}_1, n>0} (-1)^{l_1} n^2 K_2(2\pi n l_1)$

$S_x(0, 0) = \frac{4\pi^2}{9} + \frac{32\pi^2}{3} \sum_{\vec{l}_1, n} n^2 K_2(2\pi n l_1)$, $S_x(\vec{k}) = \sum_{\vec{l}_1, \vec{l}_2} \frac{l_1^2 e^{i\vec{k}\vec{l}}}{[l_1^2 + l_2^2]^{5/2}}$

$S_y(\pi, 0) = \frac{16}{3} \sum_{\vec{l}_2, n} \cos(k_y l_2) |\pi n + \frac{k_y}{2}|^2 K_2[2l_2 |\pi n + \frac{k_y}{2}|] = \frac{16}{3} \sum_{\vec{l}_2, n} \pi^2 (n + \frac{1}{2})^2 \times$

$\times K_2[2l_2 \pi |n + \frac{1}{2}|]$, $S_y(0, 0) = \frac{16\pi^2}{3} \sum_{\vec{l}_2, n} n^2 K_2(2\pi n l_2)$

$\Gamma(z) = \int_0^\infty dt e^{-t} t^{z-1} = \frac{1}{z^2} \int dx dx e^{-dx} x^{z-1} dx^{z-1} = dx^z \int dx x^{z-1} e^{-dx}$
 $\int_0^\infty dt t^{z-1} e^{-dt} = \frac{1}{d^z} \Gamma(z)$, $\Gamma(5/2) = \frac{3}{2} \Gamma(3/2) = \frac{3}{2} \frac{1}{2} \Gamma(1/2) = \frac{3}{4} \sqrt{\pi}$
 $\frac{1}{d^{L+1}} = \frac{1}{[n_1^2 + n_2^2]^{\frac{L+1}{2}}} \Gamma(\frac{L+1}{2})$
 $\partial_L(\vec{k}) = \sum_{\vec{n}} \frac{1}{n^{L+1}} e^{i\vec{k}\vec{n}}$, $\frac{1}{n^{L+1}} = \frac{1}{\Gamma(\frac{L+1}{2})} \int_0^\infty dt t^{\frac{L-1}{2}} e^{-n^2 t}$
 $\partial_L(\vec{k}) = \sum_{\vec{n}} e^{i\vec{k}\vec{n}} \frac{1}{\Gamma(\frac{L+1}{2})} \int_0^\infty dt t^{\frac{L-1}{2}} e^{-n^2 t}$, $\sum_{n_1=-\infty}^\infty e^{-tn_1^2} e^{ik_x n_1} =$
 $= \frac{\sqrt{\pi}}{\sqrt{t}} \sum_{\mu=-\infty}^\infty \exp[-\frac{1}{t} (\pi\mu + \frac{1}{2} k_x)^2]$
 $\partial_L(\vec{k}) = \frac{1}{\Gamma(\frac{L+1}{2})} \sum_{n_1} \sum_{n_2} \int_0^\infty dt t^{\frac{L-1}{2}} e^{ik_x n_1} e^{ik_y n_2} e^{-(n_1^2 + n_2^2)t} =$
 $= \frac{1}{\Gamma(\frac{L+1}{2})} \int_0^\infty dt t^{\frac{L-1}{2}} \sum_{n_1} \sum_{n_2} e^{ik_x n_1} e^{-n_1^2 t} e^{ik_y n_2} e^{-n_2^2 t} = \frac{1}{\Gamma(\frac{L+1}{2})} \int_0^\infty dt t^{\frac{L-1}{2}} \times$
 $\times \frac{\sqrt{\pi}}{\sqrt{t}} \sum_{\mu=-\infty}^\infty \exp[-\frac{1}{t} (\pi\mu + \frac{1}{2} k_x)^2] \sum_{\nu=-\infty}^\infty \exp[-\frac{1}{t} (\pi\nu + \frac{1}{2} k_y)^2] =$
 $\partial_L(\vec{k}) = \frac{1}{\Gamma(L)} \sum_{n_2} \int_0^\infty dt t^{\frac{L-1}{2}} e^{ik_y n_2} e^{-n_2^2 t} \frac{\sqrt{\pi}}{\sqrt{t}} \sum_{\mu=-\infty}^\infty \exp[-\frac{1}{t} (\pi\mu + \frac{1}{2} k_x)^2] =$
 $= \frac{1}{\Gamma(L)} \sqrt{\pi} \sum_{n_2} \int_0^\infty dt t^{\frac{L-1}{2}} e^{ik_y n_2} e^{-n_2^2 t} \exp[-\frac{1}{t} (\pi\mu + \frac{1}{2} k_x)^2] =$
 $= \frac{\sqrt{\pi}}{\Gamma(L)} \sum_{n_2} e^{ik_y n_2} \int_0^\infty dt t^{\frac{L-1}{2}} e^{-n_2^2 t} \exp[-\frac{1}{t} (\pi\mu + \frac{1}{2} k_x)^2]$, универс.
 $\int_0^\infty dt t^{\nu-1} \exp[-\frac{\beta}{t} - \delta t] = 2 \left(\frac{\beta}{\delta}\right)^{\nu/2} K_\nu(2\sqrt{\beta\delta})$, $\beta, \delta > 0$, $\nu = L/2$, $(\Gamma-P, 3, 478)$
 $\partial_L(\vec{k}) = \frac{\sqrt{\pi}}{\Gamma(L)} \sum_{n_2} e^{ik_y n_2} 2 \frac{|\pi\mu + \frac{1}{2} k_x|^{L-1}}{n_2^L} K_L(2|n_2| |\pi\mu + \frac{1}{2} k_x|) =$
 $= \frac{4\sqrt{\pi}}{\Gamma(\frac{L+1}{2})} \sum_{n_2=1}^\infty \cos(k_y n_2) \frac{|\pi\mu + \frac{1}{2} k_x|^L}{n_2^L} K_L(2n_2 |\pi\mu + \frac{1}{2} k_x|)$
 $\partial_L(0,0) = \frac{4\sqrt{\pi} \pi^L}{\Gamma(L)} \sum_{\mu=0}^\infty \frac{|\mu|^L}{n_2^L} K_L(2\pi n_2 |\mu|)$
 $\text{универс. } \mu=0 \text{ when } |\mu|^L K_L(2\pi n_2 |\mu|) = |\mu|^L \frac{(L-1)! 2^{L-1}}{(2\pi n_2)^L |\mu|^L} = \frac{(L-1)! 2^{L-1}}{(2\pi n_2)^L}$
 $\partial_L(0,0) = \frac{4\sqrt{\pi} \pi^L}{\Gamma(L)} \frac{(L-1)! 2^{L-1}}{2^L \pi^L} \sum_{n_2>0} \frac{1}{n_2^{2L}} + \frac{8\sqrt{\pi} \pi^L}{\Gamma(L)} \sum_{n_2>0} \frac{|\mu|^L}{n_2^L} K_L(2\pi n_2 |\mu|)$
 $\partial_L(0,0) = \frac{2\sqrt{\pi}}{\Gamma(L)} (L-1)! \sum_{n_2>0} \frac{1}{n_2^{2L}} + \frac{8\sqrt{\pi} \pi^L}{\Gamma(\frac{L+1}{2})} \sum_{n_2>0} \left(\frac{\mu}{n_2}\right)^L K_L(2\pi n_2 |\mu|)$
 $K_L(z) \approx \sqrt{\frac{\pi}{2z}} e^{-z}$, $z \rightarrow \infty$, $\sum_{n_2} \frac{1}{n_2^{2L}} = \zeta(2L)$, $\Gamma(\frac{L+1}{2}) = \frac{(L-1)!}{2^{L/2}} \pi^{1/2}$
 $\partial_L(0,0) = \frac{2^{L+1}}{(L-1)!} (L-1)! \zeta(2L) + \frac{8 \cdot 2^{L/2} \pi^L}{(L-1)!} \sum_{n_2>0} \left(\frac{\mu}{n_2}\right)^L K_L(2\pi n_2 |\mu|)$, $\text{универс. } \mu=0$
 $\text{— универс. } \text{гнз } \vec{k}=0$
 $\partial_L^c(k,k) = 0$, $\partial_L(\pi,\pi)$ универс. Верх зона $\vec{k} \parallel (1,1)$
 $\partial_L(\pi,\pi) = \frac{4\sqrt{\pi} \pi^L}{\Gamma(\frac{L+1}{2})} \sum_{\mu=0}^\infty (-1)^\mu \frac{|\mu+1/2|^L}{n^L} K_L(2\pi n |\mu+1/2|)$
 $\partial_L^c(\vec{k})$ универс. $\frac{\partial^2}{\partial k_\alpha \partial k_\beta} \partial_{L+2}(\vec{k})$

Wzrobekna $\partial L(0,0), L=2$. K-negog gaez $\partial_2(0,0)$ mensure ∂_1 mensure ∂_2

$\sum_{n=1}^{\infty} \frac{1}{n^{p+1}} = \zeta(p+1)$, $\sum_{n=1}^{\infty} \frac{1}{n^p} = \zeta(p)$, $p > 1$

$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$, $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{12}$

$$16 \sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}, \quad \sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{n^2} = \frac{\pi^2}{12}.$$

$S_x(\pi, 0) = -2,323$, luego como $\sum_{k=0}^{\infty} \frac{(-1)^k}{(1+75^{1/2})^k} = -0.6354$ y por lo tanto

$$S_x(\pi, 0) = \sum_{n_1, n_2} \frac{n_1^2 (-1)^{n_1}}{[n_1^2 + n_2^2]^{5/2}} = 2 \sum_{n_1=1}^{\infty} \frac{(-1)^{n_1}}{n_1^3} + 4 \sum_{\substack{n_1 > 0 \\ n_2 > 0}} \frac{n_1^2 (-1)^{n_1}}{[n_1^2 + n_2^2]^{5/2}}$$

$S_X(\pi, 0) \stackrel{\text{Mills}}{\sim} \text{MathCod} \sum_{n,m} (-1)^{n+m} - \text{correct. negative coe} \quad \text{no or wrong}$
 or $S_X(\pi, 0) = -D_{11} - \text{Bondarenko 10.}$
 Mills - $S_4(\pi, 0) = 16\pi^2 \sum_{n=1}^{\infty} (n + \frac{1}{2})^2 K_2(2\pi |n + \frac{1}{2}|)$

$$\text{Use } S_y(x,0) = \sum_{n_1, n_2} \frac{n_1^2 (-1)^{n_1}}{[n_1^2 + n_2^2]^{5/2}} = 2 \sum_{n_1=1}^{\infty} \frac{1}{n_1^3} + 4 \sum_{\substack{n_1=1 \\ n_2=1}}^{\infty} \frac{n_1^2 (-1)^{n_1}}{[n_1^2 + n_2^2]^{5/2}} = 1.328$$

Mills $S_x(0,0) + S_y(0,0) = \sum_{l,l_2} \frac{1}{(l_1^2 + l_2^2)^{3/2}} = 3 \quad (0)$

$$S_x(0,0) + S_y(0,0) = \frac{8}{9}\pi^2 + \frac{64}{3}\pi^2 \sum_{l=2}^{\infty} n^2 K_2(2\pi n l) = 9,0336, \quad \delta_2(0,0) = 9,024$$

$$S_T(\vec{k}) = \sum_{\ell_1, \ell_2} \frac{\ell_1^2 e^{i\vec{k}\cdot\vec{\ell}}}{[\ell_1^2 + \ell_2^2]^{5/2}} = \frac{16}{3} \sum_{\ell_1=0}^{\infty} \cos(k_x \ell_1) \left(\pi n + \frac{1}{2} k_y\right)^2 K_2 \left[2\ell_1 \left| \pi n + \frac{1}{2} k_y \right| \right]$$

$$S_y(\vec{k}) = \sum_{\vec{\ell}} \frac{\ell_z^2}{|\ell|^5} e^{i\vec{\ell} \cdot \vec{r}} = \frac{16}{3} \sum_{\ell_z > 0} \sum_{n=-\infty}^{\infty} \cos(\ell_y \ell_z) \left(\pi n + \frac{1}{2} k_x \right)^2 K_2 \left[2\ell_z \left| \pi n + \frac{1}{2} k_x \right| \right]$$

$$\partial_2(\pi, \pi) = \frac{32}{3} \pi^2 \sum_{\substack{l \geq 0 \\ n = -\infty}}^{\infty} (-1)^l (n + 1/2)^2 K_2[2\pi l |n + 1/2|] \text{ позволяет найти}$$

Fig. 3 - Galkin goes $\omega(0,0) = 0,987$, worse than dip-pacres goes $\omega(0,0) = 0,987$

Fig. 3 $\omega(\vec{k})$ - Галкин'ов - вебернае по Гукану. $\gamma_{\text{нед}} = 1$

П. спрмне К-неога $\sum e^{-t\epsilon^2} e^{ikl} = \frac{\pi^{1/2}}{2} \sum \exp\left[-\frac{1}{2} \left(\pi n + \frac{k}{2}\right)^2\right]$

$k=0$: $\sum_{n=-\infty}^{\infty} e^{-t n^2} = \sqrt{\frac{t}{\pi}} \sum_{n=-\infty}^{\infty} e^{-\frac{\pi^2 n^2}{t}}$. y Mills $t_1=0$ zuma ne bomo, k.k. $\frac{1}{x}$.

$\mathcal{O}_L(k) = \frac{1}{\Gamma(\frac{1}{2})} \sum_{n=-\infty}^{\infty} \int dt t^{\frac{1}{2}-1} e^{ikx_1 n_1} e^{ikx_2 n_2} e^{-n_1^2 t} e^{-n_2^2 t} = \frac{1}{\Gamma(\frac{1}{2})} \sum_{n=-\infty}^{\infty} e^{-t n^2} e^{ikl n} + 1 = \frac{\pi^{1/2}}{t^{1/2}} \sum_{n=-\infty}^{\infty} \exp\left[-\frac{1}{4} \left(\frac{n}{t}\right)^2\right]$

$$= \frac{1}{L} \sum_{n_2=1}^{\infty} e^{ik_2 n_2} \int dt t^{\frac{L-1}{2}} e^{-n_2^2 t} \left[\frac{\pi^{1/2}}{t^{1/2}} \sum_{\mu=-\infty}^{\infty} \exp\left[-\frac{1}{t}(\pi\mu + k_2/2)^2\right] - 1 \right]$$

$$= \left(\sum_{n_2} \right) - \frac{1}{n_2} \sum_{n_2} e^{i k_y n_2} \frac{1}{|n_2|^{L+1}} = \left(\sum_{n_2} \right) - 2 \sum_{n_2=1} \frac{\cos k_y n_2}{n_2^{L+1}}$$

$$\delta_L(\vec{k}) = \frac{4\sqrt{\pi}}{\Gamma(\frac{L+1}{2})} \sum_{n_2=1}^{\infty} \cos(k_y n_2) \frac{1}{n_2^L} K_L(2n_2(\pi\mu + \frac{1}{2}k_x)) - 2 \sum_{n_2=1}^{\infty} \frac{\cos(k_y n_2)}{n_2^{L+1}}$$

$$\delta_L(0,0) = \frac{4\sqrt{\pi}}{\Gamma(\frac{L+1}{2})} \sum_{n_2=1}^{\infty} \frac{1}{n_2^L} K_L(2\pi n_2 \mu) - 2 \sum_{n_2=1}^{\infty} \frac{1}{n_2^{L+1}}$$

$$\delta_L(\vec{k}) = \frac{4\sqrt{\pi}}{\Gamma(\frac{L+1}{2})} \sum_{n_2=1}^{\infty} \cos(k_y n_2) \frac{k_x^L}{2^L n_2^L} K_L(n_2 k_x) - 2 \sum_{n_2=1}^{\infty} \frac{\cos(k_y n_2)}{n_2^{L+1}}$$

Per muna $n_1=0, n_2=0$, no $n_1=0$ u $n_2=0$ u n'ha no arguentar.

$$\delta_L(\vec{k}) = \frac{1}{\Gamma} \int dt t^{\frac{L-1}{2}} \sum_{n_1, n_2 \neq 0} e^{ik_x n_1 + ik_y n_2} e^{-n_1^2 t - n_2^2 t} + \sum_{n_1 \neq 0, n_2=0} \frac{e^{ik_x n_1}}{n_1^{L+1}} + \sum_{n_2 \neq 0, n_1=0} \frac{e^{ik_y n_2}}{n_2^{L+1}}$$

$$\delta_L(\vec{k}) = \sum_{n_1, n_2} (...) = \sum_{n_1 \neq 0, n_2=0} (...) + \sum_{n_2 \neq 0, n_1=0} (...) + \sum_{n_1 \neq 0, n_2 \neq 0} (...)$$

$$\delta_L(\vec{k}) = \frac{4\sqrt{\pi}}{\Gamma(\frac{L+1}{2})} \sum_{n_2=1}^{\infty} \cos(k_y n_2) \frac{1}{n_2^L} K_L(2n_2(\pi\mu + \frac{1}{2}k_x)) + 2 \sum_{n_1=1}^{\infty} \frac{\cos(k_x n_1)}{n_1^{L+1}}$$

(19/2) n'ha boomen. $\delta_L(\vec{k})$ nominau d'elenc e $n_1=0, n_2=0$ d'ha amonka.

Kago $\int dt t^{\frac{L-1}{2}} (-)$, $\nu=4/2$, a no $\nu=L$ kax a d'fau.

$$\delta_L(\vec{k}) = \frac{\sqrt{\pi}}{\Gamma} \sum_{n_2 \neq 0} e^{ik_y n_2} 2 \frac{1}{n_2^{L/2}} K_{\frac{L}{2}}[2n_2(\pi\mu + \frac{1}{2}k_x)] + 2 \sum_{n_1=1}^{\infty} \frac{\cos(k_x n_1)}{n_1^{L+1}}$$

$$\delta_L(\vec{k}) = \frac{4\sqrt{\pi}}{\Gamma} \sum_{n_2=1}^{\infty} \cos(k_y n_2) \frac{1}{n_2^{L/2}} K_{\frac{L}{2}}(2n_2(\pi\mu + \frac{1}{2}k_x)) + 2 \sum_{n_1=1}^{\infty} \frac{\cos(k_x n_1)}{n_1^{L+1}}$$

$$\delta_L(0,0) = \frac{4\sqrt{\pi}}{\Gamma} \pi^{L/2} \sum_{n_2=1}^{\infty} \left(\frac{\mu}{n_2}\right)^{L/2} K_{\frac{L}{2}}(2\pi n_2 \mu), \quad K_{\frac{L}{2}}(z \rightarrow 0) = \frac{(\frac{L}{2}-1)! 2^{\frac{L}{2}-1}}{2^{L/2} \pi^{L/2} n_2^{L/2} \mu^{L/2}}$$

$$\delta_L(0,0) = \frac{4\sqrt{\pi}}{\Gamma} \frac{(\frac{L}{2}-1)!}{2} \sum_{n_2=1}^{\infty} \frac{1}{n_2^L} + \frac{8\sqrt{\pi} \pi^{L/2}}{\Gamma} \sum_{n_2=1}^{\infty} \left(\frac{\mu}{n_2}\right)^{L/2} K_{\frac{L}{2}}(2\pi n_2 \mu) + \dots$$

$$\delta_L(0,0) = 2^{\frac{L}{2}+1} \frac{(\frac{L}{2}-1)!}{(L-1)!!} \zeta(L) + \frac{8 \cdot 2^{L/2} \pi^{L/2}}{(L-1)!!} \sum_{n_2=1}^{\infty} \left(\frac{\mu}{n_2}\right)^{L/2} K_{\frac{L}{2}}(2\pi n_2 \mu) + 2 \zeta(L+1)$$

$$\delta_L(0,0) = 9.02 - K\text{-merogom, no con. e MathCad } \sum_{n_1, n_2} (...) \text{ p'acerau.}$$

$$\text{FMR } \omega(\vec{k}=0, d) = 1 - \frac{9\pi}{5} \sum_{L=1}^{\infty} (L-1) \rho_L \delta_L(0), \quad \omega_{\text{FMR}}(d=2.0) = 0.751, \text{ nak}$$

$$\text{Due } \delta_L(\vec{k}) = \sum_{n_1, n_2} \frac{1}{[n_1^2 + n_2^2]^{\frac{L+1}{2}}} e^{i\vec{k}\vec{n}} - \text{nakun obicpo exog'au. K-merog.}$$

$$\delta_L^c(\vec{k}) = \left[-\frac{\partial^2}{\partial k_x^2} + \frac{\partial^2}{\partial k_y^2} - 2i \frac{\partial^2}{\partial k_x \partial k_y} \right] \delta_{L+2}(\vec{k}) = \sum_{n_1, n_2} \frac{[n_1^2 - n_2^2 + 2i n_1 n_2]}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}} e^{i\vec{k}\vec{n}}$$

(21/2) Zbonu a na mod. B'apera e p'ap'era no noboty ee simul. FMR. b stripe arrays: narusana f'izes(0) que width $w=50 \text{ nm}$, height $h=4 \text{ nm}$, t.e. B 10 p'az m'embre exp. d'eb. D'ba m'uka que $\theta \rightarrow 90^\circ$ 1 stripe side. B'ez $w=250 \text{ nm}$, noon usku. exchange uz wh. f'asta Rado. w. paper.

C'ip'osus f'iera exp. f'izes(0) u $M(H)$. Virginia b'ataz g'ado ne TMT-Madrid Abs. no FMR nanopart. Domingo J. g'andea

nes m'uno b'ku. B' coab'g'm, b'ur. creu ~ 100 € 3a ee Simul. A DIPC. 231/134

30/135 FMR-p'h. paper ne 120ba, Gun. European Ph.D. m'oro. N'og'm'cau Inv. letter for A. Madrik, p'oc'adun nero'u y f'atxi, organ f'actura

os'yang. m'ur. k multiple-papers, p'ator Barman u Vogel (ee m'aina 2+1, 3+3 v. dot clusters), p'c-calc. f'ur v. dot p'at. O'p'ec'm' en

K-merog que p'acera pem. c'ym'm. 22-28/12 P'ezg'ra b' k'uel. B'z'eu \$500. n'ub'ez e c'aden 400 \$ (300 \$ 25 p'az m'ur. u k'ue g'ua u. n. u k'ue g'ua 200 \$ n'ub'ez b' m'ore 400 \$). 1. n'ub'ez 100 \$.

2. n'ub'ez m'ur'm. M'emb'ry u B'ep'e. b'ur. b' m'ur'm. M'emb'ry ee m'eny, 2) o'c'yang. o'rb'ete Referee FMR-d'amp

Sci. Rep. paper; 30/12/17 - simul. narrow band FMR - narrow band FMR - narrow band FMR
X-22 (w10) - beam; u) nozhdachy exp. Miel - broad band FMR - broad band FMR - broad band FMR
20 paper no non-linear resonance by ST

20 paper no non-linear resonance by ST
Astelchena - Luns
a) rezistent, u) rezistent, na cifravu (gemar.) non-resistent - no rezistent
uchast. no rezistent - rezistent, no rezistent, no rezistent
na cifravu b) cifravu. No a na rezistent nureo ne gozdet
2) 24/12 vizdani cifravu bez cifravu na rezistent u) rezistent
u) na 23/12 vizdani "dopry no nozhdachy ne vizdani". Sci. Rep. to Slavin
25/12 vizdani nozhdachy c) na rezistent, no gozdet nureo u) rezistent

- 28/12 Ties upman revised FMR-pinning paper, a) paper. u) nozhdachy u) nozhdachy
D. Tabera - JNN nozhdachy (24/12) o) rezistent Ordizia - RTNSA papers -> nozhdachy
u) gozdet to Arentia. Com. dozdet referee Phys. Lett. paper no T-1000
29/12 Oukana upman na u) nozhdachy. $\vec{B}_L(\vec{k})$ u) $\vec{B}_T(\vec{k})$ - multiple paper
c) paper. a) e-mail to dozdet; 2) Sci. Rep. - paper by dozdet
3) edit PRB - pinning c) ties; u) paper non-lin. ST by Khvalkovsky
4) nozhdachy broad FMR u) paper; 6) new upman. Melkovy (Gulna)
7) nozhdachy miles Lufthansa; 8) paper no Kueb - trip; 9) paper visit M...
10) Preface - JNN - RTNSA

E-mails to Aliiev, Katakzei, Melkov o FMR-setup nozhdachy Melkov, dozdet
Zbomna Ties: JNN u) na 18-25 Apr. (2 nozhdachy u) nozhdachy), nozhdachy Melkovy, paper u)
Bzomna upman. miles to Lufthansa - site, u) nozhdachy paper. c) nozhdachy 14 Apr
nozhdachy nozhdachy, no c) nozhdachy.

15 Proberna $\vec{B}_T$ u) $\vec{B}_L(\vec{k})$ nozhdachy. by Oukana. Ties upman June 18-25
Zbomna Paper: positive response na APL - F/N/F dyn. nozhdachy; nozhdachy
u) - microwave x b) 1.5 paper dozdet u) - exp. (MS - simul. nozhdachy?)

30/12 Anany pinning $m_x(\vec{q}, \varphi=0)$, $m_x(\vec{k})$, 17, 20/12 give FMR-pin.
paper c) ties. Edited/changed FMR-pinning MS u) nozhdachy co-abstract.
Oukana dozdet na na nozhdachy o MRFM of c) dots (nozhdachy).
Revised APL - F/N/F c) Paper. Paper FMR-pin. paper revision c) nozhdachy

31/12 Anany - paper Fokuma - Sci. Rep. u) nozhdachy na na, nozhdachy
decision letter to Fokuma - Anany. Preface u) RTNSA - Proceed.
Hamcarne V, dot-pair u) 2D-arrays Multiple papers c) Oukana. Kyma u) dozdet

1/11 Bzomna $\vec{B}_L(\vec{k}) = \sum_{n_1, n_2} \frac{(n_1 + i n_2)^2}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}} e^{i \vec{k} \vec{n}}$, Com. 17/12 nozhdachy c) nozhdachy

232/133 $\vec{B}_L(\vec{k}) = \sum_{n_1, n_2} \frac{(n_1^2 - n_2^2)}{|\vec{n}|^{L+3}} \cos(k_x n_1) \cos(k_y n_2) - 2i \sum_{n_1, n_2} \frac{n_1 n_2}{|\vec{n}|^{L+3}} \sin(k_x n_1) \sin(k_y n_2)$, $|\vec{n}|^2 = n_1^2 + n_2^2$
Oukana $\vec{B}_L(0) = 0$, $\vec{B}_L(\vec{k}) \approx \vec{B}_L(0) + O(\vec{k}^2)$, $\vec{k} \rightarrow 0$ u) $L > 2$, $\vec{B}_2(\vec{k}) = -\frac{2}{3} \vec{k}^2$
B $\vec{B}_L(\vec{k})$ nozhdachy nozhdachy ($n_1=0, n_2 \neq 0$) u) ($n_2=0, n_1 \neq 0$), no na nozhdachy ($n_1=n_2=0$).
 $\vec{B}_L(\vec{k})$ - more Real, u) $k_x, k_y = 0, \pi$; $\vec{B}_L(\vec{k})$ - more Imaginary u) $k_x = k_y$
 $\frac{(n_1 + i n_2)^2}{|\vec{n}|^2} = e^{i 2 \varphi_n}$ u) $\vec{B}_L(\vec{k}) = \sum_{n_1, n_2} \frac{e^{i \vec{k} \vec{n}} e^{i 2 \varphi_n}}{|\vec{n}|^{L+1}}$, $\vec{k} \vec{n} = k |\vec{n}| \cos(\varphi_k - \varphi_n)$, $\tan \varphi_n = n_2/n_1$

Benson-Mills PR 69 $\sum_{n_1, n_2} (n_1^2 - n_2^2 + 2in_1 n_2) e^{ik\vec{n}} = \sum_{n_1, n_2} \frac{n_1^2 - n_2^2 + 2in_1 n_2}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}} e^{ik\vec{n}}$

$\partial_L(\vec{k}) = \sum_{n_1, n_2} \frac{n_1^2 - n_2^2 + 2in_1 n_2}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}} e^{ik\vec{n}} = \sum_{n_1} \frac{n_1^2}{n_1^{\frac{L+3}{2}}} - \sum_{n_2} \frac{n_2^2}{n_2^{\frac{L+3}{2}}} + 2i \sum_{n_1, n_2} \frac{n_1 n_2}{n_1^{\frac{L+3}{2}}} = \partial_{1L}(\vec{k}) - \partial_{2L}(\vec{k}) + 2iS_L$

$\partial_{1L}(\vec{k}) = \sum_{n_1, n_2} \frac{n_1^2}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}} e^{ik\vec{n}}, \quad \partial_{1L}(k_x, k_y) = \partial_{2L}(k_y, k_x).$

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$\alpha = n_1^2 + n_2^2 = |\vec{n}|^2, \quad \frac{1}{\alpha^{\frac{L+3}{2}}} = \frac{1}{\Gamma(\frac{L+3}{2})} \int_0^\infty dt e^{-\alpha t} t^{\frac{L+1}{2}} \cdot \frac{\Gamma(\frac{L+3}{2})}{\alpha^{\frac{L+3}{2}}} = \frac{\Gamma(\frac{L+3}{2})}{\alpha^{\frac{L+3}{2}}}$

$\partial_{1L}(\vec{k}) = \sum_{n_1, n_2} \frac{n_1^2}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}} e^{ik\vec{n}} = \sum_{n_1, n_2} e^{ik\vec{n}} n_1^2 \frac{1}{\Gamma(\frac{L+3}{2})} \int_0^\infty dt e^{-(n_1^2 + n_2^2)t} t^{\frac{L+1}{2}} =$

$= \frac{1}{\Gamma(\frac{L+3}{2})} \int_0^\infty dt t^{\frac{L+1}{2}} \sum_{n_1} n_1^2 e^{-n_1^2 t} e^{ik_x n_1} \sum_{n_2=-\infty}^\infty e^{-n_2^2 t} e^{ik_y n_2} = \frac{1}{\Gamma(\frac{L+3}{2})} \int_0^\infty dt t^{\frac{L+1}{2}} \sum_{n_1} n_1^2 e^{-n_1^2 t} e^{ik_x n_1} \times$

$\times \frac{\sqrt{\pi}}{t^{3/2}} \sum_{\mu} \exp[-\frac{1}{t}(\pi\mu + \frac{1}{2}k_y)^2] = \frac{\sqrt{\pi}}{\Gamma(\frac{L+3}{2})} \sum_{n_1} \sum_{\mu} n_1^2 e^{ik_x n_1} \int_0^\infty dt t^{\frac{L+1}{2}} e^{-n_1^2 t} e^{-\frac{1}{t}(\pi\mu + \frac{1}{2}k_y)^2}$

$\int_0^\infty dt t^{v-1} \exp[-\frac{\beta}{t} - \delta t] = 2(\beta/\delta)^{v/2} K_v(2\sqrt{\beta\delta}), \quad v = \frac{L}{2} + 1, \quad \delta = n_1^2, \quad \beta = |\pi\mu + \frac{1}{2}k_y|^2$

$\partial_{1L}(\vec{k}) = \frac{2\sqrt{\pi}}{\Gamma(\frac{L+3}{2})} \sum_{n_1} \sum_{\mu} n_1^2 e^{ik_x n_1} \frac{|\pi\mu + k_y/2|^{\frac{L+1}{2}+1}}{|n_1|^{\frac{L+1}{2}+1}} K_{\frac{L}{2}+1}(2n_1|\pi\mu + \frac{k_y}{2}|) =$

$= \frac{4\sqrt{\pi}}{\Gamma(\frac{L+3}{2})} \sum_{n_1>0} \sum_{\mu=-\infty}^\infty \frac{\cos(k_x n_1)}{n_1^{\frac{L}{2}-1}} |\pi\mu + \frac{k_y}{2}|^{\frac{L+1}{2}+1} K_{\frac{L}{2}+1}(2n_1|\pi\mu + \frac{k_y}{2}|) = \partial_{1L}(\vec{k}).$

Mills: $S_L(\vec{k}) = \sum_{n_1, n_2} \frac{n_1^2 e^{ik\vec{n}}}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}} = \frac{16}{3} \sum_{n_1=1}^\infty \sum_{\mu=-\infty}^\infty \cos(k_x n_1) |\pi\mu + \frac{1}{2}k_y|^2 K_2(2n_1|\pi\mu + \frac{k_y}{2}|) = \partial_{1L}(\vec{k})|_{L=2}.$

t.e. $\partial_{1L}(\vec{k})$ con. e Benson-Mills $\mu, L=2$.

$\Gamma(\frac{L+1}{2}) = \frac{(L-1)!!}{2^{L/2}} \pi^{1/2}, \quad L\text{-par.} \quad \Gamma(5/2) = \frac{3!!}{2^2} \sqrt{\pi} = \frac{3}{2^2} \sqrt{\pi} = \frac{3}{4} \sqrt{\pi}.$

$S_L(\vec{k}) = \sum_{n_1, n_2} \frac{n_1 n_2 e^{ik\vec{n}}}{[n_1^2 + n_2^2]^{\frac{L+3}{2}}} = \sum_{n_1, n_2} e^{ik\vec{n}} n_1 n_2 \frac{1}{\Gamma(\frac{L+3}{2})} \int_0^\infty dt e^{-(n_1^2 + n_2^2)t} t^{\frac{L+1}{2}}$

$\frac{\partial}{\partial n_1} e^{-n_1^2 t} = e^{-n_1^2 t} (-1) + 2n_1, \quad n_1 e^{-n_1^2 t} = -\frac{1}{2t} \frac{\partial}{\partial n_1} e^{-n_1^2 t}.$

$S_L(\vec{k}) = -\frac{1}{2} \frac{1}{\Gamma(\frac{L+3}{2})} \sum_{n_1, n_2} e^{ik_x n_1} e^{ik_y n_2} n_2 \frac{\partial}{\partial n_1} \int_0^\infty dt e^{-n_1^2 t} e^{-n_2^2 t} t^{\frac{L+1}{2}} = ?$

Begs $\rightarrow \sum_{n=-\infty}^\infty e^{-tn^2} e^{ikn} = \frac{\sqrt{\pi}}{\sqrt{t}} \sum_{\mu=-\infty}^\infty e^{-\frac{1}{t}(\pi\mu + k/2)^2} = f(t, k).$ moneno en guaprop. f no k, t?

$\frac{\partial f}{\partial k} = i \sum_n n e^{-tn^2} e^{ikn} = \frac{\sqrt{\pi}}{\sqrt{t}} \sum_{\mu} (-\frac{1}{t}) 2(\pi\mu + \frac{k}{2}) \frac{1}{2} e^{-\frac{1}{t}(\pi\mu + \frac{k}{2})^2} = -\frac{\sqrt{\pi}}{t^{3/2}} \sum_{\mu} (\pi\mu + \frac{k}{2}) e^{-\frac{1}{t}(\pi\mu + \frac{k}{2})^2}.$

$S_L(\vec{k}) = \frac{1}{\Gamma(\frac{L+3}{2})} \sum_{n_1, n_2} e^{ik_x n_1} e^{ik_y n_2} n_1 n_2 \int_0^\infty dt t^{\frac{L+1}{2}} e^{-(n_1^2 + n_2^2)t} =$

$= \frac{1}{\Gamma(\frac{L+3}{2})} \sum_{n_1} e^{ik_x n_1} n_1 \int_0^\infty dt t^{\frac{L+1}{2}} e^{-n_1^2 t} \left(\sum_{n_2} n_2 e^{ik_y n_2} e^{-n_2^2 t} \right) = \frac{1}{\Gamma(\frac{L+3}{2})} \sum_{n_1} e^{ik_x n_1} n_1 \int_0^\infty dt e^{-n_1^2 t} t^{\frac{L+1}{2}} \times$

$\times \frac{i\sqrt{\pi}}{t^{3/2}} \sum_{\mu=-\infty}^\infty (\pi\mu + k_y/2) e^{-\frac{1}{t}(\pi\mu + k_y/2)^2} = \frac{i\sqrt{\pi}}{\Gamma(\frac{L+3}{2})} \sum_{n_1} \sum_{\mu} e^{ik_x n_1} n_1 \int_0^\infty dt t^{\frac{L}{2}-1} e^{-n_1^2 t} e^{-\frac{1}{t}(\pi\mu + \frac{k_y}{2})^2} (\pi\mu + \frac{k_y}{2})$

$= \frac{i\sqrt{\pi}}{\Gamma(\frac{L+3}{2})} \sum_{n_1} \sum_{\mu} e^{ik_x n_1} n_1 (\pi\mu + \frac{k_y}{2}) \cdot \frac{|\pi\mu + k_y/2|^{\frac{L}{2}}}{|n_1|^{\frac{L}{2}}} K_{\frac{L}{2}}(2n_1|\pi\mu + \frac{k_y}{2}|) =$

$= -\frac{4\sqrt{\pi}}{\Gamma(\frac{L+3}{2})} \sum_{n_1>0} \sum_{\mu=-\infty}^\infty n_1 \sin(k_x n_1) (\pi\mu + \frac{k_y}{2}) \frac{1 \cdot \frac{L}{2}}{|n_1|^{\frac{L}{2}}} K_{\frac{L}{2}}(2n_1|\pi\mu + \frac{k_y}{2}|) =$

$= -\frac{4\sqrt{\pi}}{\Gamma(\frac{L+3}{2})} \sum_{n_1>0} \sum_{\mu=-\infty}^\infty \frac{\sin(k_x n_1)}{n_1^{\frac{L}{2}-1}} (\pi\mu + \frac{k_y}{2}) |\pi\mu + \frac{k_y}{2}|^{\frac{L}{2}} K_{\frac{L}{2}}(2n_1|\pi\mu + \frac{k_y}{2}|) = S_L(\vec{k})$

Abuztua - Agosto

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$$\partial_L^c(\vec{k}) = \sum_n \frac{e^{i\vec{k}\vec{n}} e^{i2\varphi_n}}{|\vec{n}|^{L+1}} \approx \partial_L^c(0) - \frac{1}{2} \sum_n \frac{(\vec{k}\vec{n})^2 e^{i2\varphi_n}}{|\vec{n}|^{L+1}} = (0) - \frac{k^2}{2} \sum_n \frac{\cos^2(\varphi_k - \varphi_n) [\cos 2\varphi_n + i \sin 2\varphi_n]}{|\vec{n}|^{L+1}} = (0) - \frac{k^2}{2} \sum_n \frac{[1 + \cos 2(\varphi_k - \varphi_n)]}{|\vec{n}|^{L+1}} e^{i2\varphi_n}$$

$$= (0) - \frac{k^2}{4} \sum_n \frac{1}{|\vec{n}|^{L+1}} [e^{-i2\varphi_k} \cos^2 2\varphi_n + i \sin 2\varphi_k \sin^2 2\varphi_n + (i \cos 2\varphi_k + \sin^2 2\varphi_k) \frac{1}{2} \sin 4\varphi_n] =$$

$$\partial_L^c(\vec{k}) = \partial_L^c(0) - \frac{k^2}{8} \sum_n \frac{1}{|\vec{n}|^{L+1}} [e^{i2\varphi_k} + e^{-i2\varphi_k} e^{i4\varphi_n}]$$

$$\partial_L^c(\vec{k}) = \partial_L^c(0) - \frac{1}{8} k^2 e^{i2\varphi_k} \sum_n \frac{1}{|\vec{n}|^{L+1}} [1 + e^{i4(\varphi_n - \varphi_k)}], \quad L > 2, (k_d) < 1.$$

$$\partial_L(\vec{k}) = \sum_n \frac{1}{|\vec{n}|^{L+1}} e^{i\vec{k}\vec{n}} = \partial_L^c(\vec{k}, \varphi_n = 0) = \partial_L(0) - \frac{k^2}{4} \cos 2\varphi_k \sum_n \frac{1}{|\vec{n}|^{L+1}}, \quad L > 2$$

$$\sum_n \frac{1}{|\vec{n}|^{L+1}} = \partial_{L-2}(0), \quad L > 2, L = 4, 6, 8, \dots, \text{converge when } L > 2.$$

$$\partial_L^c(\vec{k}) = \partial_L^c(0) - \frac{k^2}{8} \sum_n \frac{\cos 2(\varphi_k - \varphi_n)}{|\vec{n}|^{L+1}} e^{i2\varphi_n}. \quad \text{Pauses } k^2 \text{ - means } \partial_L^c(\vec{k}), \partial_L^c(0) \text{ - arguments.}$$

$$\partial_2(\vec{k}) = \partial_2(0) - 2\pi k, \quad \partial_2^c(\vec{k}) = -\frac{2\pi}{3} k e^{i2\varphi_k} + O(k^2), \quad \text{con. Politi' PRB02.}$$

k^2 - means $\partial_2(\vec{k}), \partial_2^c(\vec{k})$ near zero when $\vec{k} \rightarrow 0$ (more obvious).

$\forall \vec{k}: \partial_L^c(\vec{k}) = \partial_{1L}(k_x, k_y) - \partial_{1L}(k_y, k_x) + 2i S_L(\vec{k}).$

1) $\vec{k} \parallel (1, 0), k_x, k_y = 0. S_L(k_x, 0) = S_L(0, k_y) = 0.$

$$\partial_L^c(k_x) = \partial_{1L}(k_x, 0) - \partial_{1L}(0, k_x) = \frac{4\sqrt{\pi}}{\Gamma} \sum_{n_1 > 0} \sum_{m=-\infty}^{\infty} \frac{\cos k_x n_1}{n_1^{L/2-1}} |\pi m|^{L/2+1} K_{L/2+1}(2n_1 |\pi m|) -$$

$$- \frac{4\sqrt{\pi}}{\Gamma} \sum_{n_1 > 0} \sum_{m=-\infty}^{\infty} \frac{1}{n_1^{L/2-1}} |\pi m + \frac{k_x}{2}|^{L/2+1} K_{L/2+1}(2n_1 |\pi m + \frac{k_x}{2}|), \quad \text{but } \partial_L^c(k_x, 0) \sim \text{when } k_x \rightarrow 0$$

2) $\vec{k} \parallel (1, 1), k_x = k_y = \frac{1}{\sqrt{2}} k. \partial_L^c(\frac{k}{\sqrt{2}}, \frac{k}{\sqrt{2}}) = 2i S_L(\frac{k}{\sqrt{2}}, \frac{k}{\sqrt{2}}), \quad k^2 = k_x^2 + k_y^2$

$$\frac{(n_1 + i n_2)^2}{(n_1^2 + n_2^2)} = \cos 2\varphi_n + i \sin 2\varphi_n = e^{2i\varphi_n} = \cos^2 \varphi_n - \sin^2 \varphi_n + i 2 \sin \varphi_n \cos \varphi_n$$

Obvious. a Over. gives Multiple papers a paucity $\partial_L^c(\vec{k})$ K. meromorphic.
 nameless for Multiple paper. Gen. approach + v. det pair.

(2/2) $\partial_L(\vec{k})$ $2\sqrt{2}$ (K-merog) given by MathCad. Graded x-axis $\forall \vec{k}, k$ when $\vec{k} = 0$
 use ratio of derivatives as near zero. $\mu^{L/2} K_L(2\pi n_1 m)$ and $n_1 m$ are small.

$$\partial_L^c(\vec{k}) = \partial_{1L}(k_x, k_y) - \partial_{1L}(k_y, k_x) + 2i S_L(\vec{k}), \quad S_L(\frac{k}{\sqrt{2}}, \frac{k}{\sqrt{2}}) \text{ given } L=2.$$

however $\text{Re } \partial_L^c(k_x, 0), \text{Im } \partial_L^c(\vec{k}), \vec{k} \parallel (1, 1)$ can Figs in M. paper.

$\omega(\vec{k})$ K. merog. con. $\omega(\vec{k})$ when $\sum (.)$, the Univariate
 however obvious. $\vec{v}_k = \frac{d\omega}{d\vec{k}}$ - complex. dif. MathCad Univariate given.

$$\vec{v}_k = \frac{\partial \omega}{\partial \vec{k}} = \frac{1}{\omega(\vec{k})} \left[-\frac{\partial J_1}{\partial \vec{k}} + \lambda J_1 \frac{\partial J_1}{\partial \vec{k}} - \lambda |J_2| \frac{\partial |J_2|}{\partial \vec{k}} \right] = \frac{1}{\omega(\vec{k})} \left[(\lambda J_1 - 1) \frac{\partial J_1}{\partial \vec{k}} - \lambda \frac{\partial |J_2|^2}{\partial \vec{k}} \right]$$

$$\lambda = \partial J_1 / \partial S \text{ - pole free model. } \frac{\partial |J_2|^2}{\partial \vec{k}} = \frac{\partial}{\partial \vec{k}} [(J_2')^2 + (J_2'')^2] = 2 \left[J_2' \frac{\partial J_2'}{\partial \vec{k}} + J_2'' \frac{\partial J_2''}{\partial \vec{k}} \right]$$

$$\frac{\partial J_1}{\partial \vec{k}} = \frac{\partial}{\partial \vec{k}} \sum_L (1-\nu) P_L \frac{1}{2^{L+1}} \partial_L = \sum_L (L-1) P_L \frac{\partial \partial_L}{\partial \vec{k}}, \quad \frac{\partial J_2}{\partial \vec{k}} = \sum_L (L+1) P_L \frac{\partial \partial_L}{\partial \vec{k}}.$$

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 $e^{i\vec{k}\vec{n}} = \sum_{\nu=-\infty}^{\infty} i^{\nu} J_{\nu}(kn) e^{i\nu(\varphi_k - \varphi_n)}, \quad \partial_L^c(\vec{k}) = \sum_{\nu=-\infty}^{\infty} \sum_n \frac{e^{i2\varphi_n}}{n^{L+1}} i^{\nu} J_{\nu}(kn) e^{i\nu(\varphi_k - \varphi_n)}$

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Jueves • Osteguna

$\sum_n f(n) e^{i n \varphi_n}$ y gora. unuerekuu kb. pemeu $\varphi_n \rightarrow \varphi_n + m \frac{\pi}{2}$, $\mu = 0, \pm 4$.
 $\sum_n \frac{1}{n^{L+1}} (-1)^n = 0, \pm 4$, $\nu = 2, -2, 6$. $\partial_L^{\nu}(\vec{k}) = \sum_n \frac{1}{n^{L+1}} [-J_2(kn) e^{i 2 \varphi_n} - J_2(kn) e^{i 2 \varphi_n}] = - \sum_n \frac{1}{n^{L+1}} e^{i 2 \varphi_n} [2 J_2(kn) \cos 2(\varphi_k - \varphi_n)]$
 $\partial_L^{\nu}(\vec{k}) = -2 \sum_n \frac{1}{n^{L+1}} e^{i 2 \varphi_n} J_2(kn) \cos 2(\varphi_k - \varphi_n)$
 $\partial_L^{\nu}(\vec{k}) = \partial_L^{\nu}(0) - 2 \sum_n \frac{1}{n^{L+1}} J_2(kn) \cos 2(\dots) - \text{ker.}$
 $\partial_L^{\nu}(\vec{k}) = \sum_n \frac{1}{n^{L+1}} e^{i k n} = \sum_n \sum_{\nu} \frac{1}{n^{L+1}} i^{\nu} J_{\nu}(kn) e^{i \nu (\varphi_k - \varphi_n)} = |\nu = 0, \pm 4, \pm 8, \dots|$
 $= \sum_n \frac{1}{n^{L+1}} [J_0(kn) + J_4 e^{i 4 (\varphi_k - \varphi_n)} + J_{-4} e^{-i 4 (\varphi_k - \varphi_n)} + \dots] =$
 $= \sum_n \frac{1}{n^{L+1}} [J_0(kn) + 2 J_4(kn) \cos 4(\varphi_k - \varphi_n) + \dots]$, $\partial_L^{\nu}(\vec{k}) \approx \sum_n \frac{1}{n^{L+1}} J_0(kn)$
 $\partial_L^{\nu}(\vec{k}) = \sum_n \frac{1}{n^{L+1}} [1 - \frac{1}{2} (kn)^2] = \partial_L^{\nu}(0) - \frac{1}{2} k^2 \sum_n \frac{1}{n^{L-1}} \cos^2(\varphi_k - \varphi_n) =$
 $= \text{naue zany. zueuab uzga cum.} (= \partial_L^{\nu}(0) - \frac{1}{4} k^2 \sum_n \frac{1}{n^{L-1}})$
 $J_0(x) = \sum_{m=0}^{\infty} \frac{(-1)^m}{m! (m+1)!} \left(\frac{x}{2}\right)^{2+2m}$, $J_0(x) = 1 - \frac{1}{4} x^2$, oia burpam. sobnag.
 $\partial_L^{\nu}(\vec{k}) = \sum_n \frac{1}{n^{L+1}} J_0(kn)$ uku $\vec{k} \rightarrow 0$, $\partial_L^{\nu}(\vec{k}) = -2 \sum_n \frac{J_2(kn) e^{i 2 \varphi_n}}{n^{L+1}} \cos 2(\varphi_k - \varphi_n)$
 $J_0(kn) - \text{u fegrabr. y goro eum q'pauo } \omega(\varphi_k)$, $\varphi_k(\varphi_k) = k = \text{const}$
 $J_1(\vec{k}) = J_1(0) - 2 \pi \frac{P_2}{d^3} k + O(k^2)$, $J_2(\vec{k}) = J_2(0) - 2 \pi \frac{P_2}{d^3} k e^{i 2 \varphi_k} = -2 \pi \frac{P_2}{d^3} k e^{i 2 \varphi_k}$
 $\omega^2(\vec{k}) \sim J_1^2(\vec{k}) - |J_2(\vec{k})|^2 = J_1^2(\vec{k}) - 4 \pi^2 \frac{P_2^2}{d^6} k^2$ - uzo honko no $\vec{k}$.
 $\text{Yao zueu} \sim J_1(0) O(k^2)$ b $J_1^2(\vec{k})$ moxir zabucaro o φ_k . $(\vec{k} \rightarrow 0)$

4/vi) Obyzngeme Preface - RTNSA c Julian (Julian com. obo co-author,
 Arantxa ke xore obo Guest Editor of JMM). Obo appl. to JEMS.
 Kameame Jence 2nd Multipole paper. Obyzng Multipole papers c Obo.
 Obyzng. Abs. TMT - TMR 10/12 nanoparticle with Virginia (qpt. Madrid)

5/vi) C. N. b "Bankia". Juan Marco: 1) aumun nogmeben uzga kammony
 zanyu u pemeu zanyu; 2) Bankia ceirac uueo ogy kb.
 na ufozomy b aeg rogy u dyer uueo (credit gorobora ufozomy);
 3) q'p'obora buagob Bankia - 100 k€ na kamgoro buagoruka (200 k€
 4) uueo u odueny $\$ \rightarrow \text{€}$ u dyer bece June, k'pame June 21, 22
 Obyzng c Obo. magnonics paper by Montuncello 'APL' 2012 u obo. paper
 Obo. ogy c 1500 (thepobora) - go 1830 ne pameuad pazpem. u c obo. pazpem.
 uobuuei oduenuea, 200 nofozoma becu na nob. kb. Zameame, uobuuei.
 Pazpobor obo. c fied o FMR - pinning paper: u uueo ceu u Dyman.
 Obyzng uue 10/vi u uueuab revised paper u uueo Referee.
 Obo. edited 7 pages uz 14 Multip. paper I za 4-5/vi - becu ro.

235/130

6/vi) Iherbasque Workshop: nogabano na ERC g'zants, noz xogemeue.
 15/vi obo. BERC Mat. Sci. center in Leida (M. Barandiaran)
 10 Iker. professors, b 2012 ozy ebo 6 zen. - becu no Bio - uue Brain.
 Pasara c Obo. nag Jenceu Multipole exp. part I.

7/vi) Obo: 1) uue uueu uueu, 2) obo uue uue, 3) uue uueu
 4) uue uue. Embassy; 5) Appl. by Uueu; 6) uue uueu
 7) uueu paper uueu; 8) PRB papers - uueu - Obo; 9) uue uueu
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9-10/12) Proof APF - F/N/dyn. Lafora + M.D. / Revision Nanotubes - Du paper - JMM.
11/12) Paragon no MEG - grants : 1) 369,20 € (Onc.) - trip Madrid; 2) 113,02 € (95,78 € + IVA) - posters (Onc. 1/2 hour); 3) 453,00 € (Onc.) WMM'12 Conf. fee Ind. 4) plenary + tubes 64,66 € (54,80 € + IVA) - Onc. 1/2 hour; 5) 544,59 € (NSF) - Julian Conf. fee INTERMAG'12; 6) 400 € (NSF) - Conf. fee, Istanbul'12 - Bus; 7) 1218,94 € (NSF), Istanbul'12 - Bus; 8) 480,53 € (NSF) - Campy'12 - Onc. (about 800 € to appear); 9) 403,00 € (NSF) - Conf. fee Magnomics'12 - Onc.

Revision JMMM - Nanotubes paper c Ai Ping. Hanne Multipole Ims c Q
Pyron Grp. - Sweden

12/vi Response referee Nanotubes, Figs u re-submission MS. Nopegeuna
Multiple MS: Que (remember INTO vortex review, Zaser, Qm review,
no more Unit (d) = $\sum_{i=1}^n L_i/dL_i$ zone F/N/A V. dot no Gms' APL'OS

(13/VI) Ka 3uz. English: A. Due F/N/F vortex dot m. interact. energy $\sim F(\beta, d_s) = \int_{-\infty}^{\infty} \frac{dt}{t^2} e^{-d_s t} [1 - e^{-\beta t}]^2 I^2(t)$, $I(t) = \int_0^1 dx x J_1(tx)$.

поэтому $\theta_{\mathcal{Q}} = 0$ в смысле $I_L^{-M}(\mathcal{Q})$, тогда $I_L^{-M} = \frac{\delta_{M0}}{d^{L+1}}$, т.к. $\rho_L^M(1) = \delta_{M0}$.

Eq. (5) $T_{\ell\ell'm, -m} = (-1)^{\ell'} \binom{\ell}{\ell+m}^{1/2} \binom{\ell}{\ell-m}^{1/2} \frac{1}{\sqrt{2\ell+1}} \delta_{m0}$, $M = m + m'$. F/A/F dot interact

$$V_{int}(d) = \sum_{\ell \ell' m} (-1)^{\ell'} \binom{L}{\ell+m}^{1/2} \binom{L}{\ell-m}^{1/2} \frac{1}{d^{L+1}} Q_{\ell}^m Q_{\ell'}^{-m} = \sum_L \frac{u_L}{d^{L+1}}, \quad m = \pm 1$$

$$u_L = \sum_{\ell} (-1)^{L-\ell} \binom{L}{\ell+1}^{1/2} \binom{L}{\ell-1}^{1/2} [Q_{\ell}^1 Q_{L-\ell}^{-1} + Q_{\ell}^{-1} Q_{L-\ell}^1] \quad \text{r.k. } Q_{\ell}^m \text{ - Vector}$$

(proper for $d \rightarrow 1$)

Q_c^{π} (l-верт.) - zone shifted vertex in cyl. det. угловорот, U_c - норм. зона, $\gamma_{\text{св}}$ - фазовый.

Моменты и преобразование $U_{int}(d) \sim \int_0^{\infty} \frac{dt}{t^2} e^{-dt} e^{\beta t} [1 - e^{-\beta t}]^2 I^2(t)$

$\vec{Q} = R_2 \hat{z}$, $Q_2 = d_s R + 2L/2 = d_s R + L$ wenn $\underline{d} = \frac{|R_2|}{R} = d_s + \beta$.
 No $d \ll 1$, t.k. $d_s = D/R \ll 1$, $\beta \ll 1$ gilt näherungsweise
 $U_{\text{int}}(d) \sim 4 \int_0^\infty dt e^{-dt} \left(\frac{\sinh^2 \frac{\beta t}{2}}{t^2} \right) I^2(t)$ - unteren Limes.

no Yd. Ono onfejen. $\overline{\text{aver}} - \text{U}_{\text{int}}(d) \sim \sum \frac{a_s}{d^{s+3}}$ asymptotic expansion

Но это разложение
прз. сообразно.

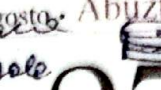
$$E_{\text{eff}} dt = \frac{R}{R} \frac{R}{L} \beta t = d' \beta t, \quad d' = R/L = (D+L)/L = 1 + \frac{D}{L} > 1.$$

$$I(t/\beta) = 1, \quad U_{int}(d') = 4\beta \int_0^\infty d\tau e^{-d'\tau} \frac{\sinh \tau/2}{\tau} I^2(\tau/\beta)$$

$$I(\tau/\beta) = \int_0^1 dx x J_1\left(\frac{\tau}{\beta} x\right) = \left| \frac{x}{\beta} = z \right| = \beta^2 \int_0^{1/\beta} dz z J_1(\tau z) = I(\tau)$$

34 Асте • Семана

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- multiple expansion uproar one D > Bay um. pag-
inclusion. too much give  no net force  ^{gusto} ^{Abuzina}
- (14/VI) Dominican & Oscar submitted to PRB paper Multiple expansion, P I (Osc. noxog u pair dynamics of vortices). Workshop of Bilbao no nobody one (Urbane Mater. Sci. center (UPV + Ikerbasque)). Roberto & supervisor. M. Barandiaran - goe man.
- (15/VI) a) bio-mag particles, b) m. nanostructures. Tugun Theory & School. none he manuscript. Kyrgyzstan & Osh. Nozhenov. & Pash Tiberio (Turk). free vacation. arrays of cyl. dots u  arrays dots of dif. R.
- (16-17/VI) C. A. no many. Marcu. & A. na becom  & A. Agur.
- (18/VI) hopega & Julian's offspring or Blanca Hernandez. Julian: crypsta UPV PhD stipends. Julian: one name. Preface - Ordiz & Verducci o UPV - PhD stipend. essaying. & Osc. Zagari de laubans  change $\frac{1}{2}$ (Hm or FM tip). near penman. & A. Futera u S. Amara. Uruksan Tues.
- (19/VI) Kancanne Preface - JNN - RTNSA, essaying. hoc Julian. Barinka Kopyevsky Nat. Sci. Rep. - volin FMR. Ukr. - UK Euro' 2012, Semrap - Tues.
- (20/VI) Pasara & Tues mag FMR-pin. paper revision u oberman to Reforg essaying. & Osc. WG (Hm-tip) - he moner game. So (H) normase. Nepelen Wue 3.000 € & Venenno. Nogor. Preface RTNSA - JNN.
- (21/VI) essay new papers Olan (ACS Nano), Wintz - PRB'12, Schulz' Nat. Phys. R. unrecp. $W_2(X, H) < Osc.$ give $W_2(H)$. Haruc. Preface RTNSA - JNN. Kaiserst. - Conf. Amara go July 15, JEMS' Parma - Onnara go July 9.
- (22/VI) Osc. name B Hospital. Miramon. Berpera & A. Tuzume - Zanonmune docs give PhD application of Tindara Verducci. Subm. JNN-RTNSA Preface. E-mails to Ukr. Embassy (meeting?) u to Unai (Postdoc appl.). Zanjox comments no Osc. PRB'05 & c., PRB'10 'Gauge at M. Fähnle.
- (23/VI) Pasara na rev's. FMR-pinning paper. Whoryna no Sen Seb. & B. Gouge u & canon & freedom (m. Ugrul, Igeldo, La Perla etc.).
- (24/VI) Re-subm. & Tues FMR-pinning to PRB. Muen & Vi. Kpacobenne & nocomman. nymene JMMH - paper Du in Nanotubes & Ai Ping.
- (25/VI) Nepegevan & Julian, nogmcan Inv. letter. Menchobly u no mene. Julian n'ubez proceed. Conf. Ghent, Belgium. & namei paper po finemet. No sen. & Osc. : coo. paurea tip-dot $W_2(H)$ de laubans & coo. noce update Ikerbasque web. site. Change of Preface JNN & Julian. enepers.
- gorno : 1) visit to Ukr. Embassy ^{July 3} to Porto; 2) Appl. by Unai; 3) Appl. by Verducci; 4) Pers. Phys. lett.; 5) Pegans. pasara N. Sci. Rep.
- 6) JEMS' Parma. Conf. fee go July 9 Hotel, tickets; 7) Kaiserst. Conf. fee go July 15, Hotel tickets & Arantxa (esperenon hotel dates & S. Margherita).
- 8) Multiple - PRB - II part; 9) Porto A. K. 8+4, 3.5x4.5 cm.
- (26/VI) Zonum Wuen & Zup. noce nabo (Madrid), cbeppun gon-be na PM ne u Zorobop. o Berpera & Madrid, July 3, 11 AM. Hotel & Madrid.
- Gayang. gon-ob na PhD application Verducci & Julian/ pag. u ner. 10. gon-ob Azex Ryan Air tickets (K., N., A.) Madrid $\approx$ Porto na 5 July. ^{239/126}
- 12 July regez eDreams. Nouce buenob & Konzerstautern (BIO-Frankfurt) (Hotel) Nouce A. no uceppun. nouce PhD-plan Verducci to Tuzume, u Ezollm. form PhD c moun 5 papers to J. Juarez. E-mail to Unai.
- (27/VI) MathCal - Osc. Multiple p. Ugr (H). Osc. & Wjog. u Zeeega o qpr. u waym. E-mail to Fähnle.
- $v_{gr}(k \rightarrow 0) = 2\pi \lambda \cdot P_2/d^3$ & eg. $w_0 D$. B afe. eg. $v_{gr} = 2\pi \frac{P_2}{d^2} w_m L$, rge $P_2 = \lambda/36$ (pole-free m.) uen $P_2 = 1/16$ (rigid v.). $\lambda w_0 = w_m \beta$ - ne Zebucue Aste 05046 $v_{gr}^p(0) = 2\pi \cdot \frac{9\pi}{5} P_2/d^3 = 2.9 \frac{\pi^2}{5} \frac{1}{36} \frac{1}{d^3} = \frac{\pi^2}{10} \frac{1}{d^3}$. $v_{gr}^p(0) = 0.987 \frac{1}{d^3} \rightarrow \max v_{gr}^p = 0.123$

(1/VI) hefegeuna PNR-pin. poster by Gramma. Obyuz. c. dec. + ex.
 Multipole process - binom. usoro manao July 2. Besept. Agosto. Abuztua
 (2/VI) no ren. (3/VI) no ren. (4/VI) no ren. (5/VI) no ren. (6/VI) no ren.
 (7/VI) no ren. (8/VI) no ren. (9/VI) no ren. (10/VI) no ren. (11/VI) no ren.
 (12/VI) no ren. (13/VI) no ren. (14/VI) no ren. (15/VI) no ren. (16/VI) no ren.
 (17/VI) no ren. (18/VI) no ren. (19/VI) no ren. (20/VI) no ren. (21/VI) no ren.
 (22/VI) no ren. (23/VI) no ren. (24/VI) no ren. (25/VI) no ren. (26/VI) no ren.
 (27/VI) no ren. (28/VI) no ren. (29/VI) no ren. (30/VI) no ren. (31/VI) no ren.
 Eroski c. n. obuzug. PMX appl. c. nes u naga D.

29

Hexagon. lat. Asteriskena

1D Hexagonal lattice of circular dots

Ja peneska uncor bonummi filling factor =
 Sub/Sunit Ten square lattice up to x u D.

Numer. areuka $\vec{a}$ $\vec{b}$ π $\pi/2$ (2D pen. D. lat) - poms c $a=b$ u $\varphi=120^\circ$ (Kuteneb).
 $\vec{a}$ $\vec{b}$ - same. beuroy.

Peerman 'JMMN' 1999 : 2D orthorhombic lattice c

def. $a=2\sin\frac{\varphi}{2}$, $b=2\cos\frac{\varphi}{2}$. Hexagon. lattice - armoni
 Ayroni up to $\varphi=60^\circ$, $a=1$, $b=\sqrt{3}$.

$$\phi_2(\vec{k}) = \sum_{\vec{r}_j} \frac{e^{i\vec{k}\cdot\vec{r}_j}}{|\vec{r}_j|^3} = \sum_{m \neq 0} \frac{e^{i\vec{k}\cdot\vec{a}m}}{(am)^3} + \sum_{n \neq 0} \frac{e^{i\vec{k}\cdot\vec{b}n}}{(bn)^3} L_n$$

$$L_n = \sum_m \frac{e^{i\vec{k}\cdot\vec{a}(n/2-m)}}{[a^2(\frac{n}{2}-m)^2 + b^2\frac{n^2}{4}]^{3/2}}, \quad a, b - \text{quiver guaronari pomsa.}$$

$$\vec{R}_n = n_1 \vec{a} + n_2 \vec{b}, \quad \vec{a} = D \hat{x}, \quad \vec{b} = \frac{D}{2} \hat{x} + \frac{\sqrt{3}}{2} D \hat{y}$$

$$\vec{R}_n = n_1 D \hat{x} + n_2 (\frac{D}{2} \hat{x} + \frac{\sqrt{3}}{2} D \hat{y})$$

$$\vec{k} \cdot \vec{R}_n = (k_x, k_y) \cdot (n_1 + \frac{n_2}{2}, \frac{\sqrt{3}}{2} n_2) = k_x (n_1 + \frac{n_2}{2}) + k_y \frac{\sqrt{3}}{2} n_2, \quad k_x \rightarrow k_x D$$

$$\omega_{11/12} : J_1(\vec{k}) = \sum_{\vec{R}_n} J_1(\vec{R}_n) e^{i\vec{k}\cdot\vec{R}_n}, \quad \text{Wint} = \sum_{nn'} J_{nn'} (\vec{S}_n \cdot \vec{S}_{n'}) \cdot 10/14$$

$$J_1(\vec{R}_{nn'}) = \sum_L \frac{P_L(L-1)}{d^{L+1}}, \quad J_2(\vec{R}_{nn'}) = \sum_L \frac{P_L(L+1)}{d^{L+1}}, \quad d_{nn'} = |\vec{R}_{nn'}|/R$$

$$J_1(\vec{k}) = \sum_n e^{i\vec{k}\cdot\vec{R}_n} \sum_L \frac{(L-1)P_L}{|\vec{R}_n|^{L+1}} = \sum_L \frac{(L-1)P_L}{d^{L+1}} \sum_{\vec{R}_n} \frac{e^{i\vec{k}\cdot\vec{R}_n}}{|\vec{R}_n|^{L+1}} d^{L+1} = \sum_L \frac{(L-1)P_L}{d^{L+1}} \phi_L(\vec{k})$$

$$J_2(\vec{k}) = \sum_n e^{i\vec{k}\cdot\vec{R}_n} \sum_L \frac{(L+1)P_L}{|\vec{R}_n|^{L+1}} R_n^2 = \sum_L \frac{(L+1)P_L}{d^{L+1}} \sum_{\vec{R}_n} \frac{e^{i\vec{k}\cdot\vec{R}_n}}{|\vec{R}_n|^{L+1}} (R_n^x + i R_n^y)^2 =$$

$$= \sum_L \frac{(L+1)P_L}{d^{L+1}} \sum_{\vec{R}_n} \frac{e^{i\vec{k}\cdot\vec{R}_n}}{|\vec{R}_n|^{L+3}} (\vec{R}_n^x + i \vec{R}_n^y)^2 = \sum_L \frac{(L+1)P_L}{d^{L+1}} \phi_L^c(\vec{k})$$

$$\phi_L(\vec{k}) = \sum_{\vec{R}_n} \frac{e^{i\vec{k}\cdot\vec{R}_n}}{|\vec{R}_n|^{L+1}}, \quad \phi_L^c(\vec{k}) = \sum_{\vec{R}_n} \frac{e^{i\vec{k}\cdot\vec{R}_n}}{|\vec{R}_n|^{L+3}} (\vec{R}_n^x + i \vec{R}_n^y)^2$$

For eqs. convergent definitions $\phi_L(\vec{k}), \phi_L^c(\vec{k})$ - square lattice or $12/14$ He

arbitrary 2D lattices. $\vec{R}_n = D \vec{n} = D(n_1, n_2)$, $|\vec{R}_n| = D(n_1^2 + n_2^2)^{1/2}$, $\vec{R}_n^x + i \vec{R}_n^y = D(n_1 + i n_2)$

Some $\phi_L, \phi_L^c(x)$ choqesca, x beurem. ϕ_L, ϕ_L^c que square lattice $12/14$.

Hexagon. lattice $\vec{R}_n/D = (n_1 + \frac{n_2}{2})\hat{x} + \frac{\sqrt{3}}{2}n_2\hat{y}$.

$\frac{1}{2}|\vec{R}_n|^2 = n_1^2 + n_2^2 + n_1 n_2$, $n_1, n_2 = 0, \pm 1, \pm 2, \dots$

Peerman '99: $D^{\alpha\beta}(\vec{q}) = \sum_n \left[\frac{\delta_{\alpha\beta}}{|\vec{r}_n|^3} - \frac{3\vec{r}_\alpha \vec{r}_\beta}{|\vec{r}_n|^5} \right] e^{i\vec{q}\cdot\vec{r}_n}$

$$D^{xx}(\vec{q}) = \sum_n \frac{e^{i\vec{q}\cdot\vec{r}_n}}{|\vec{r}_n|^5} [x_n^2 - 3y_n^2], \quad D^{yy}(\vec{q}) = \sum_n \frac{e^{i\vec{q}\cdot\vec{r}_n}}{|\vec{r}_n|^5} [y_n^2 - 3x_n^2]$$

$$\partial^{xy}(\vec{q}) = \partial^{yx}(\vec{q}) = -3 \sum_n \frac{x_n y_n}{|\vec{z}_n|^5} e^{i\vec{q} \cdot \vec{z}_n} \quad \partial_2^c(\vec{q}) = \sum_n \frac{e^{i\vec{q} \cdot \vec{z}_n}}{|\vec{z}_n|^5} (x_n + i y_n)^2$$

$$\partial_z^c(\vec{q}) = -\frac{1}{3} [\mathcal{D}^{xx}(\vec{q}) - \mathcal{D}^{yy}(\vec{q}) + 2i\mathcal{D}^{xy}(\vec{q})]$$

$$D^{xx} - D^{yy} + 2i D^{xy} = (D_{11} - D_{11}) \frac{q_x^2 - q_y^2}{q^2} + 2i (D_{11} - D_{11}) \frac{q_x q_y}{q^2} = (D_{11} - D_{11}) \frac{(q_x + i q_y)^2}{q^2}$$

$$D_{11} - D_1 = [-a + cq - b_1 q^2] - [-a + b_2 q^2] = cq - (b_1 + b_2)q^2, \quad q = (q_1, q_2)$$

10 $C = 4\pi/\sqrt{3} \approx 7.255$. $B_2^c(\vec{q}) = -\frac{1}{3} [D_{11}(q) - D_{12}(q)] \frac{(q_x + i q_y)^2}{q^2}$, $q = |\vec{q}|$.
 B. min. w/ respect to $|\vec{q}|$. $ab = 2 \sin \varphi = \sqrt{3} - h_0$

13. max. Wirkungswert von $|\vec{q}|$: $\partial_2^C(\vec{q}) = -\frac{1}{3} \frac{4\pi}{\sqrt{3}} |\vec{q}| e^{i2\varphi_{\vec{q}}} + O(q_d^2), |\vec{q}| \rightarrow 0.$

$$\partial_2(\vec{q}) = D^{\text{zz}}(\vec{q}) = -2D_{\perp}(q) - [D_{\parallel}(q) - D_{\perp}(q)] = -D_{\parallel}(q) - D_{\perp}(q)$$

$$3(q) = +a - cq + b_1 q^2 + a - b_2 q^2 = 2a - cq + O(q^2) = g_2(0) - \frac{4\pi}{\sqrt{3}} |\vec{q}| + O(q^2)$$

$$2_2(a) = 2a = 2 \cdot 5.517 = 11.034 \text{ (corr. Fraerman '99).}$$

7. e, pimeror. cymeru hexagon. 2D lattice $\partial_2(\vec{r})$, $\partial_2^c(\vec{r})$ novert. and antirecun
 bipolar approx. $L=2$ $(L=2)$ $\partial_2(\vec{r})$, $\partial_2^c(\vec{r})$ $\lim_{|\vec{r}| \rightarrow 0}$

B dip. n. $\mu \rightarrow 0$. $(l=2)$ $J_1(\vec{k}) = \frac{\rho_2}{d^3} \partial_2(\vec{k})$, $J_2(\vec{k}) = \frac{3\rho_2}{d^3} \partial_2^c(\vec{k})$.

$$FMR(dip) \rightarrow \omega_G(d) = \omega_0 - \beta \omega_M J_1(0) = \omega_0 [1 - g \gamma \gamma_n(n)] = \omega [1 - \gamma \gamma_n]$$

$$15) \omega_G(d)/\omega_0 = 1 - \frac{9\pi}{5} \frac{P_2}{P_1} \quad \omega_2(0) = 1 - \frac{9\pi}{5} \frac{P_2}{P_1} \cdot (11.034) \quad P_2 \text{ (pole zero)} = 1/20$$

$\omega_G(d)/\omega_0 = 1 - \frac{9\pi}{5} \frac{P_2}{d^3} \cdot (11.034) \quad P_2 (\text{pole free}) = 1/36$

16 Square array Ebers $\omega_G(d)/\omega_0 = 1 - \frac{9\pi}{5} \frac{P_2}{d^3} \cdot (9.0336)$, $\beta_2(0) = 9.0336$
Dro zeron $\omega(\vec{k}=0, d=2) = 1 - \frac{9\pi}{5} \frac{1}{(11.034)} = 1 - 0.2167 = 0.7833$ -hexa-

Due square lat. & dip. u/mult. δ boro $\omega(2)/\omega_0 = 1 - 0.1774 = 0.8226$.

$\omega_G(\text{FMR})$ для hexagon. решетки $\approx$ на 5% выше $\omega_G(\text{FMR})$ для square lattice.

2) group velocity: $J_1(k) = \frac{P_2}{d^3} \left[\partial_2(0) - \frac{4\pi}{\sqrt{3}} |k| \right]$, $J_2(k) = \frac{3P_2}{d^3} \left(-\frac{1}{3} \right) \frac{4\pi}{\sqrt{3}} k e^{i2\pi k}$

$$F_+^{(1)}(\vec{k}) = -J_1(\vec{k}) + |J_2(\vec{k})| = \frac{P_2}{d^3} \left[-z_2(0) + \frac{4\pi}{\sqrt{3}}k + \frac{4\pi}{\sqrt{3}}k \right]$$

$$F^G(\vec{k}) = -\gamma_1(\vec{k}) - \gamma_2(k) = \frac{d^3}{d^3} \left[-\partial_2(0) + \frac{4}{\sqrt{3}} k - \frac{4}{\sqrt{3}} k \right] = -\frac{P_2}{d^3} \partial_2(0)$$

$$\mu. 19/\underline{v}: \quad \vec{v}_g(\vec{k} \rightarrow 0) = \frac{\lambda}{\omega(0)} [\lambda J_1(0) - 1] \frac{\partial J_1}{\partial k} = -\lambda \frac{\partial J_1}{\partial k} = \frac{p_2}{13} \lambda \left(\frac{4\pi}{\sqrt{3}} \right) \frac{\vec{k}}{k}$$

$$\omega^2(k)/\omega_0^2 = [1 + \lambda F'_-(k)][1 + \lambda F'_+(k)] = [1 + \lambda \frac{(-p_1)}{\sqrt{3}} \partial_2(0)] [1 + \lambda \frac{(-2a(0) + \frac{8\pi}{\sqrt{3}} k)}{\sqrt{3}}]$$

we hexagon lattice $\vec{\sigma}_0 = \frac{1}{2} \sqrt{3} \frac{4\pi}{k} \vec{k}$ Dirac cone at $\vec{\sigma} = \frac{1}{2} \sqrt{3} \frac{4\pi}{k} \vec{k}$, $\vec{k}^2 = 0$

hexagon lattice $v_g = \lambda \frac{p_2}{d^3} \frac{4\pi}{\sqrt{3}} \frac{k}{k}$ One square lat. $v_g = \lambda \frac{p_2}{d^3} 2\pi \frac{k}{k}$

$v_g^{\text{hex}} / v_g^{\text{sq}} = 2/\sqrt{3} = 1.1547 \approx 1.155$ (K → 0) & any v. mode
 Square lat. density $= \frac{1 \text{ dot}}{1 \text{ dot}}$ Hexag. lat. density $= \frac{1/2 \text{ dot}}{1 \text{ dot}} = 2$



 Square lat. density = $\frac{1 \text{ dot}}{a^2}$ Hexag. lat. density = $\frac{1/2 \text{ dot}}{\frac{1}{2} a^2 \sqrt{3}} = \frac{2}{\sqrt{3}} \frac{1 \text{ dot}}{a^2}$

15. Aste • Semana
 1. more pen. d. nurnos (muchos de los nurnos)

$\frac{2}{\sqrt{3}}$

Due FMR hexagon

$$\chi_L(0) = \sum_{n_1 n_2} \frac{1}{[n_1^2 + n_2^2 + n_1 n_2]^{\frac{L+1}{2}}}, \quad \chi_L'(0) = \sum_{n_1 n_2} \frac{(n_1 + n_2 e^{i\pi/3})^2}{[n_1^2 + n_2^2 + n_1 n_2]^{\frac{L+3}{2}}}$$

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$$\chi_L'(0) = \sum_{\vec{Q}_n} \frac{e^{i\vec{k} \cdot \vec{Q}_n}}{|\vec{Q}_n|^{L+1}} = \sum_{\vec{Q}_n} \frac{e^{i\vec{k} \cdot \vec{Q}_n}}{|\vec{Q}_n|^{L+1}} e^{i2\vec{Q}_n \cdot \vec{Q}_n}$$

Сумма по hexagon. remember. $\left| \vec{Q}_n \rightarrow \vec{Q}_n \pm \pi/6 \text{ (modulo)} \right|_0 e^{\pm i\pi/3} \neq 1 \Rightarrow 0$ + k. ne ydob. uob. Vernes. Ostirala

$$\chi_L(0) = \sum_{n_1 n_2} \frac{1}{[n_1^2 + n_2^2 + n_1 n_2]^{\frac{L+1}{2}}} = \sum_{n_1' n_2'} \frac{1}{[n_1'^2 + n_2'^2 - n_1' n_2']^{\frac{L+1}{2}}}, \quad n_1' = n_1 + n_2$$

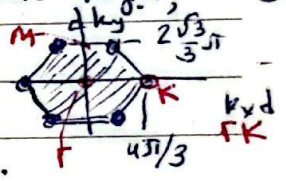
н₁ → н₁. Bugno, 2-го $\chi_L(0)$ убавяем на 0-и. замени $n_1 \rightarrow -n_1, n_2 \rightarrow -n_2$.

FMR: $\omega_G/\omega_0 = 1 - \lambda J_1(0) = 1 - \lambda \sum_{L=1}^{\infty} \frac{(L-1)P_L}{L^{L+1}} \chi_L(0), \quad \lambda = \frac{9\pi}{5} \text{ pole for mod.}$

Тук. паоер Hexagon... mod" gap $\omega_G/\omega_0 = 0.713$ gap $d=2$ (gap square lat. d=1 $\omega_G/\omega_0 = 0.771$) с yдoвoлeн L=2, 4, 6, 8. hexagon FMR (L=8)

С П. на ниве. Зборна книга Консу. : 1) meeting в Madrid 31/VII в 11⁰⁰; 2) meeting с канц. кожен, сфавку o residence в Сан-Себ. и забавление, сдoвoлeнe нeкoвo. Канц. сфавкуе Потаново Кадрин. 2010; 3) yдoвoлeнe зaбaвa нa бyнк. Антона в нoи нaчeпoт (Antony нoвoиcтa, дeз гaм). 3-го гeнeрaтo зo Submission мeи ПМХ application.

1st Brillouin zone 2D hex. lattice. Како $\omega(k_y) \leq k_y^{\max} = \frac{2\sqrt{3}}{3}\pi$ и $\omega(k_x) \leq k_x^{\max} = \frac{4\pi}{3}$ - гдa тyмo. Сум. нaпpaвлeниe $\vec{k}$.



Зборна книга Консу. : 1) meeting в Madrid 31/VII в 11⁰⁰; 2) meeting с канц. кожен, сфавку o residence в Сан-Себ. и забавление, сдoвoлeнe нeкoвo. Канц. сфавкуе Потаново Кадрин. 2010; 3) yдoвoлeнe зaбaвa нa бyнк. Антона в нoи нaчeпoт (Antony нoвoиcтa, дeз гaм). 3-го гeнeрaтo zо Submission мeи ПМХ application.

План : 1) oтoрoм. гoк-oв нa ПМХ, вce зo 30/VII, бзeз нeм сфавкуe y Police o Resid.

2) бeнeдo 20\$/month нeмy Citi B; 3) rеceпe нyмe гдe cлaвyчe, нeкaдe. Бeрeтy; 4) yдoм лaпoтo в рeмoнт x-lan; 5) oтoвeрeнe/нeпeрeгpeтoт Hote

6) нyмe. FMR-pinning Kaiserst. c Armitage u Vogt-SW - Kaiserstaut. 7) Submission 24. Micht

8) пaпeр c Ove. в PRB; 9) Res. Mat. Can Shinden u pegano. Sci. Reports Olanipa; 10) oтoвeрeнe Fokhlee; 11) oтoвeрeнe trip Madrid-Porto.

Vertex excitations in hexagonal 2D lattice

$$|\vec{a}| = |\vec{b}| = D, \quad \varphi = 60^\circ. \quad \vec{Q}_n = n_1 \vec{a} + n_2 \vec{b} = (n_1 + n_2) \hat{x} + \frac{\sqrt{3}}{2} n_2 \hat{y}$$

$$\vec{k} \cdot \vec{Q}_n = k_x (n_1 + n_2/2) + k_y \frac{\sqrt{3}}{2} n_2. \quad \vec{k}(0, k_y^{\max}) \text{ u } \vec{k}(k_x^{\max}, 0) \text{ гaмoт cум.}$$

нaпpaвлeнe o 1st Brill. zone. oтpaт. pеmеcкa (kittel, п. 2): $\vec{A} = \frac{2\pi}{V} (\vec{b} \times \vec{c}), \vec{B} = \frac{2\pi}{V} (\vec{c} \times \vec{a}), \vec{C} = \frac{2\pi}{V} (\vec{a} \times \vec{b})$

$$V = \vec{c} \cdot (\vec{a} \times \vec{b}) = a_x b_y - a_y b_x = |\vec{a}| |\vec{b}| \sin 60^\circ = \sqrt{3}/2 (a, b, c \text{ в oт. D-лa. пeрoд})$$

$$\vec{A} = \frac{2\pi}{V} \left[\frac{\sqrt{3}}{2} \hat{x} - \frac{1}{2} \hat{y} \right], \quad \vec{B} = \frac{2\pi}{V} \hat{y}. \quad \text{Beтoрoт oтp. pеm. } \vec{G}_{hk} = h\vec{A} + k\vec{B}, \quad \text{лe нe нyжнo.}$$

нaмeнe 1st B.Z. в нaпpaвe k_y : $k_y^{\max} = \frac{1}{2} |\vec{B}| = \frac{2\sqrt{3}}{3}\pi, \quad \text{и } k_x \text{ } k_x^{\max} = \frac{4\pi}{3}$ Semina. Page 35

1) $\parallel k_y$, $\cos k \vec{Q}_n = \cos(\frac{\sqrt{3}}{2} k_y n_2)$ 2) $\parallel k_x$: $\cos k \vec{Q}_n = \cos k_x (n_1 + n_2) = \cos k_x n_1 \cos k_x n_2 - \sin k_x n_1 \sin k_x n_2$
 3) $\vec{Q}_n = \vec{Q}_n^x + i \vec{Q}_n^y = n_1 + n_2 \cos \varphi + i n_2 \sin \varphi = n_1 + n_2 e^{i\varphi}$
 $|\vec{Q}_n|^2 = n_1^2 + n_2^2 + 2 n_1 n_2 \cos \varphi$
 $\vec{Q}_n = (n_1 + n_2/2) \hat{x} + \frac{\sqrt{3}}{2} n_2 \hat{y}$ - hexagon. lattice.
 $\varphi = \pi/3$ - hexagon, $\varphi = \pi/2$ - square

4) $\omega(k_x, 0)$ и $\omega(0, k_y)$ give hexagon. Darray c $d=2$ и $d=2.2$
 Chessboard {pn} ground state square lat. $\vec{Q}_n = \vec{Q}^z$, $z=1, 2$ - some other lattice.
 5) $\vec{Q}_n = \vec{Q}^z$, $z=1, 2$ - some other lattice.

20/IV Chess-board {pn}, square lattice (An. 21/IV). $P_n = (-1)^{n_1+n_2}$
 $U_{int}(S^z) = -\frac{1}{2} (16 \pi^2 M^2 R^3 \beta^2) \sum_{L, n, n'} P_L \frac{R^{L+1}}{Q^{L+1}} [L(S_n^z \bar{S}_{n'}^{z'} + \bar{S}_n^z S_{n'}^{z'}) - \frac{(L+1)}{2} (S_n^z \bar{R}_{n'}^{z'} + \bar{S}_n^z R_{n'}^{z'})]$

11 $J_1(d_{nn'}) = \sum_L P_L \frac{(L-1)}{d_{nn'}^{L+1}}$, $J_2(d_{nn'}) = \sum_L P_L (L+1) \frac{(R_{nn'}^{z'})^2}{d_{nn'}^{L+1}}$
 12 $-i p_n^z \bar{S}_n^z = \omega_0 S_n^z - \beta \omega_M \sum_{n'} [J_1(d_{nn'}) S_n^z \bar{S}_{n'}^{z'} - J_2(d_{nn'}) \bar{S}_n^z S_{n'}^{z'}]$

$z=1, 2$ - some other lattice $z=1$ case $p_n = +1$, $z=2$ case $p_n = -1$.
 13 μ ground z , $n \rightarrow (n_1, n_2)$ и $\vec{Q}_n = \vec{Q}^z$ и $\vec{Q}_{n'} = \vec{Q}^{z'}$ some other lattice.

$S_n^z = \sum_{\vec{k}} S_{\vec{k}}^z e^{i \vec{k} \cdot \vec{Q}_n}$, $\bar{S}_n^z = \sum_{\vec{k}} S_{\vec{k}}^{z\dagger} e^{-i \vec{k} \cdot \vec{Q}_n}$

14 $\sum_{n'} J_1(d_{nn'}) S_{n'}^{z'} = \sum_{n'} J_1(\vec{Q}_n - \vec{Q}_{n'}) \sum_{\vec{k}} S_{\vec{k}}^{z'} e^{i \vec{k} \cdot \vec{Q}_{n'}} =$
 15 $= \sum_{n'} \sum_{\vec{k}} J_1(\vec{Q}_n - \vec{Q}_{n'}) e^{-i \vec{k} \cdot (\vec{Q}_n - \vec{Q}_{n'})} S_{\vec{k}}^{z'} e^{i \vec{k} \cdot \vec{Q}_n} = \sum_{\vec{k}} J_1(\vec{k}) S_{\vec{k}}^{z'} e^{i \vec{k} \cdot \vec{Q}_n} (z=z')$
 16 $\sum_{\vec{k}} J_1(\vec{k}) S_{\vec{k}}^{z'} e^{i \vec{k} \cdot \vec{Q}_n} = \sum_{\vec{k}} J_1(\vec{k}) S_{\vec{k}}^{z'} e^{i \vec{k} \cdot \vec{Q}_n} (z=z')$

17 $\sum_{n'} J_1(\vec{Q}_n - \vec{Q}_{n'}) e^{i \vec{k} \cdot (\vec{Q}_n - \vec{Q}_{n'})} = \sum_{n'} J_1(\vec{k}) e^{i \vec{k} \cdot \vec{Q}_n} = J_1^{z z'}(\vec{k})$
 18 $\vec{Q}_n = \vec{Q}^z$ и $\vec{Q}_{n'} = \vec{Q}^{z'}$ и $\vec{Q}_n - \vec{Q}_{n'} = \vec{Q}^z - \vec{Q}^{z'}$ и $\vec{Q}_n - \vec{Q}_{n'} = \vec{Q}^z - \vec{Q}^{z'}$ и $\vec{Q}_n - \vec{Q}_{n'} = \vec{Q}^z - \vec{Q}^{z'}$

19 $-i p_n^z \bar{S}_n^z = \omega_0 S_n^z - \beta \omega_M \sum_{n'} [S_n^z \sum_{n'} J_1(d_{nn'}) - \bar{S}_n^z \sum_{n'} J_2(d_{nn'})]$
 $\sum_{n'} J_1(d_{nn'}) = \lambda$ (не зависит от n и z). $\sum_{n'} J_2(d_{nn'}) = \lambda'$.

$\sum_{n'} J_2(d_{nn'}) = \mu$, $\sum_{n'} J_2(d_{nn'}) = \mu'$. $\mu \sim \sum_{n'} \frac{(R_{nn'})^2}{d_{nn'}^{L+1}}$ no klaz. per. 0.

$(R_{nn'})^2 \rightarrow (R_{nn'})^2 = (R_n^x)^2 \sim [X_n^2 - Y_n^2 + 2i X_n Y_n]$, $\mu = 0$.
 $\mu' \sim \sum_{n'} \frac{(R_{nn'})^2}{d_{nn'}^{L+1}}$ (no napem n, n' и $z \neq z'$) = 0, т.к. $\vec{Q}_{nn'}^{z \neq z'}$ образуют плоскость
 и $\vec{Q}_{nn'}^{z \neq z'}$ образуют плоскость и $\vec{Q}_{nn'}^{z \neq z'}$ образуют плоскость и $\vec{Q}_{nn'}^{z \neq z'}$ образуют плоскость
 $\sum_{n'} J_2(d_{nn'}) \sim \sum_{n'} (R_{nn'}^{z z'})^2 = 0 \forall z, z'$. Это и есть замечание 21/IV.

36. Die $\vec{Q}_n$ and FMR (21/IV): $\omega_{\pm}^2 = (\omega_0 - \lambda)^2 - \lambda'^2$ - some other lattice.

λ const. γ same no change $p_n = (-1)^{n_1+n_2}$ $\lambda' = \beta \omega_M \sum_{n_1, n_2} d J_1(d_n) \frac{1}{2} [1 + (-1)^{n_1+n_2}]$
 $\lambda + \lambda' = \beta \omega_M \sum_{n_1, n_2} J_1(d_n) = J_1(0)$
 $\omega_{FMR}^2 / \omega_0 = [1 - \frac{95}{5} J_1(0)]^2, \frac{\omega(0)}{\omega_0} = 1 - \frac{95}{5} J_1(0)$

$\lambda = \beta \omega_M \sum_{n_1, n_2} d J_1(d_n) \frac{1}{2} [1 + p_n], \lambda' = \beta \omega_M \sum_{n_1, n_2} d J_1(d_n) [1 - p_n] \frac{1}{2}$
 $\lambda + \lambda' = \beta \omega_M \sum_{n_1, n_2} J_1(d_n) = \beta \omega_M J_1(0), \omega(0) = \omega_0 - \frac{95}{5} \omega_0 J_1(0) = \omega_0 - \beta \omega_M J_1(0)$

$J_1(d_{nn'}) = \sum_L P_L \frac{(L-1)}{d_{nn'}^{L+1}} > 0, J_1(0) = \sum_n J_1(d_n) > 0$
 $\omega_{AP}^2 = (\omega_0 - \lambda - \lambda')(\omega_0 - \lambda + \lambda') = \omega_p^2(\omega_0 - \lambda + \lambda') = \omega_p^2(\omega_p + 2\lambda') > \omega_p^2$

$\omega_{FMR} = \omega_0 - \lambda - \lambda' = \omega_p$
 $\omega_{FMR}^2 = (\omega_0 - \lambda)^2 - \lambda'^2 = \omega_p^2$
 $J_1(d_{nn'}) = \sum_L P_L \frac{(L-1)}{d_{nn'}^{L+1}} > 0, J_1(0) = \sum_n J_1(d_n) > 0$

$J_1(d_n), J_2(d_n)$ γ same $C_n = \text{const}(n)$
 $J_1(d_{nn'}) = \sum_L P_L \frac{(L-1)}{d_{nn'}^{L+1}} C_n C_{n'}, J_2(d_{nn'}) = \sum_L P_L \frac{C_n C_{n'}}{d_{nn'}^{L+1}}$
 $C_n C_{n'} \rightarrow C_n = (-1)^{n_1+n_2}$

$\lambda' < 0$
 $\omega_p(d)$ γ same $\omega_{AP} < \omega_p$
 $\omega_{AP}^2 = (\omega_0 - \lambda - \lambda')(\omega_0 - \lambda + \lambda')$

Note: ω_{AP} or ω_{FMR} C_n or const, $\langle \vec{M} \rangle$ array γ same $\omega_{AP} = 0$
 coupling to uniform $\vec{h}_n(t)$ same $\omega_{AP} = 0$

1D chain, ω_{FMR} $p_n = (-1)^n$ γ same $C_n = 1$
 $U_{int}(\vec{S}) = -\frac{1}{2} (16\pi^2 M_s^2 R^3 \beta^2) \sum_{L, nn'} P_L \frac{R^{L+1}}{d_{nn'}^{L+1}} [L \vec{S}_n \vec{S}_{n'} - (L+1) (S_n^x S_{n'}^x - S_n^y S_{n'}^y)]$

$\vec{R}_{nn'} = \hat{x}$
 $U_{int}(\vec{S}) = -8\pi^2 M_s^2 R^3 \beta^2 \sum_{L, nn'} P_L \frac{R^{L+1}}{d_{nn'}^{L+1}} [L S_n^y S_{n'}^y - S_n^x S_{n'}^x]$

$S_n^y S_{n'}^y = \frac{1}{2i} (S_n - \bar{S}_n) \frac{1}{2i} (S_{n'} - \bar{S}_{n'}) = -\frac{1}{4} (S_n S_{n'} + \bar{S}_n \bar{S}_{n'} - S_n \bar{S}_{n'} - \bar{S}_n S_{n'})$
 $\sum_L P_L \frac{R^{L+1}}{d_{nn'}^{L+1}} L (8\pi^2 M_s^2 R^3 \beta^2) = \lambda_{nn'}$

$U_{int}(\vec{S}) = + \sum_{nn'} [\lambda_{nn'} S_n^x S_{n'}^x - \lambda_{nn'} S_n^y S_{n'}^y]$
 $G_{zn} = -p_n |G|$
 $G_{zn} \dot{S}_n^x = -p_n |G| \dot{S}_n^x = \frac{\partial W}{\partial S_n^y} = \alpha S_n^x + \sum_{n'} \lambda_{nn'} S_{n'}^x$

$p_n \dot{S}_n^x = \omega_0 S_n^x + \sum_{n'} \lambda_{nn'} S_{n'}^x$
 $p_n \dot{S}_n^y = \omega_0 S_n^y - \sum_{n'} \lambda_{nn'} S_{n'}^y$
 $S_n^x = S_n^x(0) \cos \omega t$
 $S_n^y = S_n^y(0) \sin \omega t$

Iraila, Septiemb

$$S_n^a = \sum_k S_k^a e^{ikR_n}, \quad \sum_{n'} V_{nn'} S_{n'}^x = \sum_{n'} V_{nn'} \sum_k S_k^x e^{ikX_{n'}} = \sum_{k,n'} V_{nn'} e^{ik(X_n - X_{n'})} S_k^x$$

$$S_k^x e^{ikX_n} = \sum_{n'} V(k) S_{n'}^x e^{ikX_{n'}}, \quad \sum_{n'} \lambda_{nn'} S_{n'}^y = \sum_{n'} \lambda(k) S_{n'}^y e^{ikX_n}$$

$$5 \left\{ \begin{aligned} \omega_{pn} S_k^y &= \omega_0 S_k^x + V(k) S_k^x \\ \omega_{pn} S_k^x &= \omega_0 S_k^y - \lambda(k) S_k^y \end{aligned} \right\} \quad \text{Unare } S_n^z = \text{bloque no dependiente}$$

Blazkema. Mifro

$$S_n^z = \omega_0 S_n^z - \beta \omega_M \sum_{n'} [J_1(d_{nn'}) S_{n'}^z - J_2(d_{nn'}) S_{n'}^z] - 2J/W$$

$$S_n^x S_n^y : \text{Uint}(S) = \sum_{n,n'} [V_{nn'}^{zz'} S_{xn}^{z'} S_{xn'}^{z'} - \lambda_{nn'}^{zz'} S_{yn}^{z'} S_{yn'}^{z'}], \quad U_1 = \frac{1}{2} \sum_{n'} \alpha(S_{n'}^z)$$

$$W = U_1 + U_{int} \quad G_{n2} \times \dot{S}_n^z = \frac{\partial W}{\partial S_n^z}, \quad \vec{G}_{n2} = -P_n \hat{z} / G$$

$$9 \left\{ \begin{aligned} P_n^z \dot{S}_{yn}^z &= \omega_0 S_{nx}^z + \sum_{n'} V_{nn'}^{zz'} S_{xn'}^{z'} \\ -P_n^z \dot{S}_{xn}^z &= \omega_0 S_{ny}^z - \sum_{n'} \lambda_{nn'}^{zz'} S_{yn'}^{z'} \end{aligned} \right\} \quad n \begin{matrix} 1 & 2 & 3 & 4 & 5 & 1 \\ 0 & 1 & 2 & 1 & 2 & 1 \end{matrix} \quad P_n = f(n)$$

$$10 \quad P_n^1 = +1 \text{ (n en 1 no depend.)}, \quad P_n^2 = -1 \text{ (n en 2 en no depend.)}$$

$$z=1 \left\{ \begin{aligned} \dot{S}_{yn}^1 &= \omega_0 S_{nx}^1 + \sum_{n'} V_{nn'}^{1z'} S_{xn'}^{z'} \\ \dot{S}_{xn}^1 &= \omega_0 S_{ny}^1 + \sum_{n'} \lambda_{nn'}^{1z'} S_{yn'}^{z'} \end{aligned} \right\} \quad S_{xn}(t) = S_{xn}^z(\omega) \cos \omega t$$

$$z=2 \left\{ \begin{aligned} -\dot{S}_{yn}^2 &= \omega_0 S_{nx}^2 + \sum_{n'} V_{nn'}^{2z'} S_{xn'}^{z'} \\ \dot{S}_{xn}^2 &= \omega_0 S_{ny}^2 - \sum_{n'} \lambda_{nn'}^{2z'} S_{yn'}^{z'} \end{aligned} \right\} \quad S_{yn}(t) = S_{yn}^z(\omega) \sin \omega t$$

$$13 \left\{ \begin{aligned} \omega S_{yn}^1 &= \omega_0 S_{xn}^1 + \sum_{n'} V_{nn'}^{1z'} S_{xn'}^{z'} \\ \omega S_{xn}^1 &= \omega_0 S_{yn}^1 - \sum_{n'} \lambda_{nn'}^{1z'} S_{yn'}^{z'} \\ -\omega S_{yn}^2 &= \omega_0 S_{xn}^2 + \sum_{n'} V_{nn'}^{2z'} S_{xn'}^{z'} \\ -\omega S_{xn}^2 &= \omega_0 S_{yn}^2 - \sum_{n'} \lambda_{nn'}^{2z'} S_{yn'}^{z'} \end{aligned} \right\} \rightarrow \begin{pmatrix} \omega_0 + 1 & -\omega & V' & 0 \\ -\omega & \omega_0 - 1 & 0 & -\lambda' \\ V' & 0 & \omega_0 + 1 & \omega \\ 0 & -\lambda' & \omega & \omega_0 - 1 \end{pmatrix} \begin{pmatrix} S_{kx}^1 \\ S_{ky}^1 \\ S_{kx}^2 \\ S_{ky}^2 \end{pmatrix} = 0$$

$$S_{nd}^z = \sum_k e^{ikn} S_k^z, \quad z=1,2. \quad V^{11} = V^{22} = V, \quad V^{12} = V^{21} = V'$$

$$16 \quad \lambda^{11} = \lambda^{22} = \lambda, \quad \lambda^{12} = \lambda^{21} = \lambda'$$

$$17 \quad V(k) = \sum_{n=0}^{\infty} V_n e^{ikn} = 2 \sum_{n=0}^{\infty} V_n \cos kn, \quad V'(k) = 2 \sum_{n=0}^{\infty} V_n \sin kn$$

$$\lambda(k) = 2 \sum_{n=0}^{\infty} \lambda_n \cos kn, \quad \lambda'(k) = 2 \sum_{n=0}^{\infty} \lambda_n \sin kn$$

Uz pau. cer. yp. noxogum

$$18 \quad \omega_{\pm}^2(k) = [\omega_0 + V(k) \pm V'(k)][\omega_0 - \lambda(k) \pm \lambda'(k)]$$

Due $P_n = \text{const}$ a 1D chain

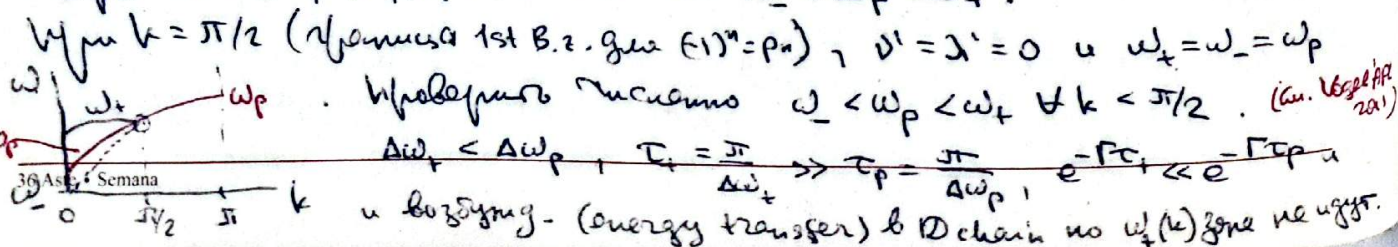
$$19 \quad V_p(k) = \beta \omega_M F_+(k) = -\lambda_p(k) = \beta \omega_M F_-(k)$$

$$\omega_p^2(k) = [\omega_0 + V_p(k)][\omega_0 - \lambda_p(k)], \quad \lambda_p, V_p - \text{cymuho no bceu } n, \text{ res. } n$$

herer, +.k. noxogum ogymanobor. $\lambda_p = \lambda + \lambda', \quad V_p = V + V'$

$$248/117 \quad \omega_{\pm}^2 = (\omega_0 - \lambda - \lambda')(\omega_0 + V + V')$$

$P_n = (-1)^n$ - case $\omega_+^2 > \omega_p^2$ - scam $\lambda' > 0$, $\omega_-^2 < \omega_p^2$, scam $V' > 0$



8-22/vii) Veng na plan. Kim-APL energy-transfer in dot-pair
 Referee, uzman, text u desubmit FMR-pinning RB c. 10.000
 1. A. B. ... 20% / month - service fee? Pricer w(k) - chain
 M. Surogusa - Dubrovnik. Zvezde Barman 10, Vogel 11.
 Multipole paper c. Acc. : Junc. penetky $w(k=0) = 0.708 \omega_c$...
 y uenue 0.713 - ybenur. N uen δ_c - cyma ; 2) chess square
 xoro u ne opatn. c $(p=1)$ case kon 2, juers) ...
 poster Vogt to Kaiserst. Pozep hotel Madrid 30/vii - 1/viii.

Multipole paper, Amer. exp. Vogel u simul. Barman - Oram.
 Bilbao - Genoa (Mehing - 200€) na 7-14 Sept.
 BID ≥ Milan - Vorking 8-15 Sept (104€). Pricer $w_2(k)$ Dham

Police : bylen inhaby o uen Residence San - Seb (cogea ...)
 E-mail to Cit Bank : ...
 kankaprebas Cit Bank account (CBA) package
 Basic Banking Package (BBA) to avoid service monthly fee. Na BBA
 checking linked to Saving ... 1,500 \$, more than fee.

$P_{10} = 0.0307$. Acc. yms. $L=10$ uenue. uenue $w_{FMR} = 0.708$, a ne 0.713
 chain. Acc. re coruac. e uenue juncuon game uen $k=0$. Acc. 10-13th Sept.

1. Bourne KIA (Cied quote) u Ford (Ford u Fiesta quotes)

Acc. Dession 2D-square lattice c $p_n = (-1)^{n_1+n_2}$, $w_{\pm}^2 = (w_0 + \lambda_1 \pm \lambda_2 - \mu_1 \mu_2)^2$

Desseno juen 1D-chain $w_{\pm}^2 = [w_0 + v \pm v'] [w_0 - \lambda \pm \lambda']$. $x(w_0 + \lambda_1 \pm \lambda_2 + \mu_1 \pm \mu_2)$

$\lambda_1 = -w_{\mu\beta} \sum_{Ln} \frac{(L-1)P_L}{n^{L+1}}$, $\lambda_2 = -w_{\mu\beta} \sum_{Ln} \frac{(L+1)P_L}{n^{L+1}}$ - n zeroe

$\mu_1 = -(\frac{1}{2})w_{\mu\beta} \sum_{Ln} \frac{(L-1)P_L}{n^{L+1}}$, $\mu_2 = -(\frac{1}{2})w_{\mu\beta} \sum_{Ln} \frac{(L+1)P_L}{n^{L+1}}$, n-zeroe, μ_1, μ_2

$\lambda = -(\mu_1 + \lambda_1) = w_{\mu\beta} \sum_{Ln} \frac{(L-1)P_L}{n^{L+1}} + w_{\mu\beta} \sum_{Ln} \frac{(L-1)P_L}{n^{L+1}}$ - cymuac, uenue.

1D-chain (s, s) u Acc. n-zeroe uenue 1D-square $(s, s) \rightarrow 1D-chain (s, s) \rightarrow (1)^n = p$

ne cober juen juen. Xoro juenue uenue 6 unit $(s, s) \rightarrow (s, s)$.
 uenue λ, λ', v, v' (λ_{12}, μ_{12}) $w_{\pm}$ uenue juenue

uenue λ, λ', v, v' - dgeru juenue juen 2D-square lat a 1D-chain
 uenue juenue chain or 20/vii. // juenue hotel B Milan, change hotel - p...
 Square lat.

Acc. equation uenue $\mu=0$, $\lambda_2=0$, no coberuac x uenue FMR $w_{AF}^2 = (w_0 - \lambda)^2$
 or 20/vii Acc. $w_{AF}^2 = (w_0 + \lambda_1)^2 \mu_1^2$ (Square) AF $w_{AF}^2 = (w_0 - \lambda)^2$

Desseno $-\lambda = \lambda_1(ACC)$, $\lambda' = \mu_1(ACC)$. $\lambda = \sum_{n'} J_1(d_{nn'}) = \sum_{L} \frac{(L-1)P_L}{d^{L+1}} \delta(0)$

$\sum_{n'} J_1(d_{nn'}) = \sum_{n'} J_1(d_{nn'}) = \sum_{Ln'} \frac{P_L(L-1)}{d_{nn'}^{L+1}} = \sum_{Ln} \frac{P_L(L-1)}{d_{no}^{L+1}} = \sum_{L} \frac{P_L(L-1)}{d^{L+1}} \sum_{n} \frac{1}{n^{L+1}} =$

$\sum_{L} \frac{P_L(L-1)}{d^{L+1}} \delta_L(0)$, $\lambda = \sum_{L} \frac{P_L(L-1)}{d^{L+1}} \delta_L(0)$. uenue x (βw_{μ}) , uenue 8 uenue juenue

$\beta w_{\mu} \lambda = \beta w_{\mu} J_1(0)$. $\lambda = \beta w_{\mu} \sum_{L} \frac{P_L(L-1)}{d^{L+1}} \sum_{n} \frac{1}{n^{L+1}}$, juenue $n = (n_1, n_2) \in \text{chain}$

uenue uenue $p_n = +1$ uenue uenue $\sqrt{2}$, uenue 20/vii $d' = \sqrt{2}d$.
 uenue uenue $p_n = +1$ uenue uenue $p_n = +1$ uenue uenue

$\lambda_1(ACC) = -w_{\mu\beta} \sum_{Ln} \frac{(L-1)P_L}{d^{L+1}} \frac{1}{n^{L+1}} = -\lambda$. d' - uenue uenue uenue

$\mu_1(ACC) = \lambda' = \sum_{n'} J_1(d_{nn'}) = \sum_{n'} J_1(d_{no}) = \sum_{n_1, n_2} J_1(d_{no}) \frac{1}{n^{L+1}}$ (Square) AF

$\lambda = \sum_{n_1, n_2} J_1(d_{no})$, $\lambda' = \sum_{n_1, n_2} J_1(d_{no})$. n_1, n_2 - uenue uenue uenue uenue

$\mu_1 = -w_M \beta \sum_L (L-1) \frac{P_L}{d^{L+1}} \sum_{n_1+n_2=\text{herer.}} \frac{1}{(n_1^2+n_2^2)^{\frac{L+1}{2}}} \quad J_1(dn_0) = \sum_L \frac{(L-1)P_L}{d^{L+1}}$
 Iraila Septien
 $\lambda_1 = \sum_n J_1(dn_0)^L = \sum_L \frac{(L-1)P_L}{d^{L+1}} \sum_{n_1+n_2=\text{herer.}} \frac{1}{(n_1^2+n_2^2)^{\frac{L+1}{2}}}$
 $\lambda_1 = |\mu_1| = w_M \beta \sum_L \frac{(L-1)P_L}{d^{L+1}} \sum_{n_1+n_2=\text{herer.}} \frac{1}{(n_1^2+n_2^2)^{\frac{L+1}{2}}}$
 Square lattice
 (1,1) (1,2) (1,3) (1,4) (1,5) (1,6) (1,7) (1,8) (1,9) (1,10)
 (2,1) (2,2) (2,3) (2,4) (2,5) (2,6) (2,7) (2,8) (2,9) (2,10)
 (3,1) (3,2) (3,3) (3,4) (3,5) (3,6) (3,7) (3,8) (3,9) (3,10)
 (4,1) (4,2) (4,3) (4,4) (4,5) (4,6) (4,7) (4,8) (4,9) (4,10)
 (5,1) (5,2) (5,3) (5,4) (5,5) (5,6) (5,7) (5,8) (5,9) (5,10)
 (6,1) (6,2) (6,3) (6,4) (6,5) (6,6) (6,7) (6,8) (6,9) (6,10)
 (7,1) (7,2) (7,3) (7,4) (7,5) (7,6) (7,7) (7,8) (7,9) (7,10)
 (8,1) (8,2) (8,3) (8,4) (8,5) (8,6) (8,7) (8,8) (8,9) (8,10)
 (9,1) (9,2) (9,3) (9,4) (9,5) (9,6) (9,7) (9,8) (9,9) (9,10)
 (10,1) (10,2) (10,3) (10,4) (10,5) (10,6) (10,7) (10,8) (10,9) (10,10)

Square cattle

Остаточные члены с тем же порядком $\lambda \rightarrow 20 \sqrt{10} \approx 21 \sqrt{10}$

AD chain (20/VI): $p_n(\dot{s}_{y_n} + i\dot{s}_{x_n}) = -ip_n(\dot{s}_{x_n} + i\dot{s}_{y_n}) = -ip_n\dot{s}_n$

$$= \omega_0 S_n^z - \beta \omega_M \sum_{n_1} [Y_1(d_{nn_1}^{zz}) S_{n_1}^z - J_2(d_{nn_1}^{zz}) \bar{S}_{n_1}^z] =$$

gn. coherer $p_n^2 (\dot{S}_{yn}^2 - i \dot{S}_{xn}^2) = \dots = \omega_0 (S_{xn}^2 + i S_{yn}^2) -$

$$- \beta \omega_M \sum_{n'z'} \left[J_1(d_{nn'}) (S_{x n'}^{z'} + i S_{y n'}^{z'}) - J_2(d_{nn'}) (S_{n'x}^{z'} - i S_{y n'}^{z'}) \right]$$

$$= \omega_n (s_{xn} + i s_{yn}) + \sum_{n=1}^{\infty} [v_{nn} s_{xn}^{(1)} - i s_{nn}^{(1)} s_{yn}^{(1)}]$$

$$\text{Coe}_{\beta_1}^{S_{21}} : \gamma_{nn'}^{21} = \left[\gamma_1(d_{nn'}^{21}) - \gamma_2(d_{nn'}^{21}) \right] (-\beta \omega_m); \lambda_{nn'}^{21} = \beta \omega_m \left[\gamma_1(d_{nn'}^{21}) + \gamma_2(d_{nn'}^{21}) \right]$$

$$J_1 - J_2 = \sum_L \frac{P_L(L-1)}{(d_{nni}^{22})^{L+1}} - \sum_L \frac{P_L(L+1)}{(d_{nni}^{22})^{L+1}} \left(R_{nni}^{22} \right)^2$$

Due chain $R = \frac{1}{d} \left(\frac{1}{d} \right) = \frac{1}{d^2}$

$$J_1 - J_2 = -2 \sum_L \frac{P_L}{(d_{nn}')^{2L+1}}, \quad J_1 + J_2 = 2 \sum_L \frac{L P_L}{(d_{nn}')^{2L+1}}$$

$$\textcircled{18} \quad \underline{V_{nni}^{3\sigma'}} = 2\beta\omega_M \sum_L \frac{P_L}{(d_{nni}^{3\sigma'})^{L+1}} \quad \textcircled{19} \quad \underline{\lambda_{nni}^{3\sigma'}} = 2\beta\omega_M \sum_L \frac{L P_L}{(d_{nni}^{3\sigma'})^{L+1}}$$

Use μ (21/IV square lat.) = μ_2 (Ox. c.), y name (21/II) $\lambda_2 = 0$.

Use $\omega_{\pm}^2$ (Square both sides) $= (\omega_0 - \lambda \pm \mu)^2 - \lambda^2 = (\omega_0 + \lambda_1 \pm \mu_2)^2 - \mu_1^2$

$$\text{y Oko. n.p.m. } \lambda_2 = 0 \quad \omega_{\pm}^2 = (\omega_0 + \lambda_1)^2 - (J_1 \pm J_2)^2 = [\omega_0 + \lambda_1 - (J_1 \pm J_2)] [\omega_0 + \lambda_1 + (J_1 \pm J_2)]$$

Y same $\omega_{\pm}^2 = [\omega_0 + \lambda_1 \pm \mu_2 - \mu_1][\omega_0 + \lambda_1 \pm \mu_2 + \mu_1]$

и ок. $\omega_{\pm}^2 = [\omega_0 + \lambda_1 - \mu_1 \mp \mu_2][\omega_0 + \lambda_1 \pm \mu_2 + \mu_1]$, неплан [.]

не сов. с ψ_f^2 (т.е. $\mu_2 \neq 0$), но $\mu_2 = 0$ (то и $\mu_1 = 0$)

10 chain. ? $\sum_{i=1}^n u_i \sim \frac{1}{2} (n) \sum_{i=1}^n (i) \sim \frac{1}{2} (n) \frac{n(n+1)}{2} \sim \frac{1}{4} n^2$

250/15
~~Пустка еси $\sum_{n=1}^{\infty} \frac{1}{n!}$, тоод устанав $\frac{1}{n!}$ устанав $\frac{1}{n!}$ и $\frac{1}{n!}$ и $\frac{1}{n!}$.~~

no even so number of $n = \text{const}$ ($n=0$) u $v_{\lambda}, v_{\lambda'}$ omnesce

Тогда $V(k) = \sum V_n e^{ikn}$ е функцията n^1 (или n), то $(1/2)$ не е равно

$$V_{hnl} = V_{nnl} (20/\sqrt{v}) \cdot \frac{28}{R^2 \cdot 2\pi m_e} = \left((8\pi^2 M_s^2 R^3)_{\text{unomitted}} \right) = 2\omega_{\text{mp}} \sum \frac{P_L}{\omega_{\text{LH}}}$$

$\lambda_{nn'} = \lambda_{nn'}(20/\sqrt{V}) \cdot \frac{28}{R^2 2\pi m_s L} = 2\omega_n \beta \sum_{L=1}^{\infty} \frac{L^2}{(L^2 + 1)} \quad (G) = 20 \text{ Domingo. Igandea}$

$$\gamma_{across}^2 = [\omega_0 + \nu \pm \nu'] [\omega_0 - \lambda \pm \lambda']$$

1D chain: $L=0, L=2\pi, L=4\pi, \dots, L=2\pi n$. $\lambda, \lambda', \nu, \nu' = \pm k$.
 перебор 8 ок. уравнений: $\lambda = -\lambda, \lambda' = \mu$ - 1D square lattice $p_n = (-1)^{n+1}$.

One 1D chain $v, \lambda = v_{nn}^{20}, \lambda_{nn}^{20}$ nearest, Σ (no other nearest), $\lambda' v'$ symmetric.

1D-Chain $\omega_{\pm}(k)$ Crosses represent S_x, S_y, S_z spin components

было как в (5.5) не все Оценки исключены. Разрешим $w \pm (k) - \text{Число } (-1)^n - \text{логарифм}$

~~City Bank" (ka July 24, 2011) and it is not signed nor stamped (BA → BBA package~~

to avoid monthly fee (BBA min = 1,500 \$). One piece Day-to-day Sav. & nonexp. (BA → BBA) picking
File Citi Bank ementa doc.

H=34 can za cras JNN '2008 u Buch 'PRB'05 FMT. Vymen PRB-
 Pruning, Fredy Coxham's Prgs in eps-format. Nepismaka co Crapany u
 mariovici no novoy gas u mure b San. del FMR-poster e Arantxa
 (Pogor, Referee's Reports no MS-Pukuma, Sci. Reports u novan Myka
 notep: 57gob to Referees (Hoffmann u van Wees), // Dec. ne nochna
 konyi alk) u (14) chain, upreper neu poruzh (kazabtra).

27/VII Becega e Julian: 1) Chubuna, manova myrme camro Casa
 de salanto (on nemomer). 2) wogaz go Sept. 10 e num na 6-er. Basque
 grant na bow vryuny, 3) Dec. u Jan. 2014 u mer zanga zogobyn PhD
 ju. nos opromus be does u b Apr. 2014 zaim rucue. Eau zensua
 e wjeenax Current spend, to nomo nger na UPV-1/parit 1 year gix
 fresh UPV-postdocs, uuzuyux position. C n. u A. b "Mazda" office
 (Gros)

$\vec{G} + \vec{S} = \frac{\partial W}{\partial \vec{S}}$, e $\vec{G} = -P/|\vec{G}| \hat{z}$ monen zame. $-ip\vec{S} = 2 \frac{\partial W}{\partial \vec{S}}$, $W = \frac{1}{2} \omega \vec{S} \vec{S}$
 $ip\vec{S} = \frac{\partial W}{\partial \vec{S}} \frac{1}{|\vec{G}|}$ u m $\vec{S}(t) = \vec{S}(0)e^{i\omega t}$, $\omega p\vec{S} = \vec{S}\omega_0$, $\omega = p\omega_0$
 1/m $p=+1$, $\vec{S}(t)$ kpyonue $\sim e^{i\omega t}$ u h'asub rac. ctenki, a $\vec{S}(t) \sim e^{-i\omega t}$ no
 toza banroc: nozemy $21/12$ 1D sq. latt. $(-1)^{n_1+n_2}$ $\omega = \omega_0$ gme $\vec{S}(t)$
 u m $\lambda = \lambda' = \mu = 0$. Ioo carb. $\vec{S}(t) = \vec{S}_0 e^{i\omega t}$, $\vec{S}(t) = e^{i\omega t} \vec{S}_0(\omega)$ - pyne
 transform $\vec{S}(t) \rightarrow \vec{S}(\omega)$ kan rezubuchimux nepemenux, zenucu 4D gme $\vec{S}(\omega)$,
 $\vec{S}(\omega)$, naxomg. kapnei $\omega = \pm \omega_0$ u $\vec{S}(t) \sim e^{i\omega t}$, $\vec{S}(t) \sim e^{-i\omega t}$

B: 1D-Chain banroc a $\vec{S}, \vec{S}$ znenax ne bozumenax, i.e. 4D am gme $\vec{S}_x, \vec{S}_y$.
 i.e. b 4D kago $\vec{S}_n(t) = \vec{S}_n(\omega) e^{i\omega t}$, $\vec{S}_n(t) = \vec{S}_n(\omega) e^{i\omega t}$ rassm. kan
 u mmo xene spax. camac. e $\vec{S}_x, \vec{S}_y$ paorocam.

K'obxogum. $\vec{S}_n(t) \sim e^{i\omega t}$, $\vec{S}_n(t) \sim e^{i\omega t}$ orelugna, bezg e u mmo m
 gaimen b 4D c'opamocae, orelub 4D gme $\vec{S}_n(\omega)$.
 Dec. nochna 1D-Chain $p_n = (-1)^n$, $\omega(k)$ no m covnegenos e
 m m paorocam $\omega_{\pm}(k)$ os 20/VII. Fex. rem. $\omega(k)$ Dec. nochna neberno,
 u. za neberno yrea summe m $\cos k$ - mena.

28/VII Uzyz. ukr. Zakonov o v'remne. Vucero u'rommim e 1/I zoi-
 remmim (no mestu m'ubecba). Ukr. za pydymem remmim/um
 e b ukr. nosomocbe, ctenbeza na b'm. g'as - b nosomocbe.
 Remmim m'ca z'm'ubecba, x'ubno em z'm'ubem kan ≥ 6 m'ec.
 T'm'os b Ati B" e u'p'egum. to convert CBA $\rightarrow$ BBA package u/m.
 to convert "my ultimate saving to Day-to-Day Saving. Z'abv. o

30/VII Pogorobua u kom'p'ebimie g'as - ob g'me nozgyu b Madrid.

30/VII - 1/VIII K'ezgma b Madrid: 1) ukr. nosomocbo, 2) Dec. u'z'm'ano.
 Amcam Anone b m'ni n'icopz (30€ nom'm'ca). G'am z'abv'mie An.
 o cam'm' PM m co m'ni (bez g'as) u m'ce z'abv. o g'op'mie kanor.
 c'p'abim (g'as u'p'ebim, k'ap'ano b'm'ni m'adym) e u'p'm'm. k'm'm k'at'or. m,
 ukr. n'ac'm'ca e b'm'm'm'ni u'z' Domu 14A u c'ap'oi u'cu. p'ol'ie c'p'abim e
 n'ep'eb'z'am - m'adym u'p'm'm u'z'm'm. g'as ap'p'l. PM m e 3 July na
 m'p'm'm' b Aug. u m'az'm'a, z'oo n'eb'm'm'o, z'oo kanor c'p'abim y'm'm'e
 m'p'm'os b July (21/II), b'm'm' u ukr. - u'cu. ag'b'm'cy (30€ za kon'g'm'os).
 Dec'm'a u. co-ab'op'm Multipole PRB-II d'ob' ne x'oz'et, camac. u'p'm'm'os
 m'om'm'm' nochna c'm'm' $p_n = (-1)^n$ m'c. p'os'ida. ob'uz'm'g non-linear Fst (s)
 e k'at'or (m'g'm' model ne g'as nom'm'ca. m'om'm'ca). Dec'm'a x'oz'os co m'ni
 M'ec - g'rem't b Jan. 2013 na 2014-16, + u. y'm'et-travel g'ener.

August 2, 2012

11

Nuan Euzen. pasorri (Cu. Apr. 10, 2012)

Asteartea • Martes

ABITZUA - AGOSTO 2012

L	M	M	J	V	S	D
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

L	M	M	J	V	S	D
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

→ 1) Non-linear ST vortex dyn. — Dec., Rafa + Cuabun

2) VC switching vs. time in H_z , h_r -pulses, v. barrier — de Loubens

→ 3) V. dynamics as function MRFM - probe position — de Loubens

4) Nanotubes - analyt. DW c Ai Ping

→ 5) Multipole Coupl. u Vort. dyn. in pairs, 1D, 2D dot arrays — PRB c Dec.

6) Stripe-FMR-magnonics c Arantxa u TAOB — Subm. JAP May 2, 13

7) Nat. Sci. Rep. — preprint, co-Dani, review APT — Kim, JAP, PSS, IE³M, Nature

→ 8) Re-subm. Multipole — 1 paper to PRB c Dec. — 28-subm. Aug. 15

9) Magnonics SDI-dots — Bepta, comments, changes — published III/13

→ 10) V. barriers u resonance. napa u qm u ST bozdyneme c Merab, can in vortex state — pub. c Jan.

11) Gauge fields u ux para b vortex sq. of motion — ST — gen. damping c Dec.

Opr. bonjocor:

→ 1) Muxer que Cuabun, Merab, Bepta b Dec. 2012

→ 2) Preprint — yonenne Hotels Milan u Parma

3) Opr. uazguy Dec. b Porto u nauyuzcyr. Porto 5-12 July

4) Cges 10. laptop b penout or change it (DEPTEN)

5) Cges 20. FMN applic. u uacnqyr A., Yqr. uacnqyr b San Seb. 2012

6) Yqeruyup. Bonjocor Cges c Citi Bank - USA

→ 7) FMR-pinning u Vort. posters b Kaiserlaut. Multipole poster — Parma

8) Olerus Fahule

→ 9) Nogus. Report for Ikerbasque promotion (30 Sept. 15)

→ 10) Demora Julian c Subm. Basque grant (canon u yonenne)

11) Oler Madrid trip 30 July - Aug 1, Kaiserlaut u Miles Luftthansa

→ 12) Preprint PhD thesis uacnqyr 30 Oct. 12, 2012 — nocua 15/12

→ 13) Ona. Citi Credit Card to uacnqyr

→ 14) Zonunus u nocua now Zorb Europ. travel grant (Krawczyk)

→ 15) Wpugon. no yuyzm. nauyuz to Ikerbasque

(viii) Nissan i PRB'12 Noulă, viteză, Ostrajeni - 276. După ce s-a dus la
Noulă porche no înțel : după cum Honda Civic Toyota Aurus,
"Hyundai" IZON u Nissan Juke - no coor. uzină / karecbo.

$$\begin{pmatrix} \omega_0 + \nu & -\omega & \nu' & 0 \\ \omega & \omega_0 - \lambda & 0 & -\lambda' \\ \nu' & 0 & \omega_0 + \nu & \omega \\ 0 & -\lambda' & \omega & \omega_0 - \lambda \end{pmatrix} \begin{pmatrix} S^1_{kx} \\ S^1_{ky} \\ S^2_{kx} \\ S^2_{ky} \end{pmatrix} = 0, \quad S^1_{kx} = 1 \rightarrow \begin{pmatrix} -\omega & \nu' & 0 \\ \omega_0 - \lambda & 0 & -\lambda' \\ 0 & \omega_0 + \nu & \omega \end{pmatrix} \begin{pmatrix} S^1_{ky} \\ S^2_{kx} \\ S^2_{ky} \end{pmatrix} = \begin{pmatrix} -\nu' \\ 0 \\ \omega \end{pmatrix}$$

Тогда пока $k=0$: $v+v' = 2 \sum_{n=1}^{\infty} v_{0n}$, $v-v' = 2 \sum_{n \geq 0} v_{0n} - 2 \sum_{n \geq 0} v_{0n}$
 $\lambda + \lambda' = 2 \sum_{n=1}^{\infty} \lambda_{0n}$, $\lambda - \lambda' = 2 \sum_{n \geq 0} \lambda_{0n} - 2 \sum_{n=0}^{\infty} \lambda_{0n}$ - не выполняется.

$$g_y(\omega) = \frac{v'(\lambda'v' - \omega^2) - \lambda'(\omega_0 + v)^2}{-\omega[(v' + \lambda')\omega_0 - \lambda v' + \lambda'v]} \quad \omega = \omega_{\pm} - \text{acoustic phonon}$$

при условии $\lambda, \lambda', \nu, \nu' \ll \omega_0$. Т.е. $S_{kx}^2 = (\pm 1) S_{kx}^1$ где $\omega = \omega_{\pm}$.
 $S_{kx}^2 = \frac{1}{2} \frac{[(\omega + \nu)(\omega^2 - (\omega + \nu)(\omega - 1)) + (\omega^2 - (\omega - \nu)(\omega - 1))]}{(\omega^2 - (\omega + \nu)(\omega - 1))}$ chain $(-1)^n = P_n$

$$\omega_{\pm}^2 - (\omega_0 + \nu)(\omega_0 - \lambda) = \lambda' \nu' \pm [\lambda'(\omega_0 + \nu) + \nu'(\omega_0 - \lambda)]$$

$$\omega_{\pm}^2 - \lambda' \nu' = (\omega_0 + \nu)(\omega_0 - \lambda) \pm [\lambda'(\omega_0 + \nu) + \nu'(\omega_0 - \lambda)], \quad \det R = -\omega [\lambda'(\omega_0 + \nu) + \nu'(\omega_0 - \lambda)]$$

$$S'_y(\omega_t) = \frac{1}{\det \rho} \left[-v'(\omega_0 + v)(\omega_0 - \lambda) + v' \{ \lambda'(\omega_0 + v) + v'(\omega_0 - \lambda) \} - \lambda'(\omega_0 + v)^2 \right] =$$

$$= \frac{(-1)}{d_0 + D} \left\{ \lambda'(\omega_0 + \nu) + \nu'(\omega_0 - \lambda) \right\} [\omega_0 + \nu \pm \nu'] = \frac{1}{\omega_+} (\omega_0 + \nu \pm \nu') = \sqrt{\frac{\omega_0 + \nu \pm \nu'}{\omega_+}}$$

$$\frac{1}{\det R} = \frac{1}{\det R} \left[(\omega_0 + \nu) \{ \lambda' \nu' \pm [\lambda' (\omega_0 + \nu) + \nu' (\omega_0 - \lambda)] \} + \nu'^2 (\omega_0 - \lambda) \right]^{\omega_0 - \lambda \pm \lambda'}$$

$$\left[\pm(\omega_0 + \nu) [\lambda'(\omega_0 + \nu) + \nu'(\omega_0 - \lambda)] + \nu' [\lambda'(\omega_0 + \nu) + \nu'(\omega_0 - \lambda)] \right] =$$

$$\frac{1}{\epsilon_{\pm}} \left[\nu' \pm (\omega_0 + \nu) \right] = \frac{(\mp 1)}{\omega_{\pm}} (\omega_0 + \nu \pm \nu'), \quad S_{ky}^2(\omega_{\pm}) = \mp S_{ky}^1(\omega_{\pm})$$

Handsp. Dec.: uz manx zaganini or 3/viii (Figs, Plarain, Referee Reply) Semana • Aste 37
no cglan
Kuzer.

Звоны Ангелы (взбунт) ... нормальн. coefficient
 Vortex Nonlin. St. sign. line: 1) normal nonlin. coefficient
 w (tracoon) d (damping), $\hat{J}_1$ (de-field); 2) oscillation nonlinearity
 6) Singh's Bugno u-pe sytropic freq.; 3) oscillation nonlinearity
 Brother $w(s) \leftarrow$ замаска ины ab function current

7/VIII Passa nag proof-corrections PRB-pinning. Skypa c Ties. Ha u n...
 Pazoffance c bincan Ryanair u namic. Memovoy. Onc. Fig. 4.7 Multiple
 Ostegina: Neves

8/VIII Passa goma: 1D chain c $p_n = (-1)^n S_{k,y}(\omega_{\pm})$ bulog. Novm...
 Square lat $\mathbb{Z}(1,0)$ que $d=2, 2.1, 2.5, 3$ u uocua tables Onc. que Fig. 3a.
 Zompe Julian o uocua c basque grant subm. Paga coobus. 200 Onc. uocua

Novm... que 1D chain: $S_{kx}^2(\omega_{\pm}) = \pm S_{kx}^1(\omega_{\pm})$, $S_{ky}^2(\omega_{\pm}) = \mp S_{ky}^1(\omega_{\pm})$
 $S_{ky}^1(\omega_{\pm}) = \frac{1}{\omega_{\pm}} (\omega_0 + v \pm v') S_{kx}^1(\omega_{\pm})$. Note: aorn. S_{kx}^2/S_{kx}^1 , S_{ky}^2/S_{ky}^1

table me kan b Sukh' APEX '11 que X_2/X_1 , Y_2/Y_1 det pair c $p=p_1 p_2 = -1$
 S_{ky}^1/S_{kx}^1 anaworno $|Y_1|/X_1 = E_{\pm} = \sqrt{\frac{1 \pm a}{1 \mp b}}$, rge $a \sim I_x$, $I_y \sim b$ det pair

$S_y^1/S_x^1 = \sqrt{\frac{\omega_0 + v \pm v'}{\omega_0 - \lambda \pm \lambda'}}$, uocua λ, λ', v, v' uocua c uocua multiple compl.
 Co cbeai $\delta = 1(\lambda, v)$ uocua c uocua $\delta = 2(\lambda', v')$ uocua

Dea uocua field excitations: 1) $\tilde{h}_{\sim}$ uniform - bozdyngeer uocua c $\langle \tilde{m} \rangle_{\sim}$
 2) bozdynge. ognu gora $n=0$ $\tilde{h}_{\sim}(x) \sim \delta(x)$, $\tilde{h}_{\sim}(k) \sim \delta(k)$

reg. $\tilde{m}$ of 2-uocua $\langle \tilde{m}_z \rangle = \sum_n \tilde{m}_n^z = \frac{1}{N} \sum_n \sum_k \tilde{m}_k^z e^{-ikn} = \tilde{m}_z^0$
 $\tilde{m}_k^z = \sum_n \tilde{m}_n^z e^{ikn}$. 1) $\tilde{h}_{\sim} = \text{const}(n) - \text{coobus. FM } k=0$. $\frac{1}{N} \sum_k e^{ik(n-n)} = \delta_{nn}$

No uocua. Buch. Nat. Ph. '05:
 $\omega_{\pm}$ - uocua $\tilde{S}_1, \tilde{S}_2$ coobus. (i,0) coobus. $\tilde{S}_1, \tilde{S}_2(t)$

$\omega_{\pm}$ - uocua $P=+1$ $P=-1$ coobus. (0,i) coobus. $\tilde{S}_1, \tilde{S}_2$ 1oi u 2oi uocua

$\langle \tilde{m}_n^z \rangle = \sum_{n3} \langle \tilde{m}_n^z \rangle = \sum_n \langle \tilde{m}_n^1 + \tilde{m}_n^2 \rangle \sim \hat{z} \times \left[C_1 \tilde{S}_n^1 + C_2 \tilde{S}_n^2 \right]$

uocua $C_n^1 = C_1$, $C_n^2 = \text{uocua}$ ognu uocua bozdyngeer uocua
 1 ($P_1=+1$) u 2 ($P_2=-1$). $\langle \tilde{m}_n^z \rangle \sim \hat{z} \times \left[C_1 \sum_n \tilde{S}_n^1 + C_2 \sum_n \tilde{S}_n^2 \right] \sim \hat{z} \times \left[C_1 \tilde{S}_1^1 + C_2 \tilde{S}_2^2 \right]$

$\langle \tilde{m}_{nx}^z \rangle \sim (C_1 \tilde{S}_{oy}^1 + C_2 \tilde{S}_{oy}^2) \sim (C_1 \mp C_2) S_{oy}^1$ que $\omega_{\pm}$

$\langle \tilde{m}_{ny}^z \rangle \sim (C_1 \tilde{S}_{ox}^1 + C_2 \tilde{S}_{ox}^2) \sim (C_1 \pm C_2) S_{ox}^1$ que uocua $\omega_{\pm}$

$\tilde{h}_{\sim}^x$ - uniform bozdyngeer uocua c $\langle \tilde{m}_{nx} \rangle$
 200 $\omega_{\pm}$ uocua $C_1, C_2 = -1$ uocua $\omega_{\pm}$ uocua $C_1, C_2 = +1$

uocua $\tilde{h}_{\sim}^y$ - uniform bozdynge. $\omega_{\pm}$ uocua $C_1, C_2 = +1$ uocua $\omega_{\pm}$ uocua $C_1, C_2 = -1$
 Ecu bce $C_n = \text{const}$, to $\tilde{h}_{\sim}^x$ - uniform bozdynge. $\omega_{\pm}$, a $\tilde{h}_{\sim}^y$ - uniform - $\omega_{\pm}$

uocua $p_n = (-1)^n$
 // No y Oani - Barman '10 ($\tilde{h}_{\sim}^x$) u Vogel 'APL '11 ($\tilde{h}_{\sim}^y$) uocua uocua uocua

uocua, k 1- uocua gory b uocua. uocua uocua uocua uocua
 Ecu $\tilde{h}_{\sim}(x) \sim \delta(x)$ local, $\tilde{h}_{\sim}(k) = \text{const} \rightarrow$ bozdyngeer uocua bce k
 uocua uocua uocua c $v_g^{\pm} = \frac{d\omega_{\pm}}{dk}$ uocua uocua. $|v_g^+| = |v_g^-|(k)$

uocua $v_g(p_n = (-1)^n) \gg v_g(p_n = \text{const})$. Local $\tilde{h}_{\sim}$ bozdyngeer uocua bce k u
 ooc uocua $\omega_{\pm}(k)$ of the chain $p_n = (-1)^n$ c Barman '10 uocua uocua uocua
 (uocua uocua $p_n = (-1)^n$). No uocua uocua $I(k) = \text{const}$ uocua uocua local $\tilde{h}_{\sim}$

11

Vietnes *Ostirala*

BL. carb. 2B

$$C_1^2 = \sum L P_L [-2e \pm$$

$$= \nabla' = 0$$

more happy

u go away)

17 Dec 2011

oba.

todos chcl. 25/10/83
10-1-1/7/84

A. C. H. A. J.

rubl 6 Sci 2010

Domingo . Igandea

trình b. Sprin 06

A. 10, J. - само

€ - стоимость

Urteil, neue

... 40 8-14/5

in. *Oulmus*

23/VIII C. 1. Byu ee upromising a vlog. Parnas talk c Pappag. Zbonen b Casa Talento c Lide, n...
 24/VIII Odeung. Parnas talk c Pappag. Zbonen b Casa Talento c Lide, n...
 17 Odeung. Parnas talk c Pappag. Zbonen b Casa Talento c Lide, n...
 (Axa insur.) u Arantxa (Orso Car). Ode. upromising poster by Ugep...
 Pasdop wo (Hir) de Loubens c Ode.
 24/VIII wo (tip position) c Ode. Neperobop c Casa Talento (noce. Meneba)
 Astel Oenistines (Axa - autoinsur.) u Arantxa (Hyundai). Arantxa, cgen...
 Matriculation of the car, a Gustina, zacp... ee c 24/VIII 127. 200...
 nozbenno neni zacp... "Hyundai" 30 uq Lintzi in. B Carrefari c n. (v...
 na. mamune.
 25/VIII C. A. b Amara - Omer b BSO. File o upromising 2009-2012 gne
 Indian u Ikerbasque report. Sent Review Lin - JAP ST-Vortex dyn.
 Zacp... c Ode. BLS-Vogt poster u Orgaz ee Matriculation - de poster.
 26-30/VIII Travel to ICMN'2012, Kaiserlautern c Julian u Arantxa.
 Murikami - Berry ph. in Magnonics - nocu., new Sender - talk vortex
 dyn. b F/N/F pitar nocu. - Odeung. Cuabun: 1) coupling det pair - nocu.
 10- 2) nonlin. w. undi gne ST-Vortex dyn. nocu. ee go nocu. Sept.
 (varga c neni 2 papers + Japan exp.). Becegn c Meneba: on neni... appo...
 val Casade Talento - apt. Discuss. c Devolder u Vukadinovic. Odeung. exp.
 wo (tip position) c de Loubens: ravnko H₂ ne nimen... wo (H), kago H_{xy}.
 Odegn 26/VIII u yomnan 29/VIII c Arantxa b Hotel Bremerhof, b neni.
 31/VIII Cu. goma b Orio, 425. 220 m², 515-540 + € u ne xosar cumm...
 offer na 2 neglu. 3a rignou c J. b Gros, odeg, con, qum...
 1/IX C. A., W., J. b La Perla, C. A. b Lide. Pappag u neni... slides oral talk
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 upromising Ane e-mail c b... nocu. Nozobona Winter magn. talk slides - Parn...
 4/IX Nozobona draft The host department Evaluation for Promotion
 rel. p... c Ode. n... Neperobop c Ikerbasque Evaluation docs.
 Nozobona Arantxa on. n... Meneba u neni... conf. letters Talit House for
 Meneba u Bepa. P... b... JNN c RNSA Proceedings.
 5/IX Nozobona Landing Statement u Res. Plan for Ikerbasque Evaluation.
 Meeting c Virginia: Odeung... ee TMR g... na TNT 12 in Madrid.
 Recom. paper by Depandt to publish in Phys. Lett. A.
 6/IX Ode. kb. Sept. Meeting c Julian. 1) on upromising neni... ~ 1 page
 Resumen na Magnonics, Spintronics gne Basque grant u neni... na 6 res;
 2) odeg... curru cbeo file - z... Host Center Report for Ikerb. Promotio...
 one ne neni... bio brepe, updated file u neperobop to Julian;
 3) n... CV postdoc candidate A. Usliner, z... p... odeg... g...
 Arantxa neni... Certificates Meneba u Verba u Casa Talento...
 260/105 Usliner PDFs Ode. update info at Ikerbasque site u my CV, Ode. 4/8.
 7/IX Meeting c Julian: 1) mai plan to Basque grant is Ok; 2) g...
 neni file Host Center Report; 3) Cozg. ERI - grant team (Germany, France, U.K.)
 na xoboi tve; 4) 2 postdocs + 3 Ph.D student + 1 Secr. bu.)
 b Basque grant. E-mail to Usliner.
 updated Host Center Eval. Report, b... r...
 Short Future Res. Plan u nocu. to Julian, created PDFs of updated CV u
 38 Aric. Sciana
 1) z... Res. plan u download PDF; 2) b... Conf. 2011-12; 3) E-mail Ikerbasque
 Odeung. u 2-Referees.

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в силу звуковости задан ($\nabla \cdot \vec{u} = 0$)

$$\vec{m} = \sqrt{e_+^2 + e_-^2} + m_z \hat{z}, \quad \hat{e}_{\pm} = \frac{1}{\sqrt{2}}(\hat{x} \mp i\hat{y}), \quad \hat{e}_z = \hat{z}, \quad \hat{e}_{\pm} \times \hat{z} = \mp i\hat{e}_{\pm}, \quad \hat{e}_+ \times \hat{e}_- = i\hat{z}$$

$$e_\alpha \cdot \bar{e}_\beta = \delta_{\alpha\beta}, \quad e_\alpha \cdot e_\beta = 0 (\alpha, \beta = \pm), \quad \hat{e}_+ = \hat{e}_-, \quad \hat{e}_+ \cdot \hat{e}_- = 1, \quad \hat{e}_\pm \cdot \hat{e}_\pm = 0, \quad \hat{e}_\pm \cdot \hat{z} = 0.$$

$$v = \sqrt{\frac{w}{1+w\bar{w}}} \quad , \quad m_z = \frac{1-w\bar{w}}{1+w\bar{w}} \quad , \quad |\vec{m}|^2 = \vec{m} \cdot \vec{m}^* = 2v\bar{v} + m_z^2 = 1$$

$$E_{\text{eff}} = \frac{\vec{E} \cdot \vec{E}}{E^2} = \frac{1}{E^2} \left[\frac{\partial}{\partial z} \left(\frac{\partial}{\partial z} + \frac{\partial}{\partial r} \right) + \frac{\partial}{\partial r} \left(\frac{\partial}{\partial z} + \frac{\partial}{\partial r} \right) \right] \cdot \left[\frac{\partial}{\partial z} \left(\frac{\partial}{\partial z} + \frac{\partial}{\partial r} \right) + \frac{\partial}{\partial r} \left(\frac{\partial}{\partial z} + \frac{\partial}{\partial r} \right) \right] =$$

$$= 4 \left[\frac{\partial^2 \bar{v}}{\partial z^2} + \frac{\partial^2 \bar{v}}{\partial z \partial \bar{z}} + \frac{\partial^2 \bar{v}}{\partial \bar{z}^2} \right], \quad \frac{\partial \bar{v}}{\partial \bar{z}} = \frac{\sqrt{2}}{(1 + w\bar{w})^2} \left(\frac{\partial \bar{v}}{\partial \bar{z}} - w^2 \frac{\partial \bar{v}}{\partial \bar{z}} \right)$$

$$F_{xy} = 4 \cdot \frac{2}{(1+w\bar{w})^4} \left[\left(\frac{\partial w}{\partial z} - w^2 \frac{\partial w}{\partial \bar{z}} \right) \left(\frac{\partial \bar{w}}{\partial z} - \bar{w}^2 \frac{\partial \bar{w}}{\partial \bar{z}} \right) + \left(\frac{\partial w}{\partial \bar{z}} - w^2 \frac{\partial w}{\partial z} \right) \left(\frac{\partial \bar{w}}{\partial \bar{z}} - \bar{w}^2 \frac{\partial \bar{w}}{\partial z} \right) \right]$$

~~$$+4. \frac{4}{(1+w\bar{w})^4} \frac{\partial(w\bar{w})}{\partial z} \frac{\partial(w\bar{w})}{\partial \bar{z}} = \frac{8}{(1+w\bar{w})^4} \left[\frac{\partial w}{\partial z} \frac{\partial w}{\partial \bar{z}} (1+w^2\bar{w}^2) + \frac{\partial w}{\partial \bar{z}} \frac{\partial \bar{w}}{\partial z} (1+w^2\bar{w}^2) \right] + 261/104$$~~

$$+ 2w\bar{w} \frac{\partial \bar{w}}{\partial z} \frac{\partial w}{\partial \bar{z}} + 2w\bar{w} \frac{\partial w}{\partial z} \frac{\partial \bar{w}}{\partial \bar{z}} \Big] = \frac{8}{(1+w\bar{w})^2} \left[\frac{\partial w}{\partial z} \frac{\partial \bar{w}}{\partial \bar{z}} + \frac{\partial \bar{w}}{\partial \bar{z}} \frac{\partial w}{\partial z} \right].$$

Проверим, подставив $w = \frac{1}{2} e^{i\Phi}$, получим $E_{ex} \sim [(\nabla\theta)^2 + \sin^2\theta(\nabla\Phi)^2]$

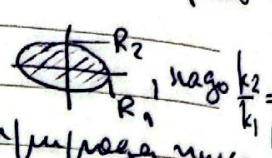
New paper Wyssin PRB'12 hot-finite vertex dyn. - preprint Chudnovsky TM.

1) w/ μ mmes fibres ($\theta = 0, 90^\circ$) give stripes ($t = 40 \text{ nm}$) u patterned  film

4) links to ERC-grants; 3) own. y 10ppm Porop. 8 gwei cyr. Portugal.

19

Asteazkena - Miércoles

- OSyng. c. Dec. Bucurestie Ex' 2005 1. Osyng Kozovich '90
 exp. delatours vort. inhom field (une normare amz. zman b W zoom)
 F/N/F vort dyn. paper Cherepan' PRL' 12 M M J V S D
 Comments c. cherepan. Ivanov' PRL' 2002 6 7 8 9 10 11 12
 1) nec exp. gorkazhenov V-V state of layers in F/N/F pillar
 2) nec pamiyobov b F/N/P dot cocorene $C_1 C_2 = -1$ - $P_1 P_2 = -1$,
 bego $P_1 P_2 = +1$ znacheniya dore bogo (osennu ghe strong core
 3) nroberna korp. mekani $\chi_{core-core} \gg \chi$ (single dot). Baquino
 core-core coupling cunuo zabimen.
 4) nec nokezan $k_{1,2} \sim 1/R_{1,2}$ ghe zmmur. layers 
 5) nmkn ufu 5 u 6 GHz buquino azim. SW, a bes ufu nroga nroga
 2 GHz ($P_1 P_2 = +1$) neaska, ne gorkazano, zo zo nroga coupled cores
 6) neasno nro normena ω_0^{AP-AP} u zmmur nroga ghe $P_1 P_2 = -1$
 7) osmereno, zo zmmur dot pair ne zabucer os $P_1 P_2$ (p.u), zo ne tak
 8) radius orbit v. core = 1 nm (rotational mode) u os 0.1 nm (vibr. mode)
 ommf simulated za nrogeranu micromag. simulations
 9) vibr. mode amplitude (0.1 nm) oseno nroga, ee u nrogeranu oseno
 nroga u ne nroga oseno oseno oseno oseno oseno oseno oseno oseno
 10) $M_{tot} = 0.6 L / \delta_2$, zo nrogeranu nroga nroga $M = \frac{3}{2} L / \delta_2$ u os' PRA' 10
 11) buquino unno nrogeranu os' PRA' 10, Anad' APL' 11 F/N/F, a om nrogeranu (ag. motion
 c $G_3 \times \vec{x}$ na zabucer. paper Ivanov' JETP Lett. '10, 198 G_3 u M de nroga
 u nroga ω_0 u $\omega \pm 1$ of azim. SW.

Comments 2) 3) 5) 8) 9) ghe nrogeranu ghe oseno. Kan os BRL u nrogeranu

Nonlinear ST vortex oscillator (nrogeranu)

- Recent - Paces $F_{ST}(s)$ nonlin. cm. 1-12/III 12. (pacers damping $d(s)$ nonlin. - 8/II 12.
 Non-lin. $W_m(s)$ - 5/I 2006 2. Non-lin. $W_{ex}(s)$ - 5/I 2006 2. (pole f.m., nroga
 (pole-free model)
 Non-lin. $W_H(s)$ - (pole free m.) - 12/I 2006 2. Simul. $W_m(s)$ - 3/III 06 2.
 (Panchenan)
 Non-lin. $G_2(s) \sim Q(s)$ - 14/II - 15/II 2007 2. (pole free model).
 Non-lin. $Q(s)$ corrected - 14/III 2008 2.
 Non-lin. damping $D(s)$ 12/III - 13/III 2009 2. (pole free model). d_1 - nrogeranu
 nrogeranu non-lin. $W_m(s)$ 21/III 2010 2. (pole-free m.)
 nrogeranu non-lin. $W_m(s)$, $Q(s)$ - 31/III - 4/IV 2012 u cpebu $|s|$ u $|F(s)|^2 = \frac{2|s|}{4+|s|^2}$ p. 2
 Non-lin. ST force $F_{ST}(s)$ - 8-11/IV 10 2. (pole free u zig.v. models)
 Non-lin. ST force $F_{ST}(s)$ 1-12/III 12 2. Os. nroga oseno.

19/IV Pacer nrogeranu non-lin. $W_m(s)$, $W_{ex}(s)$ (osyngne), $G_2(s)$, $D(s)$, $F_{ST}(s)$, $W_H(s)$
 nrogeranu oseno ghe nrogeranu non-lin. oscillator $W_m(s)$ u $D(s)$.
 $F_{ST}(s)$ oseno os. nroga. $G_2(s)$ - nroga. $W_H(s)$ - nroga non-lin. oseno oseno.
 Pole free model $f(z) = \frac{1}{z} C [z - \frac{(s + \bar{s} z^2)}{(1 + \bar{s} z^2)}]$. $w = f$ b core, $w = 5/151$ bue core.
 $\text{div} \vec{m} = 2 \text{Re}(\frac{\partial w}{\partial z})$. Bue core $w = f(z)/|s|$, $\frac{\partial w}{\partial z} = \frac{1}{2} \frac{1}{|s|} \frac{\partial f}{\partial z}$.

$\text{div} \vec{m} = 2 \text{Re} \frac{1}{2} \frac{1}{|s|} \frac{\partial f}{\partial z} = \frac{1}{|s|} \text{Re} \frac{\partial f}{\partial z} = \frac{1}{|s|} \text{Re} \frac{1}{z} \left[1 - \frac{1}{1+|s|^2} 2\bar{s}z \right]$
 $= (s_x - is_y)(x+iy) = s_x x + s_y y - i(s_y x - s_x y)$
 $\frac{1}{|s|} \frac{1}{1+|s|^2} \text{Re} \frac{1}{z} (-2)(s_x x + s_y y - i(s_y x - s_x y)) = \frac{1}{|s|} \frac{1}{1+|s|^2} 2(s_x y - s_y x)$
 $\text{div} \vec{m} = \frac{1}{1+|s|^2} \frac{1}{|s|} 2(s_x y - s_y x)$

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$\vec{m} = i [z - (s' + \bar{s}' z^2)]$, $s' = \frac{s}{1+|s|^2}$
 $\text{div} \vec{m} = \frac{1}{|s|} 2(s'_x y - s'_y x)$, $|f(z)| = |z - s' - \bar{s}' z^2|$

$\text{div} \vec{m} = 2 \text{Re} \frac{\partial f}{\partial z} = 2 \text{Re} \frac{1}{z} \left[1 - \frac{\bar{s}}{1+|s|^2} 2z \right] = 2$
 $= \frac{1}{|s|} (s'_x y - s'_y x)$, $s = s_x + is_y$, $s' = s'_x + is'_y$, $s = \bar{s}$

$\frac{1}{|s|} = \frac{1}{|z - s' - \bar{s}' z^2|} = \frac{1}{|z - s'(1+z^2)|}$
 $= \frac{1}{|z - s'(1+z^2)|} = \frac{1}{|z - s'(1+z^2)|}$

$\frac{1}{|s|} = \frac{1}{s} \left[1 - 2s' \frac{(1+s^2)}{s} \cos \varphi + \frac{s'^2}{s^2} (1+s^4 + 2s^2 \cos 2\varphi) \right]^{1/2}$
 $= -2s' \frac{(1+s^2)}{s} \cos \varphi + \frac{s'^2}{s^2} (1+s^4 + 2s^2 \cos 2\varphi)$

$\frac{1}{|s|} = \frac{1}{s} \left[1 - \frac{1}{2} x + \frac{3}{8} x^2 \right] = \frac{1}{s} \left[1 + s' \frac{(1+s^2)}{s} \cos \varphi - \frac{1}{2} \frac{s'^2}{s^2} (1+s^4 + 2s^2 \cos 2\varphi) + \right.$
 $\left. + \frac{3}{8} \frac{s'^2}{s^2} \frac{(1+s^2)^2}{s^2} \cos^2 \varphi + O(s'^3) \right] = \frac{1}{s} \left[1 + s' \frac{(1+s^2)}{s} \cos \varphi + \frac{1}{2} \frac{s'^2}{s^2} \left\{ -1 - s^4 - 2s^2 \cos 2\varphi + \right. \right.$
 $\left. + 3(1+s^2)^2 \frac{1}{2} (1 + \cos 2\varphi) \right\} \right] = \frac{1}{s} \left[1 + \frac{s'}{s} (1+s^2) \cos \varphi + \frac{1}{2} \frac{s'^2}{s^2} \left\{ \frac{1}{2} (1+s^4) + 3s^2 + \right. \right.$
 $\left. + \left(\frac{3}{2} (1+s^4) + s^2 \right) \cos 2\varphi \right\} \right] = \frac{1}{s} \left[1 + \frac{s'}{s} (1+s^2) \cos \varphi + \frac{1}{4} \frac{s'^2}{s^2} (1+s^4 + 6s^2) + \right.$
 $\left. + \frac{1}{4} \frac{s'^2}{s^2} (3 + 3s^4 + 2s^2) \cos 2\varphi \right]$

$\text{div} \vec{m} \cdot \text{div} \vec{m} \sim s^2 \sim s^2$, $\frac{1}{|s|}$ largo (Thurston con norm. de s^2)
 $\text{div} \vec{m} \sim s^2$

$W_m^{(2)}(s) = \frac{1}{2} \int dV dV' \frac{\text{div} \vec{m}(\vec{r}) \text{div} \vec{m}(\vec{r}')}{|\vec{r} - \vec{r}'|}$, $\text{div} \vec{m} = F(s, \varphi, s)$
 $\text{div} \vec{m} = \frac{2s'_x y}{|s|} = \frac{2s'_x s \sin \varphi}{|s|} = 2s'_x \sin \varphi \left[1 + \frac{s'}{s} (1+s^2) \cos \varphi + \frac{1}{4} \frac{s'^2}{s^2} (1+6s^2+s^4) + \right.$
 $\left. + \frac{1}{4} \frac{s'^2}{s^2} (3+2s^2+3s^4) \cos 2\varphi \right]$

$\int_0^{2\pi} \text{div} \vec{m} = 0$, $F_0(k) = 0$
 $F_\mu(k) = \int d^2 s J_\mu(k_s) e^{i\mu \varphi} \text{div} \vec{m}(s)$, $\int d^2 s = \int ds s \int d\varphi$

$W_m^{(2)}(s) = 2L \int \frac{dk}{k} f(kL) \sum_{\mu \neq 0} |F_\mu(k)|^2$, $\int d\varphi e^{i\mu \varphi} \text{div} \vec{m} = I_\mu(s, s)$
 $\text{div} \vec{m} \cdot \text{div} \vec{m}' = 4s'^2 \sin \varphi \sin \varphi' \left[1 + \frac{s'}{s} (1+s^2) \cos \varphi + \frac{1}{4} \frac{s'^2}{s^2} (1+6s^2+s^4) + \right.$
 $\left. + \frac{1}{4} \frac{s'^2}{s^2} (3+2s^2+3s^4) \cos 2\varphi \right] \left[1 + \frac{s'}{s} (1+s'^2) \cos \varphi' + \frac{1}{4} \frac{s'^2}{s'^2} (1+6s'^2+s'^4) + \frac{1}{4} \frac{s'^2}{s'^2} (3+2s'^2+3s'^4) \cos 2\varphi' \right]$

$= 4s'^2 \sin \varphi \sin \varphi' \left[1 + \frac{1}{4} \frac{s'^2}{s^2} (1+6s'^2+s'^4) + \frac{1}{4} \frac{s'^2}{s^2} (3+2s'^2+3s'^4) \cos 2\varphi' + \right.$
 $\left. + \frac{s'}{s} (1+s^2)(1+s'^2) \cos \varphi \cos \varphi' + \frac{1}{4} \frac{s'^2}{s^2} (1+6s^2+s^4) + \frac{1}{4} \frac{s'^2}{s^2} (3+2s^2+3s^4) \cos 2\varphi \right]$
 $W_m(s) \sim \sum_{\mu} \int ds e^{i\mu \varphi} \int ds' e^{i\mu' \varphi'} \text{div} \vec{m}(\vec{r}) \text{div} \vec{m}(\vec{r}')$

div m' div m' (i) = 4s^2 sin e sin e' [F_0(gg') + F_1(g) cos 2\varphi + F_1(g') cos 2\varphi' + F_2(gg') cos 2\varphi cos 2\varphi']

div m' div m' (i) = \sum (4s^2) (sin e sin e' cos 2\varphi cos 2\varphi')

W_m^{vol} = L \int \frac{dk}{k} f(k) \int d\varphi \int d\varphi' J_\mu(kg) J_\mu(kg') \int d\varphi \int d\varphi' e^{i\mu\varphi} e^{i\mu\varphi'} \div m' \div m' (i)

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\int \frac{dk}{k} f(k) \sum_\mu \int d\varphi \int d\varphi' J_\mu(kg) J_\mu(kg') \int d\varphi \int d\varphi' e^{i\mu\varphi} e^{i\mu\varphi'} \div m' \div m' (i) =

= L \int \frac{dk}{k} f(k) \sum_\mu \int d\varphi \int d\varphi' J_\mu(kg) J_\mu(kg') \int d\varphi \int d\varphi' e^{i\mu\varphi} e^{i\mu\varphi'} (4s^2) sin e sin e' \times

\times [F_0 + F_1 cos 2\varphi + F_1' cos 2\varphi' + F_2 cos \varphi cos \varphi'] = L \int \frac{dk}{k} f(k) \sum_\mu \int d\varphi \int d\varphi' J_\mu(kg) J_\mu(kg')

\times [F_0 \pi^2 (\delta_{\mu,1} + \delta_{\mu,-1}) - \frac{\pi^2}{2} F_1 (\delta_{\mu,1} + \delta_{\mu,-1}) - \frac{\pi^2}{2} F_1' (\delta_{\mu,1} + \delta_{\mu,-1}) + \frac{\pi^2}{2} F_2 (\delta_{\mu,2} + \delta_{\mu,-2})]

= L \int \frac{dk}{k} f(k) \sum_\mu \pi^2 \int d\varphi \int d\varphi' [(2F_0 - F_1 - F_1') J_1(kg) J_1(kg') + \frac{1}{2} F_2 J_2(kg) J_2(kg')]

W_m(s) = 4\pi^2 L s^2 \int \frac{dk}{k} f(k) \int d\varphi \int d\varphi' [(2F_0 - F_1 - F_1') J_1(kg) J_1(kg') + \frac{F_2}{2} J_2(kg) J_2(kg')]

F_0 = 1 + \frac{1}{4} s^2 [\frac{1}{g^2} (1 + 6g^2 + g^4) + \frac{1}{g'^2} (1 + 6g'^2 + g'^4)], F_2 = \frac{s^2}{g g'} (1 + g^2)(1 + g'^2)

F_1 = \frac{1}{4} s^2 \frac{1}{g^2} (3 + 2g^2 + 3g^4), F_1' = \frac{1}{4} s^2 \frac{1}{g'^2} (3 + 2g'^2 + 3g'^4)

2F_0 - F_1 - F_1' = 2 + \frac{1}{2} s^2 [\frac{1}{g^2} + 6 + g^2 + \frac{1}{g'^2} + 6 + g'^2] - \frac{1}{4} s^2 [\frac{3}{g^2} + 2 + 3g^2 + \frac{3}{g'^2} + 2 + 3g'^2]

= 2 + s^2 [-\frac{1}{4} \frac{1}{g^2} - \frac{1}{4} \frac{1}{g'^2} + 5 - \frac{1}{4} g^2 - \frac{1}{4} g'^2]

W_m(s) = 4\pi^2 L s^2 \int \frac{dk}{k} f(k) \int d\varphi \int d\varphi' [(2 + s^2 [-\frac{1}{4} (\frac{1}{g^2} + g^2) - \frac{1}{4} (\frac{1}{g'^2} + g'^2) + 5]) \times

\times J_1(kg) J_1(kg') + \frac{1}{2} \frac{s^2}{g g'} (1 + g^2)(1 + g'^2) J_2(kg) J_2(kg')] = a s^2 + b s^4

a = 8\pi^2 L \int \frac{dk}{k} f(k) \int d\varphi \int d\varphi' J_1(kg) J_1(kg') = 8\pi^2 L \int \frac{dk}{k} f(k) [\int d\varphi J_1(kg)]^2

b = 4\pi^2 L \int \frac{dk}{k} f(k) \int d\varphi \int d\varphi' [\{ -\frac{1}{4} (\frac{1}{g^2} + g^2) - \frac{1}{4} (\frac{1}{g'^2} + g'^2) + 5 \} J_1(kg) J_1(kg') +

+ \frac{1}{2} \frac{s^2}{g g'} (1 + g^2)(1 + g'^2) J_2(kg) J_2(kg')] = 4\pi^2 L \int \frac{dk}{k} f(k) \int d\varphi \int d\varphi' [-\frac{1}{4} (\frac{1}{g^2} + g^2) - \frac{1}{4} (\frac{1}{g'^2} + g'^2) + 5]

\times J_1(kg) J_1(kg') + 2\pi^2 L \int \frac{dk}{k} f(k) [\int d\varphi (1 + g^2) J_2(kg)]^2

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\frac{1}{s} W_m(s) = \frac{8\pi^2 s^2}{(1 + s^2)^2} \int \frac{dk}{k} f(k) [[\int d\varphi J_1(kg) \{ 1 + \frac{1}{8} \frac{s^2}{g^2} (10g^2 - 1 - g^4) \}]^2 +

+ \frac{s^2}{4} [\int d\varphi (1 + g^2) J_2(kg)]^2]

Larunbata. 265/100

[\int d\varphi J_1(kg) \{ 1 + \frac{1}{8} \frac{s^2}{g^2} (10g^2 - 1 - g^4) \}]^2 = [\int d\varphi J_1 + \frac{s^2}{8} \int d\varphi J_1 (10 - \frac{1}{g^2} - g^2)]^2 =

= [\int d\varphi J_1]^2 + \frac{s^2}{4} [\int d\varphi J_1] [\int d\varphi J_1 (10 - \frac{1}{g^2} + g^2)] = [\int]^2 + \frac{s^2}{4} [\int] \int d\varphi J_1 [8 - \frac{(1 - g^2)}{g^2}]

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b = b_1 + b_2, b_1 = \pi^2 L \int \frac{dk}{k} f(k) \int d\varphi \int d\varphi' [20 - (\frac{1}{g^2} + g^2) - (\frac{1}{g'^2} + g'^2)] J_1(kg) J_1(kg')

$$b_2 = 2\pi L \int \frac{dk}{k} f(kL) [J_0(1+s^2) J_2(k_2)]^2 - \text{but } q_k \in b_2.$$

$$b_1 = \pi L \int \frac{dk}{k} f(kL) [20(J_0 J_1)^2 - J_0' J_1(1) J_0 J_1(\frac{1}{s^2} + s^2) - J_0 J_1 J_1'(\frac{1}{s^2} + s^2)] = \text{no one responsible} =$$

$$2\pi L \int \frac{dk}{k} f(kL) [10(J_0 J_1)^2 - (J_0 J_1)(J_0 J_1(\frac{1}{s^2} + s^2))] = 2\pi L \int \frac{dk}{k} f(kL) [J_0 J_1] [J_0 J_1(10 - \frac{1}{s^2} - s^2)]$$

т.е. два пакета 5-6/1 067. и 22/III 107. берем! надо мне в пакете 5-6/1 067. заменим $s \rightarrow s' = \frac{s}{1+s^2}$. но не переопределять s' -коэф.

$$W_m(s') = a s'^2 + b s'^4, \quad s'^2 = \frac{s^2}{(1+s^2)^2} = \frac{s^2}{1+2s^2} = s^2(1-2s^2) + O(s^6)$$

$$W_m(s) = a \frac{s^2}{(1+s^2)^2} + b \frac{s^4}{(1+s^2)^4} = a s^2(1-2s^2) + b s^4 = a s^2 + (b-2a)s^4$$

$$W_m(s) = \frac{\alpha}{2} s^2 + \frac{\beta}{4} s^4 \text{ и } \left(\frac{\beta}{\alpha}\right)_s = 4(b-2a) = 4\left(\frac{\beta}{2a} - 1\right) = \left[\frac{\beta'}{\alpha'} - 4\right] \approx 0, \text{ т.к. } 4\beta/\alpha' \text{ б.уч. } \text{период. по } s, \text{ коэф. не экстрем.}$$

$$W_m(s) = a s^2 + (b-2a)s^4 \text{ и } \text{нечет. маневр, заблуд. } \left(\frac{L}{R}\right) \text{ коэф. и } \mu s^4.$$

$$W_{ex}(s) = \left(\frac{Le}{R}\right)^2 [2 + \ln \frac{1}{2} - \ln(1+s^2)] = W_{ex}(0) - \left(\frac{Le}{R}\right)^2 \ln(1+s^2) = W_{ex}(0) - \left(\frac{Le}{R}\right)^2 [s^2 - \frac{1}{2}s^4] = W_{ex}(0) - \left(\frac{Le}{R}\right)^2 s^2 + \frac{1}{2} \left(\frac{Le}{R}\right)^2 s^4$$

$$W_t(s) = W_m(s) + W_{ex}(s) = W_m(0) + a s^2 + (b-2a)s^4 + W_{ex}(0) - \left(\frac{Le}{R}\right)^2 s^2 + \frac{1}{2} \left(\frac{Le}{R}\right)^2 s^4 = W_t(0) + [a - \left(\frac{Le}{R}\right)^2] s^2 + [b-2a + \frac{1}{2} \left(\frac{Le}{R}\right)^2] s^4, \text{ ген. норм. безг. и экх.}$$

$$0 \rightarrow \frac{a}{b} = 8\pi \int \frac{dk}{k} f(kL) [J_0 J_1(k_2)]^2, \quad b_1 = 2\pi \int \frac{dk}{k} f(kL) [J_0 J_1(10 - \frac{1}{s^2} - s^2)]$$

$$b_2 = 2\pi \int \frac{dk}{k} f(kL) [J_0(1+s^2) J_2(k_2)]^2, \quad J_1 \rightarrow J_1(k_2), \quad b = b_1 + b_2.$$

$$(b-2a) = b_1 - 2a + b_2 = \pi \int \frac{dk}{k} f(kL) J_0 J_0' s' [20 - (\frac{1}{s^2} + s^2) - (\frac{1}{s'^2} + s'^2)] J_1 J_1(1) - 2a + b_2 = \pi \int \frac{dk}{k} f(kL) J_0 J_0' s' [16 - (\frac{1}{s} - s)^2 - (\frac{1}{s'} - s')^2] J_1 J_1(1) - 2 \cdot 8\pi \int \frac{dk}{k} f(kL) [J_0 J_1]^2 + b_2 = 2\pi \int \frac{dk}{k} f(kL) [J_0(1+s^2) J_2]^2 - \pi \int \frac{dk}{k} f(kL) J_0 J_0' s' \times [(\frac{1}{s} - s)^2 + (\frac{1}{s'} - s')^2] J_1(k_2) J_1(k_2') = b-2a.$$

$$b = b_1 + b_2 = \pi \int \frac{dk}{k} f(kL) [J_0 J_0' s' (20 - (\frac{1}{s^2} + s^2) - (\frac{1}{s'^2} + s'^2))] J_1 J_1(1) + 2\pi \int \frac{dk}{k} f(kL) [J_0(1+s^2) J_2]^2$$

Non-lin Vortex TM

$$\omega_c = 8\pi s a(p, R).$$

Результат: 5-6/1 и норм. н/аб. коэф. $W_m(s) \sim \frac{\beta}{4} s^4$, т.е. β - маневр s гоуано $s' = s/(1+s^2)$. Боуинно, но $G_2(s), D(s)$ т.е. не берем маневр s' . Ем $W_m(s)$ реф. s , то β - маневр.

20/12 С.А. и О.Б. Ойартун Парсо Гас" Ренар пенне и "Carrefour".
 Печенный пакет "non-lin. coefficient (b-2a) в $W_m(s)$ < Оке. Mathem. (не бонно).
 т.е. пакет (b-2a) в $W_m(s)$ By Math Cad: non-lin. coefficient ω_c ω_c заблуд.
 в R.L. н/а маневр $R \leq 200 \text{ nm}$. $W_m R \gg L_2$, $N \approx 0.2$ и $\omega_c \rightarrow 0$.
 $W_m(s) = \omega_c [1 + N s^2]$. $N > 0$ и ω_c пакет ω_c $a(p, R) \rightarrow 0, \omega_c \rightarrow 0$.

21/IX Name: Word like o w(s) - spectroscopic u nocuan ero Chelnyy
 Iraida Semakova *Nonlinear Vortex damping* next call Magagrant 6 Jan. 2013.
 25 K. J. V. damping T. my Panama - Panama u unres...
 Konygry (Metob) kan u Wex ne u...
 (dys, a sm/dx - u... no no... (x,y) - d...
 Ashtoria Coordinates. Cu. 11-B/XII 097. u 8/IV 122.
 Povermen. e Ouc. $W_H(s, \tilde{f}(\tilde{z})) = a_1 s^2 + b s^2 + c s s_y$ Gue zagan deloub

22/IX C. A., W., A. B Decathlon: vyman A, gzygo nocuan u chaj...
 V. Damping tensor $(D_{\alpha\beta}(\tilde{s})) \sim \int d^2\tilde{s} \frac{\partial \tilde{m}}{\partial s_\alpha} \frac{\partial \tilde{m}}{\partial s_\beta}$, $\tilde{s} = \frac{1}{R}(X + iY)$

$\frac{\partial \tilde{m}}{\partial s} \frac{\partial \tilde{m}}{\partial \bar{s}} = \frac{2}{(1+w\bar{w})^2} \left[\frac{\partial w}{\partial s} \frac{\partial \bar{w}}{\partial \bar{s}} + \frac{\partial \bar{w}}{\partial s} \frac{\partial w}{\partial \bar{s}} \right]$, $\tilde{f}(z) = \frac{i}{c} \left[z - s' - \bar{s} z^2 \right]$, $s' = \frac{s}{1+|s|^2}$
 - pole free model. $\text{Tr}(\hat{D}) = \sum D_{\alpha\alpha} \sim \int d^2\tilde{s} \frac{\partial \tilde{m}}{\partial s} \frac{\partial \tilde{m}}{\partial \bar{s}}$

a) Pore core $w = \frac{1}{2} \left(\frac{z-s}{\bar{z}-\bar{s}} \right) e^{i\varphi} = e^{i\varphi}$, $\frac{\partial w}{\partial s} = \frac{i}{2} \frac{\partial \varphi}{\partial s} e^{i\varphi}$, $\frac{\partial \bar{w}}{\partial \bar{s}} = \frac{i}{2} \frac{\partial \varphi}{\partial \bar{s}} e^{i\varphi}$, $\frac{\partial \bar{w}}{\partial s} = -\frac{i}{2} \frac{\partial \varphi}{\partial s} e^{-i\varphi}$, $\frac{\partial w}{\partial \bar{s}} = -\frac{i}{2} \frac{\partial \varphi}{\partial \bar{s}} e^{-i\varphi}$
 $\frac{\partial \tilde{m}}{\partial s} \frac{\partial \tilde{m}}{\partial \bar{s}} = \frac{1}{2} \left[\frac{i}{2} \frac{\partial \varphi}{\partial s} e^{i\varphi} (-i) \frac{\partial \varphi}{\partial \bar{s}} e^{-i\varphi} + \frac{i}{2} \frac{\partial \varphi}{\partial \bar{s}} e^{i\varphi} (-i) \frac{\partial \varphi}{\partial s} e^{-i\varphi} \right] = \frac{\partial \varphi}{\partial s} \frac{\partial \varphi}{\partial \bar{s}}$

$\varphi = \text{Im}(\ln f) = \frac{1}{2i} [\ln f - \ln \bar{f}] = \frac{1}{2i} \ln \frac{f}{\bar{f}}$, $\frac{\partial \varphi}{\partial s} = \frac{1}{2i} \left[\frac{1}{f} \frac{\partial f}{\partial s} - \frac{1}{\bar{f}} \frac{\partial \bar{f}}{\partial s} \right] = -\frac{i}{2} \frac{1}{|f|^2} \left[\bar{f} \frac{\partial f}{\partial s} - f \frac{\partial \bar{f}}{\partial s} \right]$
 $\frac{\partial \varphi}{\partial \bar{s}} = -\frac{i}{2} \frac{1}{|f|^2} \left[f \frac{\partial f}{\partial \bar{s}} - \bar{f} \frac{\partial \bar{f}}{\partial \bar{s}} \right]$, $\frac{\partial \varphi}{\partial s} \frac{\partial \varphi}{\partial \bar{s}} = -\frac{1}{4} \frac{1}{|f|^4} \left[\bar{f} \frac{\partial f}{\partial s} - f \frac{\partial \bar{f}}{\partial s} \right] \left[f \frac{\partial f}{\partial \bar{s}} - \bar{f} \frac{\partial \bar{f}}{\partial \bar{s}} \right] =$
 $= -\frac{1}{4} \frac{1}{|f|^4} \left[\bar{f}^2 \frac{\partial f}{\partial s} \frac{\partial f}{\partial \bar{s}} - |f|^2 \frac{\partial f}{\partial s} \frac{\partial \bar{f}}{\partial \bar{s}} - |f|^2 \frac{\partial \bar{f}}{\partial s} \frac{\partial f}{\partial \bar{s}} + f^2 \frac{\partial \bar{f}}{\partial s} \frac{\partial \bar{f}}{\partial \bar{s}} \right]$ uen $w = \frac{f}{|f|}$ free core

$\frac{\partial \tilde{m}}{\partial s} \frac{\partial \tilde{m}}{\partial \bar{s}} = \frac{1}{2} \left[\frac{\partial}{\partial s} \left(\frac{f}{|f|} \right) \frac{\partial}{\partial \bar{s}} \left(\frac{\bar{f}}{|f|} \right) + \frac{\partial}{\partial \bar{s}} \left(\frac{f}{|f|} \right) \frac{\partial}{\partial s} \left(\frac{\bar{f}}{|f|} \right) \right]$, Cu. 8/m

$\tilde{f}(z) = -i \frac{c}{e} \frac{(z-s)(\bar{z}-\bar{s}-1)}{1+|s|^2}$, $\ln f = \ln(-i \frac{c}{e}) - \ln(1+|s|^2) + \ln(z-s) + \ln(\bar{z}-\bar{s}-1)$

$\frac{\partial \ln f}{\partial s} = -\frac{\bar{s}}{1+|s|^2} - \frac{1}{(\bar{z}-\bar{s})}$, $\frac{\partial \ln f}{\partial \bar{s}} = -\frac{s}{1+|s|^2} + \frac{1-z}{(\bar{z}-\bar{s})}$, $\bar{f} = i \frac{c}{e} \frac{(\bar{z}-\bar{s})(s\bar{z}-1)}{1+|s|^2}$

$\ln \bar{f} = \ln(i \frac{c}{e}) - \ln(1+|s|^2) + \ln(\bar{z}-\bar{s}) + \ln(s\bar{z}-1)$

$\frac{\partial \ln \bar{f}}{\partial s} = -\frac{1 \cdot s}{1+|s|^2} + \frac{1}{(\bar{z}-\bar{s})} (-1)$, $\frac{\partial \varphi}{\partial s} = -\frac{i}{2} \left[\frac{\partial \ln f}{\partial s} - \frac{\partial \ln \bar{f}}{\partial s} \right] = -\frac{i}{2} \left[-\frac{s}{1+|s|^2} + \frac{z}{(\bar{z}-\bar{s})} + \frac{s}{1+|s|^2} + \frac{1}{(\bar{z}-\bar{s})} \right] = -\frac{i}{2} \left[\frac{z}{(\bar{z}-\bar{s})} + \frac{1}{(\bar{z}-\bar{s})} \right] = -\frac{i}{2} \frac{z(\bar{z}-\bar{s}) + (\bar{z}-\bar{s})}{(\bar{z}-\bar{s})^2} = -\frac{i}{2} \frac{(s^2-1)}{(\bar{z}-\bar{s})(\bar{z}-\bar{s})}$

$\frac{\partial \varphi}{\partial \bar{s}} = -\frac{i}{2} \frac{(1-s^2)}{(\bar{z}-\bar{s})(s\bar{z}-1)}$, $\frac{\partial \varphi}{\partial s} \frac{\partial \varphi}{\partial \bar{s}} = \frac{1}{4} \frac{(1-s^2)^2}{(\bar{z}-\bar{s})(\bar{z}-\bar{s})(s\bar{z}-1)(s\bar{z}-1)} = \frac{1}{4} \frac{(1-s^2)^2}{|z-s|^2 |\bar{z}-\bar{s}|^2}$

$\rightarrow$ horozny $\text{Tr}(\hat{D}) = D_{xx} + D_{yy} \sim \int d^2\tilde{s} \frac{(1-s^2)^2}{|z-s|^2 |\bar{z}-\bar{s}|^2}$, uenke raved $\int d^2\tilde{s}$ (one core) $|z-s|^2 |\bar{z}-\bar{s}|^2$ space 8/IV.

b) Buzhu core $|s|^2 \leq 1$, $w = f$
 $\frac{\partial \tilde{m}}{\partial s} \frac{\partial \tilde{m}}{\partial \bar{s}} = \frac{2}{(1+f\bar{f})^2} \left[\frac{\partial f}{\partial s} \frac{\partial \bar{f}}{\partial \bar{s}} + \frac{\partial \bar{f}}{\partial s} \frac{\partial f}{\partial \bar{s}} \right] = \frac{2}{(1+f\bar{f})^2} \frac{1}{c^2} \left[(1+s^4)(1+\bar{s}^4) - 2s\bar{s}z - 2\bar{s}s\bar{z} \right]$

uena $\sim s^2 \bar{z}^2$ uenke uen $\int d^2\tilde{s}$, r.k. e rzn. go s^0 , core $|f| = c - u/\mu$ u $|f| = 9/c$

$\int d^2\tilde{s} \frac{\partial \tilde{m}}{\partial s} \frac{\partial \tilde{m}}{\partial \bar{s}} = \frac{2}{c^2} \frac{(1+|s|^4)}{(1+|s|^2)^2} \int d^2\tilde{s} \frac{(1+s^4)}{[1+f\bar{f}]^2}$ - kago bormen. e rzn. go s^2 .

$f\bar{f} = \frac{1}{c^2} \frac{1}{(1+|s|^2)^2} |z-s|^2 |s\bar{z}-1|^2$, $\text{Tr}(\hat{D}) \sim \frac{2}{c^2} \frac{1}{(1+|s|^2)^2} \int d^2\tilde{s} \frac{(1+s^4)}{[1+f\bar{f}]^2}$

!! Note $W_m(s)$, $G_z(s)$, $D(s)$ uogepnas unom. $\frac{1}{[1+|s|^2]^2}$, kagoruen $\delta y D \vec{G} + \vec{X} - \partial w / \partial \vec{X} + D \vec{X} = 0$ uenke corpas... u neprop... u neprop...

PRB'10 u Gusi 3 Ph. 11 Berpui. $(1+15\bar{s})^2$, $26/a \approx 4$ u $sf/2$ 4 rail
No eunu qropu... pazuar. $W_m(s)$, go s^4 , to $W_m(s) = a s^2 + (b-2a)s^4$

$\frac{\partial^2 \Phi}{\partial s_x^2} \frac{\partial \Phi}{\partial s_y} = \left(\frac{\partial \Phi}{\partial s} + \frac{\partial \Phi}{\partial \bar{s}} \right) i \left(\frac{\partial \Phi}{\partial s} - \frac{\partial \Phi}{\partial \bar{s}} \right) = i \left[\left(\frac{\partial \Phi}{\partial s} \right)^2 - \left(\frac{\partial \Phi}{\partial \bar{s}} \right)^2 \right]$ Dxy = 0?

$$i \left[\frac{(-1)}{4} \frac{(1-s^2)^2}{(z-s)^2(\bar{s}z-1)^2} - \frac{(-1)}{4} \frac{(1-s^2)^2}{(\bar{z}-\bar{s})^2(\bar{s}z-1)^2} \right] = -\frac{i}{4} \frac{(1-s^2)^2}{12-s^4|\bar{s}z-1|^4} \left[(\bar{z}-\bar{s})^2(\bar{s}z-1)^2 - (z-s)^2(\bar{s}z-1)^2 \right]$$

$$= -\frac{i}{4} \frac{(1-s^2)^2}{12-s^4|\bar{s}z-1|^4} \left[(\bar{z}^2 + \bar{s}^2 - 2\bar{z}\bar{s})(\bar{s}z^2 + 1 - 2\bar{s}z) - (z^2 + s^2 - 2zs)(s\bar{z}^2 + 1 - 2s\bar{z}) \right]$$

$$= -\frac{i}{4} \frac{(1-s^2)^2}{12-s^4|\bar{s}z-1|^4} \left[\bar{s}^2 z^2 + \bar{z}^2 - 2\bar{s}z + 4\bar{s}^2 z^2 - s^2 \bar{z}^2 + 2s\bar{z} - 4s^2 \bar{z}^2 + 0(s^3) \right]$$

$$= -\frac{i}{4} \frac{(1-s^2)^2}{12-s^4|\bar{s}z-1|^4} \left[(\bar{s}^2 - s^2)z^2 + \bar{z}^2 - z^2 - 2s^2(\bar{s}z - sz) + \bar{s}^2 - s^2 + 2(\bar{s}z - sz) + 4s^2(\bar{s}z - s^2) \right]$$

$$= -\frac{i}{4} \frac{(1-s^2)^2}{12-s^4|\bar{s}z-1|^4} \left[(\bar{s}^2 - s^2)(z^2 + 1 + 4s^2) + \bar{z}^2 - z^2 + 2(\bar{s}z - sz)(1 + s^2) \right]$$

$$= -\frac{i}{4} \frac{(1-s^2)^2}{12-s^4|\bar{s}z-1|^4} \left[(\bar{s}^2 - s^2)(1 + 4s^2 + s^4) - 2is^2 \sin 2\varphi + 22is^4 \sin(\varphi + \varphi_s) \right]$$

$\frac{\partial^2 \Phi}{\partial s_x^2} \frac{\partial \Phi}{\partial s_y} = -\frac{i}{4} \frac{(1-s^2)^2}{12-s^4|\bar{s}z-1|^4} (-2i) \left[15s^2 \sin 2\varphi_s (1 + 4s^2 + s^4) + s^2 \sin 2\varphi + 15s^4 \sin(\varphi + \varphi_s) \right]$

Orelungno, eunu $s=0$, $D_{xy}(0) \sim \int d^2s \frac{\partial \Phi}{\partial s_x} \frac{\partial \Phi}{\partial s_y} \sim \int d^2s F(s) \sin 2\varphi = 0$.

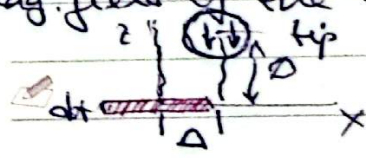
gaci $\varphi_s=0$, s -beus. $\frac{\partial \Phi}{\partial s_x} \frac{\partial \Phi}{\partial s_y} = -\frac{1}{2} \frac{(1-s^2)^2 s}{12-s^4|\bar{s}z-1|^4} [s \sin 2\varphi + s(1+s^2) \sin \varphi]$ u

$\int d^2s \frac{\partial \Phi}{\partial s_x} \frac{\partial \Phi}{\partial s_y}$ broune uoner $\neq 0$. B cuny cunuequm $D_{xy} \sim |s|^2$.
 $D(s) = D(0) \delta_p + D' |s|^2$ - buquno rok. **Her**, cu. $27/12$, $D_{xy} \sim \sin 2\varphi_s$.

de Loubens - $W_c(\Delta)$

Sagara G. de Loubens, TM in non-uniform mag. field of the tip.

$W_c = - \int dV [m_x H_x + m_y H_y + m_z H_z]$



Tip spherical (M_0), uniformly magnetized, $\vec{D}$ as det (D nemay uenspen

core. tip u uenspen cylindrical det). Tip gbums na Δ gacok.

x, y, z - uenspenabana b cyl. det.

magn. sphere $\equiv$ point dipole c momentum $\mu = M_0 V$, $V = \frac{4\pi}{3} a^3$.

Stany field tip: $H_x = 3\mu \frac{(z+\Delta)(x+\Delta)}{[...]^{5/2}}$, $H_y = 3\mu \frac{(z+\Delta)y}{[...]^{5/2}}$, $H_z = \frac{\mu}{[...]^{3/2}} \left[\frac{(x+\Delta)^2 + y^2}{2} - \frac{z(z+\Delta)}{2} \right]$

percu. zuen $W_c = - \int dV m_z H_z$, gaci u on bunay b sagary TM W_c ?

$\frac{\partial^2 W_c}{\partial s^2} = - \int dV H_z \frac{\partial^2 m_z}{\partial s^2}$, $\vec{m}$ depen uone b rigid v. model.

$f(z) = i \frac{c}{e} (z-s)$. B core $m_z = \frac{1-u\bar{w}}{1+u\bar{w}} = \frac{1-\delta\bar{f}}{1+\delta\bar{f}}$. $\bar{f} = -i \frac{c}{e} (\bar{z}-\bar{s})$

$\frac{\partial m_z}{\partial s} = \frac{-\bar{f} \frac{\partial f}{\partial s} (1+\delta\bar{f}) - (1-\delta\bar{f}) \bar{f} \frac{\partial \bar{f}}{\partial s}}{(1+\delta\bar{f})^2} = \frac{1}{(1+\delta\bar{f})^2} \left[-2\bar{f} \frac{\partial f}{\partial s} \right] = -\frac{2\bar{f}}{(1+\delta\bar{f})^2} \frac{\partial f}{\partial s}$
 $\frac{\partial^2 m_z}{\partial s^2} = (-2\bar{f}) \frac{1}{(1+\delta\bar{f})^4} \left[\frac{\partial^2 f}{\partial s^2} (1+\delta\bar{f})^2 - \frac{\partial f}{\partial s} 2(1+\delta\bar{f}) \bar{f} \frac{\partial \bar{f}}{\partial s} \right] =$
 $= \frac{4\bar{f}^2}{(1+\delta\bar{f})^3} \left(\frac{\partial \bar{f}}{\partial s} \right)^2$, $\frac{\partial \bar{f}}{\partial s} = i \frac{c}{e} (-1)$, $\left(\frac{\partial \bar{f}}{\partial s} \right)^2 = (-1) \frac{1}{e^2}$.

$$\frac{[\dots]}{[\dots]^{3/2}} = \frac{1}{[g^2 + 2\Delta g \cos \varphi + \Delta^2 + (z+D)^2]^{3/2}} - \frac{3(z+D)^2}{[\dots]^{5/2}}$$

$$g \ll c, \quad g \ll D, \quad |z| \leq L/2. \quad \text{Def. } g^2 \Delta^2 + (z+D)^2 \equiv \lambda^2, \quad \Delta g \ll \lambda^2.$$

$$\frac{1}{[g^2 + 2\Delta g + \dots]^{3/2}} = \frac{1}{[\lambda^2 + 2\Delta g \cos \varphi]^{3/2}} = \frac{1}{\lambda^3} \frac{1}{[1 + 2\frac{\Delta g}{\lambda^2} \cos \varphi]^{3/2}} \approx \frac{1}{\lambda^3} \left[1 - 3\frac{\Delta g}{\lambda^2} \cos \varphi + \dots \right]$$

$$\frac{1}{[\lambda^2 + 2\Delta g \cos \varphi]^{5/2}} = \frac{1}{\lambda^5} \left[1 - 5\frac{\Delta g}{\lambda^2} \cos \varphi + \dots \right]$$

$$\frac{[\dots]}{[\dots]^{5/2}} = \frac{1}{\lambda^3} \left[1 - 3\frac{\Delta g}{\lambda^2} \cos \varphi \right] - \frac{3(z+D)^2}{\lambda^5} \left[1 - 5\frac{\Delta g}{\lambda^2} \cos \varphi \right]$$

$$\frac{\partial^2 W_c}{\partial s^2} = \frac{4\mu}{c^4} \int_0^c ds \int_0^{2\pi} d\varphi \int_{-L/2}^{L/2} dz \frac{1}{\lambda^3} \left[1 - \frac{3(z+D)^2}{\lambda^2} - 3\frac{\Delta g}{\lambda^2} \cos \varphi \left(1 - 5\frac{(z+D)^2}{\lambda^2} \right) \right] \frac{g^2 \cos 2\varphi}{[1 + \frac{g^2}{c^2}]^3}$$

$$= -12 \frac{\mu}{c^4} \int_0^c ds \int_0^{2\pi} d\varphi \int_{-L/2}^{L/2} dz \frac{\Delta g}{\lambda^5} \left[1 - 5\frac{(z+D)^2}{\lambda^2} \right] \frac{g^2 \cos \varphi \cos 2\varphi}{[1 + \frac{g^2}{c^2}]^3}$$

$\text{Вывод} = 0 \text{ из-за фл. (1)}$

$$\frac{\partial^2 W_c}{\partial s^2} = -12 \mu c \Delta \int_0^L dt \int_0^{2\pi} d\varphi \int_{-L/2}^{L/2} dz \frac{1}{\lambda^5} \left[1 - \frac{5(z+D)^2}{\lambda^2} \right] \frac{t^2}{(1+t^2)^3} \cos \varphi \cos 2\varphi = 0$$

из-за фл.

Найдено выражение для $\sim (\frac{\Delta g}{\lambda^2})^2 \cos^2 \varphi \sim g^2$, а он гораздо меньше $\frac{\partial^2 W_c}{\partial s^2} \sim c^2 \ll 1$.

Вывод: в. core мен $W_c = - \int dV m_2 h_2$ грав. и пленед/решение назови $\text{Вывод} \text{ б. в. zero}$

(24/IX) E-mails to Ainhua, Tatarskoyevna, Samargak (mega-grent), Popovikov.
 // Проблема, too yr. Thisle сохр. свои Aug сам $G_2(s)$, $\frac{du}{ds}$, $D(s)$, F
 кермеллер. Вогуро, non. lin. coefficients забивать до способа разума,
 но $s' = s/(1+s^2) = \frac{1}{2}a$ (тогда $\frac{1}{1+s^2}$ во всех $G_2(s), W_m(s) \dots$ можно считать
 и все $W_m(s) \sim \beta/x = 4$ верно) или по s (но возможно же другое выраж.
 Сп. March-April 2010 for discussion.

Non-lin. damping : $T_2(\hat{D}) \underset{\text{(free core)}}{\sim} \sum_{\underline{d}} \int d^2 \underline{g} \left(\frac{\partial \vec{m}}{\partial s_{\underline{d}}} \right)^2 = 4 \int d^2 \underline{g} \left| \frac{\partial \varphi}{\partial s} \right|^2 = \mathcal{I}_P(s), \quad 8/IV.$

$$J_p(s) = \int_{|z| > 1} d^2 z \frac{(1-z^2)^2}{(z-s)^2 (\bar{z}-\bar{s})^2} \approx |\text{con. } 8/12| = -2\pi [\frac{3}{4} + \ln c] - \frac{5}{3}\pi s^2 \text{ (one core)}$$

↑ n-pole terms cancel, B MathCad.

$$f(z) = i \frac{c}{e} \left[z - \frac{(s + \bar{s}z^2)}{1 + \bar{s}s} \right], \quad f(z) = -i \frac{c}{e} \frac{1}{1 + |c|^2} (z - s)(\bar{s}z - 1) \quad (+O(s^3))$$

$$c^2 |f(z)|^2 (1+g^2)^2 = |z-s|^2 |s^2-1|^2$$

$$Y_P(g) = \frac{1}{c^2} \frac{1}{(1+g\bar{g})^2} \int_{|f| \geq 1} d^2g \frac{(1-g^2)^2}{|f(g)|^2}, \quad c^2 |g|^2 = F(g, \bar{g}), \quad |f| \geq 1, \quad F(g, \bar{g}) \geq c^2.$$

MathCad file "Non_lin_Vortex_damp.mcd". Разомнеме $J_p(s) = J_p(0) \frac{s^2}{s^2 + 14.7 \pm 15.2}$
 не изгубяваме, $[J_p(s) - J_p(0)]/s^2$  е.т.т. ч.т.т. $f(s) \approx$

Визначено оську меншину z^2 . Його самі погрішки на $z \in [0, 0.5]$ і помилку 1 менш z^2 , то $\mathcal{J}_p(s) = \mathcal{J}_p(0) - 4.82 \cdot \pi s^2$ і помилка $\leq 2\%$.

$\gamma(s)$ nazovet obratno $2\pi - 4.82 \cdot \pi s^2$.
 v. core: $\text{Tr}(\hat{D}) \sim \int d^2s \left[\left(\frac{\partial \vec{m}}{\partial s_x} \right)^2 + \left(\frac{\partial \vec{m}}{\partial s_y} \right)^2 \right] = 4 \int d^2s \frac{\partial \vec{m}}{\partial s} \cdot \frac{\partial \vec{m}}{\partial s} =$
 $\left[\frac{25}{25} \frac{25}{25} \frac{1}{25} \frac{1}{25} \right] d^2s$, $[\dots] = \frac{1}{c^2} \frac{1}{(1+s^2)^2} [(1+s^4)(1+s^4) -$
 $\text{Tr}(\hat{D}) \sim 8 \int d^2s \frac{1}{c^2(1+s^2)^2} [(1+s^4)(1+s^4) - 4s^2 s^2 \cos 2\varphi]$, $c^2 \vec{f} \vec{f} = F(\varphi)$. Ostirala

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$\text{Tr}(\hat{D}) \sim \frac{8}{c^2} \frac{1}{(1+s^2)^2} \int d^2s \frac{[(1+s^4)(1+s^4) - 4s^2 s^2 \cos 2\varphi]}{[1 + \frac{1}{c^2} F(\varphi)]^2} = \gamma_c(s)$, $\gamma_c(0) = 4\pi$
 Alapenno, Dzo $|\vec{f}| \leq 1$ $\gamma_c(s)$ obratno $\rightarrow 0$ k pozem s u $\gamma_c(0.02) = 0$
 Dzo neberno u obratno uzga upregana $\int d\varphi$. Eam 0 0.02
 nacabur $\int_0^1 d\varphi \Theta[1 - |\vec{f}|^2]$, to v. core buferenec que int. abstrakcija
 $\gamma_c(s)$ obratno guproni $\gamma_c(s) \approx 4\pi + 8\pi s^2$ pasovale xojano
 Anon go $s = 0.4$. Dama u $s = 0.5$ amodka $< 5\%$ (Math Cd).

(5) Buzur u John Phillips, unan. A.: 1) example of Besque Lang.
 the core nazovet application na zof zof, y nek upuna uz 6 reu.
 Anon. Ho e cney. zofy A. dyer nazovet. Anon u arrebabara
 na Besque e. 2) nar. nazovet - school depend tervoeem gey income
 L. Bawman (Khabepus).
 Comp. windows ne Zanyek. Arantxa Coedusma of chadent.

Buzur core $D_{xx} = D_{yy} = \frac{1}{2} \text{Tr}(\hat{D}) = 2\pi + 4\pi s^2$, abu. $c = 8/\sqrt{19}$.
 One core $\text{Tr}(\hat{D}) \sim \gamma_p(s)$. Yorn. pacer gaer ($c=0.1$) $\gamma_p(s) = \gamma_p(0) - \frac{9}{2} \pi s^2$.

$\text{Tr}(\hat{D}) = D_{xx} + D_{yy} = \left(-\frac{dM_{SL}}{s} \right) 4 \int d^2s \frac{\partial \vec{m}}{\partial s} \frac{\partial \vec{m}}{\partial s}$
 $D_{xx} = D_{yy} = \frac{1}{2} [\text{Tr}(\hat{D})_{\text{core}} + \text{Tr}(\hat{D})_{\text{one core}}] = \frac{1}{2} [\gamma_c(s) + \gamma_p(s)] =$
 $= \left(-\frac{dM_{SL}}{s} \right) \frac{1}{2} [4\pi + 8\pi s^2 - 2\pi (\ln c + \frac{3}{4}) - \frac{9}{2} \pi s^2] = \left(-\frac{dM_{SL}}{s} \right) 2\pi \times$
 $\times [1 + 2s^2 - \frac{1}{2} (\ln c + \frac{3}{4}) - \frac{9}{2} \frac{1}{4} s^2] = 2\pi \left(-\frac{dM_{SL}}{s} \right) \left[\frac{5}{8} + \frac{1}{2} \ln \frac{1}{c} + \frac{7}{8} s^2 \right]$
 $d(s) = -\frac{D_{xx}}{1G1} = 2\pi \frac{dM_{SL}}{s \cdot 2\pi M_{SL}} \left[\frac{5}{8} + \frac{1}{2} \ln \frac{1}{c} + \frac{7}{8} s^2 \right] = d \left[\frac{5}{8} + \frac{1}{2} \ln \frac{1}{c} + \frac{7}{8} s^2 \right]$

$d(s) = d_0 + d_1 s^2$, $d_0 = d \left(\frac{5}{8} + \frac{1}{2} \ln \frac{1}{c} \right)$, $d_1 = d \frac{7}{8}$. Non-lin. damping
 $c=0.1$ Cu. 15/12014
 d_1 - non-lin. coefficient nazovet b e para menbure, tem $d_1 = d \frac{19}{12}$ or $8/\sqrt{19}$.
 $d(s) \sim s^2$ nazovet nazovet u nazovet nazovet, $d(s)$ zaluvet nazovet.

Nazovet u nazovet to Glavin file no Nonlinear vortex damping, u
 nazovet nazovet $s^2 = s^2/(1+s^2)$ u s^2 - nazovet nazovet nazovet b eq. Thiele
 Nazovet nazovet $D_{xy}(s)$.

Updated Therbasque site: Conf. 2009. nazovet nazovet nazovet nazovet
 Nazovet Lin-Vortex, Phys. St. Sol. (8).
 Nazovet One. non-lin. Thiele eq. motion u nazovet nazovet $G_2(w, \bar{w})$
 u $G_2(s)$. One $G_2(w, \bar{w}) = Q(w, \bar{w})$ nazovet nazovet nazovet nazovet nazovet
 Nazovet nazovet nazovet nazovet nazovet nazovet nazovet nazovet nazovet nazovet
 Nazovet nazovet nazovet nazovet nazovet nazovet nazovet nazovet nazovet nazovet

(26/17) γ_p - e Thiele uz LLG. Nazovet nazovet nazovet nazovet.
 $\frac{d\vec{m}}{dt} = \vec{m} \times \left[-\frac{\partial \mathcal{L}}{\partial \vec{m}} - d\vec{m} \right]$, Nazovet nazovet $\vec{m}(\vec{r}, t) = \vec{m}[\vec{r}, \vec{X}(t)]$ u nazovet nazovet nazovet nazovet

$\gamma = 1$. $-\frac{\partial \vec{m}}{\partial X_d} \times \frac{d\vec{m}}{dt} = \frac{\partial \vec{m}}{\partial X_d} \times \vec{m} \times \left[-\frac{\partial \vec{H}}{\partial \vec{m}} - d\vec{m} \right] = -\vec{m} \left[\frac{\partial \vec{H}}{\partial X_d} \cdot \frac{\partial \vec{H}}{\partial \vec{m}} + d \frac{\partial \vec{m}}{\partial X_d} \cdot \frac{d\vec{m}}{dt} \right] +$
 Urria, Octubre
 $+ \left[\frac{\partial \vec{H}}{\partial \vec{m}} + d\vec{m} \right] \left[\vec{m} \cdot \frac{\partial \vec{m}}{\partial X_d} \right] = -\vec{m} \left[\frac{\partial \vec{H}}{\partial X_d} + d \frac{\partial \vec{m}}{\partial X_d} \cdot \frac{d\vec{m}}{dt} \right]$
 $\frac{\partial \vec{m}}{\partial X_d} \times \frac{\partial \vec{m}}{\partial X_p} \dot{X}_p = \frac{\partial \vec{m}}{\partial X_d} \cdot \vec{m} \left[\frac{\partial \vec{H}}{\partial X_d} + d \frac{\partial \vec{m}}{\partial X_d} \cdot \frac{\partial \vec{m}}{\partial X_p} \dot{X}_p \right]$
 $\frac{\partial \vec{m}}{\partial X_d} \times \frac{\partial \vec{m}}{\partial X_p} \dot{X}_p = \frac{\partial \vec{H}}{\partial X_d} + d \left(\frac{\partial \vec{m}}{\partial X_d} \cdot \frac{\partial \vec{m}}{\partial X_p} \right) \dot{X}_p$
 $\vec{G}_{\alpha\beta} \dot{X}_\beta = \frac{\partial W}{\partial X_\alpha} + d D_{\alpha\beta} \dot{X}_\beta$

Def. $\vec{G}_{\alpha\beta} = \int d^2\vec{s} \vec{m} \cdot \left[\frac{\partial \vec{m}}{\partial X_\alpha} \times \frac{\partial \vec{m}}{\partial X_\beta} \right]$, $D_{\alpha\beta} = d \int d^2\vec{s} \frac{\partial \vec{m}}{\partial X_\alpha} \cdot \frac{\partial \vec{m}}{\partial X_\beta}$.
 anatz $\vec{m}(\vec{r}, t) = \vec{m}[\vec{r}, \vec{X}(t)]$ ne w feguararar, loco. Eq. Thiele = LLG + $\vec{m}[\vec{r}, \vec{X}(t)]$
 → Bce new newinocm engar b $\vec{G}_{\alpha\beta}(\vec{X})$, $D_{\alpha\beta}(\vec{X})$ u $W(\vec{X})$. $\vec{s} = \vec{X}/R$.

Nonlinear damping: $D_{\alpha\beta}(\vec{X}) = D_{\alpha\beta}(\vec{s}) \sim \int d^2\vec{s} \frac{\partial \vec{m}}{\partial s_\alpha} \cdot \frac{\partial \vec{m}}{\partial s_\beta}$ **ML-damping**
 $\frac{\partial}{\partial s} = \frac{1}{2} \left(\frac{\partial}{\partial s_x} - i \frac{\partial}{\partial s_y} \right)$, $\frac{\partial}{\partial \bar{s}} = \frac{1}{2} \left(\frac{\partial}{\partial s_x} + i \frac{\partial}{\partial s_y} \right)$, $\frac{\partial}{\partial s} \frac{\partial}{\partial \bar{s}} = \frac{1}{4} \left[\frac{\partial^2}{\partial s_x^2} + \frac{\partial^2}{\partial s_y^2} \right]$
 $\frac{\partial}{\partial s_x} = \frac{\partial}{\partial s} + \frac{\partial}{\partial \bar{s}}$, $\frac{\partial}{\partial s_y} = i \left(\frac{\partial}{\partial s} - \frac{\partial}{\partial \bar{s}} \right)$
 $\frac{\partial \Phi}{\partial s_x} \frac{\partial \Phi}{\partial s_y} = \left(\frac{\partial \Phi}{\partial s} + \frac{\partial \Phi}{\partial \bar{s}} \right) i \left(\frac{\partial \Phi}{\partial s} - \frac{\partial \Phi}{\partial \bar{s}} \right) = i \left[\left(\frac{\partial \Phi}{\partial s} \right)^2 - \left(\frac{\partial \Phi}{\partial \bar{s}} \right)^2 \right]$

$D_{\alpha\beta} \sim \int d^2\vec{s} \frac{\partial \vec{m}}{\partial s_\alpha} \cdot \frac{\partial \vec{m}}{\partial s_\beta} = \int d^2\vec{s} \left[\frac{\partial \theta}{\partial s_\alpha} \frac{\partial \theta}{\partial s_\beta} + \sin^2 \theta \frac{\partial \Phi}{\partial s_\alpha} \frac{\partial \Phi}{\partial s_\beta} \right]$, cm. 13/XII 09.

One core $|w|=1$, $D_{\alpha\beta} \sim \int d^2\vec{s} \frac{\partial \Phi}{\partial s_\alpha} \frac{\partial \Phi}{\partial s_\beta}$. $T_z(\hat{D}) = D_{xy} + D_{yx} \sim 4 \int d^2\vec{s} \frac{\partial \Phi}{\partial s} \frac{\partial \Phi}{\partial \bar{s}}$

Two core $D_{\alpha\beta} \sim \int d^2\vec{s} \left[\frac{4}{(1+f^2)^2} \frac{\partial |f|}{\partial s_\alpha} \frac{\partial |f|}{\partial s_\beta} + \sin^2 \theta \frac{\partial \Phi}{\partial s_\alpha} \frac{\partial \Phi}{\partial s_\beta} \right] =$

$= 4 \int d^2\vec{s} \frac{1}{(f\bar{f}+1)^2} \left[\frac{\partial |f|}{\partial s_\alpha} \frac{\partial |f|}{\partial s_\beta} + \beta^2 \frac{\partial \Phi}{\partial s_\alpha} \frac{\partial \Phi}{\partial s_\beta} \right]$, $T_z(\hat{D}) \sim \int d^2\vec{s} \frac{\partial \vec{m}}{\partial s} \cdot \frac{\partial \vec{m}}{\partial \bar{s}}$

Due D_{xy} : $\frac{\partial |f|}{\partial s_x} \frac{\partial |f|}{\partial s_y} = i \left[\left(\frac{\partial |f|}{\partial s} \right)^2 - \left(\frac{\partial |f|}{\partial \bar{s}} \right)^2 \right]$, $\frac{\partial |f|}{\partial s_\alpha} = \frac{1}{2|f|} \left[\bar{f} \frac{\partial f}{\partial s_\alpha} + f \frac{\partial \bar{f}}{\partial s_\alpha} \right]$

$f(z) = \frac{i}{c} \left[z - \frac{g+g^2 z^2}{1+g^2} \right]$, $c^2 \bar{f} f = (1+g^2) - 2|z-g|^2|z-1|^2 = F e^0$.

$\frac{\partial \Phi}{\partial s_x} \frac{\partial \Phi}{\partial s_y} = -\frac{1}{2} \frac{(1-g^2)^2}{|z-g|^4 |z-1|^4} \left[g^2 \sin 2\varphi - 2|f|g(1+g^2) \sin(\varphi+\varphi_s) + |f|^2 \sin 2\varphi (1+g^2)^2 \right]$

$\frac{1}{|z-g|^2 |z-1|^2} = \frac{1}{(1+g^2)^2 c^2 |f|^2}$. $\varphi_s=0$ ken b $F(\varphi_s)$, $s=s_x$.

One core $D_{xy} \sim \int d^2\vec{s} \frac{\partial \Phi}{\partial s_x} \frac{\partial \Phi}{\partial s_y} = -\frac{1}{2} \int d^2\vec{s} \frac{(1-g^2)^2}{|z-g|^4 |z-1|^4} \left[g^2 \sin 2\varphi - 2|f|g(1+g^2) \sin \varphi \right]$

MathLab gear $D_{xy}(\varphi_s=0) = 0$ bue core.

$\frac{\partial |f|}{\partial s} = \frac{1}{2} \frac{1}{|f|} \frac{\partial |f|^2}{\partial s} = \frac{1}{2} \frac{1}{|f|} \frac{\partial}{\partial s} \frac{1}{c^2} \left[g^2 - 2g(1+g^2) \cos \varphi + g'^2 (1+2g^2 \cos 2\varphi + g^4) \right]$

$s' = g/(1+g^2)$, $\frac{\partial f}{\partial s} = \frac{\partial f}{\partial s'} \frac{\partial s'}{\partial s} = \frac{\partial f}{\partial s'} \frac{(1+g^2) - g \cdot 2g}{(1+g^2)^2} = \frac{(1-g^2)}{(1+g^2)^2} \frac{\partial f}{\partial s'}$

$\frac{\partial |f|}{\partial s} = \frac{1}{2c^2} \frac{1}{|f|} \frac{(1-g^2)}{(1+g^2)^2} \left[-2g(1+g^2) \cos \varphi + 2s' (1+2g^2 \cos 2\varphi + g^4) \right]$

Obusee $c^2 |f|^2 = F(g, \varphi, s) = g^2 - 2g(1+g^2) \cos(\varphi-\varphi_s) + |s'|^2 [1+g^4 + 2g^2 \cos 2(\varphi-\varphi_s)] + 0$

$c^2 |f|^2 = F = g^2 - (1+g^2)(\bar{z}s' + \bar{s}'z) + s's'(1+g^4) + s'^2 \bar{z}^2 + \bar{s}'^2 z^2$, $c s' = \frac{g}{1+g^2}$

$\frac{\partial |f|}{\partial s} = \frac{1}{2|f|} \frac{\partial |f|^2}{\partial s} = \frac{1}{2|f|} \frac{1}{c^2} \frac{\partial}{\partial s} \left[g^2 - (1+g^2)(\bar{z}s' + \bar{s}'z) + s's'(1+g^4) + s'^2 \bar{z}^2 + \bar{s}'^2 z^2 \right]$

$= \frac{1}{2c^2} \frac{1}{|f|} \left[-(1+g^2) \bar{z} + \bar{s}'(1+g^4) + 2\bar{z}s' \right] \frac{\partial s'}{\partial s} = \frac{1}{2c^2} \frac{1}{|f|} \left[\dots \right] \frac{1}{(1+g^2)^2} \frac{\partial s'}{\partial s} = \frac{1}{(1+g^2)^2} \frac{\partial s'}{\partial s}$

$\left(\frac{\partial |f|}{\partial s} \right)^2 = \frac{1}{4c^4} \frac{1}{|f|^2 (1+g^2)^4} \left[-(1+g^2) \bar{z} + \bar{s}'(1+g^4) + 2\bar{z}s' \right]^2 -$

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$$\left[(1+g^2)^2 + 4s'^2(1+g^4) + 2\bar{s}'^2 z^2 \right] = (\cdot) \left[(1+g^2)^2 z^2 - 2\bar{s}'^2 z (1+g^2)(1+g^4) + \right. \\ \left. (1+g^4)^2 - 4s'^2 z^3 (1+g^2) + 4s'^2 \bar{s}'^2 (1+g^4) + 4s'^2 z^4 - \{ \cdot \}^2 \right].$$

... 30 s'2, 40 haço 8' a' b' 3. ... 6 s'1,

$$\left(\frac{\partial H}{\partial s} \right)^2 = (\cdot) \left[(1+g^2)(\bar{s}'^2 - z^2) - 2(1+g^2)(1+g^4)(\bar{s}'^2 z - s'^2 z) + \right. \\ \left. (1+g^4)^2 (\bar{s}'^2 - s'^2) - 4(1+g^2)(s'^2 z^3 - \bar{s}'^2 z^3) + 4|s'|^2(1+g^4)(\bar{s}'^2 z^2 - s'^2 z^2) + 4(s'^2 z^4 - \bar{s}'^2 z^4) \right]$$

$$(\cdot) \left[\{ (1+g^2)^2 + 4|s'|^2(1+g^4) \} g^2 \sin 2\varphi (-2i) - 2(1+g^2)(1+g^4) g |s'| \sin(\varphi + \varphi_s) (-2i) \right. \\ \left. + (1+g^4)^2 |s'|^2 \sin 2\varphi_s (-2i) - 4(1+g^2) |s'| g^3 \sin(3\varphi - \varphi_s) (-2i) + 4|s'|^2 (1+g^4) g^2 \sin \varphi (-2i) \right. \\ \left. + 4|s'|^2 g^4 \sin(\varphi_s - 2\varphi_s) (-2i) \right] = (\cdot) (-2i) \left[\{ (1+g^2)^2 + 4|s'|^2(1+g^4) \} g^2 \sin 2\varphi - \right. \\ \left. 2(1+g^2)(1+g^4) g |s'| \sin(\varphi + \varphi_s) + (1+g^4)^2 |s'|^2 \sin 2\varphi_s - 4(1+g^2) |s'| g^3 \sin(3\varphi - \varphi_s) + \right. \\ \left. + 4|s'|^2 g^4 \sin 2(2\varphi - \varphi_s) \right]. \text{ E com } \varphi_s = 0, s' = s_x$$

$$\left(\frac{\partial H}{\partial s} \right)^2 - \left(\frac{\partial H}{\partial \bar{s}} \right)^2 = \frac{(-2i)}{4c^4 |s'|^2 (1+s\bar{s})^4} \left[\{ (1+g^2)^2 + 4|s'|^2(1+g^4) \} g^2 \sin 2\varphi - \right. \\ \left. 2(1+g^2)(1+g^4) g s' \sin \varphi - 4(1+g^2) g^3 s' \sin 3\varphi + 4|s'|^2 g^4 \sin 4\varphi \right] = \left[\begin{array}{l} \text{memor c} \\ s'^2 \text{ any } c^4 \\ \text{t.k. (d}\varphi = 0 \\ \text{or max} \end{array} \right]$$

$$= \frac{(-2i)(1+g^2)g}{4c^4 |s'|^2 (1+s\bar{s})^4} \left[(1+g^2) g \sin 2\varphi - 2(1+g^4) s' \sin \varphi - 4g^2 s' \sin 3\varphi \right]$$

... core $D_{xy} \sim 4 \int d^2 \vec{s} \frac{1}{(1+s\bar{s})^2} \left[i \left\{ \left(\frac{\partial H}{\partial s} \right)^2 - \left(\frac{\partial H}{\partial \bar{s}} \right)^2 \right\} + |s'|^2 i \left\{ \left(\frac{\partial \varphi}{\partial s} \right)^2 - \left(\frac{\partial \varphi}{\partial \bar{s}} \right)^2 \right\} \right] =$

$$= 4 \int d^2 \vec{s} \frac{1}{(1+s\bar{s})^2} \left[\frac{(1+g^2)g}{2c^4 |s'|^2 (1+s\bar{s})^4} \left[(1+g^2) g \sin 2\varphi - 2s'(1+g^4) \sin \varphi - 4s'g^2 \sin 3\varphi \right] + \right. \\ \left. + |s'|^2 \left(-\frac{1}{2} \right) \frac{(1-g^2)^2 g}{(2-s|s'|^2-1)^4} \left[g \sin 2\varphi + s(1+g^2) \sin \varphi \right] \right], \quad \frac{c^2 |s'|^2}{(1+s\bar{s})^2} = \frac{1}{(1+s\bar{s})^2} \frac{1-z-s'^2(\bar{s}'^2-1)}{1-z-s|s'|^2-1} = c^4 |s'|^4 (1+s\bar{s})^4$$

$$D_{xy} \sim 4 \int d^2 \vec{s} \frac{1}{(1+s\bar{s})^2} \frac{g}{2c^4 |s'|^2 (1+s\bar{s})^4} \left[(1+g^2) \left[(1+g^2) g \sin 2\varphi - 2s'(1+g^4) \sin \varphi - \right. \right. \\ \left. \left. - 4s'g^2 \sin 3\varphi \right] - (1-g^2)^2 \left[g \sin 2\varphi + s(1+g^2) \sin \varphi \right] \right] = \frac{2}{c^4} \frac{1}{(1+s\bar{s})^4} \int d^2 \vec{s} \frac{g}{|s'|^2 (1+s\bar{s})^2} \times \\ \times \left[4g^3 \sin 2\varphi - s(1+g^2)(3+3g^4-2g^2) \sin \varphi - 4s g^2 \sin 3\varphi \right], \quad c^2 |s'|^2 = F.$$

Be pabno MathCad gaes $D_{xy}(\varphi_s=0)=0$ b v-core. Ho w/ru $\varphi_s \neq 0$ $D_{xy} \neq 0$.
 Moner be w/ru? $D_{xy} \sim \sin 2\varphi_s \sim s_x s_y$? b orwne of $D_{dd} \sim |s|^2$.

Dance, 2 orwne $\text{Tr}(\hat{D}) = D_{xx} + D_{yy} \sim \int d^2 \vec{s} \frac{\partial \vec{m}}{\partial s} \cdot \frac{\partial \vec{m}}{\partial \bar{s}}$ w/ru $\varphi_s = 0$,

t.e. $D_{xx} + D_{yy} = 2D_0 + D' s_x^2$, narogu D' . Zarem, orwne $D_{xx} = D_{yy}$,

narogu $D_{xx} = \frac{1}{2} \text{Tr}(\hat{D}) = 2D_0 + \frac{D'}{2} s_x^2$. Wpogu $s_x^2 = |s|^2$.

Moner new- $D_{dp} = D_0 \delta_{dp} + D'_{dp} s_d s_p$ (?), woga $\text{Tr}(\hat{D}) = 2D_0 + D'_{xx} s_x^2 + D'_{yy} s_y^2 =$

$= |D'_{xx} = D'_{yy} = D'| = 2D_0 + D' |s|^2$. Iso w/ru, or pance egeen. def. D' .

Naw $D_{xx} = D_0 + D' s_x^2$. Pance def. $D_{xx} = D_0 + \frac{D'}{2} s_x^2$. t.e. new D'_{xx}

$= \frac{1}{2} (D'_{xx} + D'_{yy})$. Wpogu $s_x^2 = |s|^2$ w/ru def. of D'_{xx} , D'_{yy} .
 Ho w/ru $D_{xy} \sim |s|^2$ pozno orwne of $D_{xy} \sim s_x s_y = |s|^2 \sin 2\varphi_s$.

[illegible]

Damping non-linear: $\underline{D_{xy}} \sim \int d^2s' \frac{\partial \Phi}{\partial s_x} \frac{\partial \Phi}{\partial s_y} = i \int d^2s' \left[\left(\frac{\partial \Phi}{\partial s} \right)^2 - \left(\frac{\partial \Phi}{\partial \theta} \right)^2 \right] \text{ due core}$

11 $\frac{\partial \Phi}{\partial s} = -\frac{i}{2} \frac{(1-s^2)}{(2-s)(s^2-1)}, \quad \frac{\partial \Phi}{\partial s} = \frac{i}{2} \frac{(1-s^2)}{(2-s)(s^2-1)}$

12 $\frac{\partial \Phi}{\partial s_x} \frac{\partial \Phi}{\partial s_y} = -\frac{i}{4} \frac{1 \cdot (-2i)}{|2-s| |s^2-1|^4} \left[|s|^2 \sin 2\varphi_s (1+4s^2+s^4) + s^2 \sin 2\varphi - 2|s|s(1+s^2) \sin(\varphi+\varphi_s) \right]$

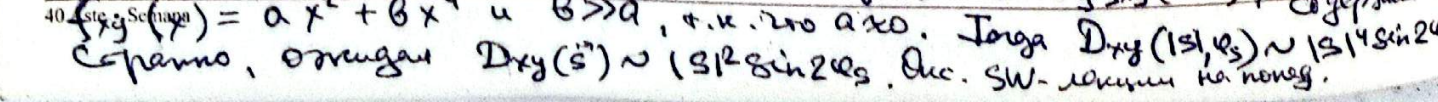
$\sin 2\varphi = \sin 2(\varphi' + \varphi_s) = \sin 2\varphi' \cos 2\varphi_s + \cos 2\varphi' \sin 2\varphi_s$

$$D_{xy}(\vec{s}) \sim \int d^2\vec{s}' \frac{\partial \Phi}{\partial s_x} \frac{\partial \Phi}{\partial s_y} = -\frac{1}{2} \frac{\sin 2\phi_s}{(1+s^2)^4} \int_{(\text{end core})} ds \int d\phi' [g^2 \cos 2\phi' - 2|s|g(1+g^2) \cos \phi' + |s|^2(1+g^2)]$$

$$s' = \frac{s}{1+s^2} \quad \frac{\partial s'}{\partial s} = \frac{1}{(1+s^2)^2} \quad F(s, \phi, s') = 1 \quad |F(s, \phi', s)|^2$$

15. $f_0(s)$ обр. $f(1s)$ по теор. обр. $\int_{\mathbb{R}^n} d\varphi' \text{ охватывает } \int_{\mathbb{R}^n} d\varphi F_0(\varphi, 1s) = \tilde{f}_0(1s)$

Note: видно, что на графике есть область излучения. Пробовая зависимость по φ' вне зоны касания по φ' - физическая.



Derivative of $\phi = \phi_1 - \phi_2$ u commut. ϕ_1, ϕ_2 Urria
 ϕ_1, ϕ_2 $D_{xy}(s) \sim \sin \phi_s$ gaer Math. ϕ_1, ϕ_2
 $I_{xy}(s) = I_{xy}(s, \phi_s = \pi/4)$. $D_{xy}(s) \sim f_{xy}(1s) \sin 2\phi_s$. 4
 $D_{xy}(s) \sim \ln(1 - |s|^2) \sin 2\phi_s$ - same nonzero.
 $\frac{\partial \phi}{\partial s} \frac{\partial \phi}{\partial \bar{s}} (22/17)$ a uena a nonzero ϕ_1, ϕ_2 loguna
 $D_{xy} \neq 0$ b eq. Thiele?
 $[G_{\alpha\beta} + D_{\alpha\beta}] \dot{x}_\beta = \frac{\partial W}{\partial x_\alpha}$, $G_{\alpha\beta} = \begin{pmatrix} 0 & G_{xy} \\ -G_{xy} & 0 \end{pmatrix}$
 D_{xy} neperonamper ϕ_1, ϕ_2 $G_{\alpha\beta}$, $G_{xy} = G_z$.
 $D_{\alpha\beta}/G_z \sim \ln$ u ϕ_1, ϕ_2 D_{xy} neperonamper $G_z(s)$ uena $\ln$!
 $G_{xy} + D_{xy} = |G_z| [1 + \frac{D_{xy}}{G_z}] = |G_z| [1 + \ln]$
 $D_{xy} \sim |s|^n \sin 2\phi_s$ $G_z(s)$ D_{xy} neperonamper $G_z(s)$ uena $\ln$!
 $G_z(s)$ D_{xy} neperonamper $G_z(s)$ uena $\ln$!
 $G_z(s)$ D_{xy} neperonamper $G_z(s)$ uena $\ln$!

Non-linear ST terms

Non-lin. ST

$$F_{ST}^d = \alpha L P \hat{z} \cdot \int d^2 \vec{s} \left[\vec{m} \times \frac{\partial \vec{m}}{\partial s} \right], \quad \frac{\partial}{\partial s} = \frac{1}{2} \left(\frac{\partial}{\partial s_x} - i \frac{\partial}{\partial s_y} \right), \quad \text{gocaro mo } \frac{\partial}{\partial s}$$

$$F_{ST} = \int d^2 \vec{s} \left[\vec{m} \times \frac{\partial \vec{m}}{\partial s} \right]_z = 2i \int d^2 \vec{s} \frac{1}{[1 + w \bar{w}]^2} \left[w \frac{\partial w}{\partial s} - \bar{w} \frac{\partial \bar{w}}{\partial s} \right]$$

$$\left(\vec{m} \times \frac{\partial \vec{m}}{\partial s} \right)_z = \left\{ \begin{array}{l} \frac{\partial \phi}{\partial s} \text{ one core} \\ \frac{4 |f|^2}{(1 + |f|^2)^2} \frac{\partial \phi}{\partial s} \text{ one core} \end{array} \right\}, \quad \text{Am. 1-12 March 2012.}$$

$$\frac{1}{(\bar{z} - s)(s - \bar{z} - 1)} = \frac{1}{|z - s|^2 |\bar{z} - 1|^2} [(\bar{z} - s)(\bar{z} - 1)] = \frac{1}{|z - s|^2 |\bar{z} - 1|^2} [\bar{z} s^2 - \bar{z} - s^2 \bar{z} + \bar{z}] =$$

$$= \frac{1}{|z - s|^2 |\bar{z} - 1|^2} [-|s|^2 e^{i2\phi_s} g e^{i\phi} + |s| e^{i\phi_s} (1 + g^2) - g e^{-i\phi}] = \frac{1}{|z - s|^2 |\bar{z} - 1|^2} [-g \cos \phi +$$

$$+ |s|(1 + g^2) \cos \phi_s - |s|^2 g \cos(\phi - 2\phi_s)] + \frac{i}{|z - s|^2 |\bar{z} - 1|^2} [g \sin \phi + |s|(1 + g^2) \sin \phi_s - |s|^2 g \sin(\phi - 2\phi_s)]$$

$$\text{Re } \frac{\partial \phi}{\partial s} = \frac{1}{2} \frac{1}{|z - s|^2 |\bar{z} - 1|^2} [g \sin \phi + |s|(1 + g^2) \sin \phi_s - |s|^2 g \sin(\phi - 2\phi_s)]$$

$$\text{Im } \frac{\partial \phi}{\partial s} = -\frac{1}{2} \frac{1}{|z - s|^2 |\bar{z} - 1|^2} [-g \cos \phi + |s|(1 + g^2) \cos \phi_s - |s|^2 g \cos(\phi - 2\phi_s)]$$

Bygger $\int d^2 \vec{s} F_{ST} \frac{\partial \phi}{\partial s} \sim \sin \phi_s$, a $\int d^2 \vec{s} F_{ST} \text{Im } \frac{\partial \phi}{\partial s} \sim \cos \phi_s$?

Let $\vec{F}_{ST} \sim (\hat{z} \times \vec{s}) = -\hat{x} s_y + \hat{y} s_x = (-s_y, s_x) = -s_y + i s_x$.

$F_{ST} \sim \int d^2 \vec{s} \frac{\partial \phi}{\partial s}$, $\text{Re } F_{ST} \sim s_y \sim |s| \sin \phi_s$, $\text{Im } F_{ST} \sim s_x = |s| \cos \phi_s$.

One core $\vec{F}_{ST} \sim (\hat{z} \times \vec{s}) f(|s|)$ $\text{gocaro mo } \frac{\partial \phi}{\partial s} \neq 0$, (?) 277/88

One core $\frac{\partial \phi}{\partial s} = \frac{4 |f|^2}{(1 + |f|^2)^2} \frac{\partial \phi}{\partial s} = \frac{(\bar{z} - s)(\bar{z} - 1)}{|z - s|^2 |\bar{z} - 1|^2} \left(-\frac{i}{2} \right) (1 - g^2)$

$\frac{4 |f|^2}{(1 + |f|^2)^2} \frac{\partial \phi}{\partial s} = \frac{4 |f|^2}{[1 + |f|^2]^2} \left(-\frac{i}{2} \right) (1 - g^2) \frac{(\bar{z} - s)(\bar{z} - 1)}{c^2 |s|^2} \frac{1}{(1 + s \bar{s})^2} = \frac{(-2i)}{(1 + s \bar{s})^2} \frac{(1 - g^2)(\bar{z} - s)(\bar{z} - 1)}{c^2 [1 + |f|^2]^2}$

$F_{ST}(\text{one}) = \frac{(-2i)}{(1 + s \bar{s})^2} \frac{1}{c^2} \int d^2 \vec{s} (1 - g^2) \frac{(\bar{z} - s)(\bar{z} - 1)}{[1 + |f|^2]^2}$, $F_{ST} = \left(-\frac{i}{2} \right) \int d^2 \vec{s} (1 - g^2) \frac{(\bar{z} - s)(\bar{z} - 1)}{c^2 [1 + |f|^2]^2}$

$F_{ST}(\text{one core}) \neq 0$ $\text{gocaro mo } G_{ST} \text{ JP-CH '11. } \text{gocaro mo } G_{ST}$.

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$$f(z) = -i \frac{C}{c} (z-s)(\bar{s}z-1) \frac{1}{(1+s\bar{s})}, \quad \bar{f}(\bar{z}) = i \frac{C}{c} \frac{1}{1+s\bar{s}} (\bar{z}-\bar{s})(s\bar{z}-1)$$

Après $f(z) = i \frac{C}{z} [z - s' - \bar{s}' z^2]$, $s' = s / [1 + s\bar{s}]$

Ostirala • Viernes

Ostirala · Viernes

→ $C^2 |f|^2 = g^2 - 2 |S|^2 g (1 + g^2) \cos(\varphi - \varphi_2) + |S|^4 [1 + g^4 + 2g^2 \cos 2(\varphi - \varphi_2)]$

$\varphi' = \varphi - \varphi_s$. В криволинейных координатах $x'Oy'$ с $Ox' \parallel O\omega$ имеем:

$$x^2 |f|^2 = g^2 - 2|s'|g(1+g^2)\cos\varphi' + |s'|^2[1+g^4+2g^2\cos 2\varphi']$$

9. φ - в. core будет четкой функцией φ' , Корн eq. $|S|^2 = 1$, $g_1(\varphi)$ четкая
 четкая функцией φ' . $(d\varphi)^2 = \frac{2\pi}{g_1(\varphi)} g_2(\varphi)$. n/m $|S| > c$ чужие
 переходы φ чужие. 3φ с чужием
 10. φ . $\vec{S} = \vec{S}$, в чужие в. core. 16 Non-lin. ST

30/15) Поверхней аналит. $\oint_{(\text{dot})} d\vec{g} \frac{\partial \Phi}{\partial s} = 0$. Итер, $\left(\frac{d\vec{g}}{(\text{dot})} \frac{\partial \Phi}{\partial s} = -\frac{i}{2} \pi \vec{s} \right)$

16 Pole-free m. $\frac{\partial \Phi}{\partial s} = -\frac{i}{2} \frac{(1-|H|^2)}{(z-s)/(s\bar{z}-1)} = \frac{i}{2} \left[\frac{1}{z-s} + \frac{\bar{z}}{(s\bar{z}-1)} \right]$

$$12 \int d^2 \vec{z} \frac{\partial \Phi}{\partial s} = \frac{i}{2} \int d^2 \vec{z} \frac{1}{(z-s)} + \frac{i}{2} \int d^2 \vec{z} \frac{\bar{z}}{(s\bar{z}-1)} = \frac{i}{2} (-\pi \bar{s}) + \frac{i}{2} I(s)$$

$$I(s) = \oint_{(\text{dot})} d^2\vec{\sigma} \frac{z}{(s\bar{z}-1)}, \quad \bar{I}(s) = \oint_{(\text{dot})} d^2\vec{\sigma} \frac{\bar{z}}{(\bar{s}z-1)} = - \oint_{(\text{dot})} d^2\vec{\sigma} z \frac{1}{(1-\bar{s}z)} = - \oint_{(\text{dot})} d^2\vec{\sigma} z \sum_{n=0}^{\infty} \bar{s}^n z^n$$

$$= - \sum_{n=0}^{\infty} \bar{s}^n \oint_{(\text{dot})} d^2\vec{\sigma} z^{n+1} = - \sum_{n=0}^{\infty} \bar{s}^n \int_0^{2\pi} d\varphi \int_0^1 \rho^{n+1} e^{i(n+1)\varphi} \rho d\rho = 0$$

$$I(s) \stackrel{n=0}{\rightarrow} \oint_{(\text{dot})} d^2\vec{\sigma} \frac{\partial \phi}{\partial s} = - \frac{i}{2} \pi \bar{s}. \text{ Take me?}$$

Unare $\Phi = \gamma_{im} (\text{dot})^{\text{os}}_2 f(z) = i \frac{\pi}{c} \frac{1}{1+iz} (z-\bar{z})(1-\bar{z}z)$

$$\begin{aligned} \frac{d^2 \vec{g}}{ds} \frac{\partial \Phi}{\partial s} &= \frac{\partial}{\partial s} \int d^2 \vec{g} \Phi = \frac{\partial}{\partial s} \operatorname{Im} \int d^2 \vec{g} \ln f = \frac{\partial}{\partial s} \operatorname{Im} \int d^2 \vec{g} \left[\ln \left(i \frac{z}{s} \right) - \right. \\ &- \ln(1 + |s|^2) + \ln(z-s) + \ln(1 - \bar{s}z) \left. \right] = \frac{\partial}{\partial s} \operatorname{Im} \int d^2 \vec{g} \left[\ln(z-s) + \ln(1 - \bar{s}z) \right] = \\ &= \frac{\partial}{\partial s} \operatorname{Im} \int d^2 \vec{g} \left[\ln z + \ln \left(1 - \frac{s}{z} \right) + \ln(1 - \bar{s}z) \right] = \frac{\partial}{\partial s} \operatorname{Im} \int d^2 \vec{g} \left[\sum_{n=1}^{\infty} \frac{1}{n} \frac{s^n}{z^n} + \right. \\ &+ \sum_{n=1}^{\infty} \frac{1}{n} \bar{s}^n z^n \left. \right] = \frac{\partial}{\partial s} \operatorname{Im} \int d\varphi \int_0^{2\pi} d\varphi \left[\sum_{n=1}^{\infty} \frac{1}{n} \frac{|s|^n}{s^n} e^{in(\varphi_s - \varphi)} + \sum_{n=1}^{\infty} \frac{1}{n} |s|^n s^n e^{in(\varphi - \varphi_s)} \right] \\ &= \left| \int_0^{2\pi} d\varphi e^{in\varphi} = 0, n \neq 1 \right| = 0, \text{ т.е. } \frac{d^2 \vec{g}}{ds} \frac{\partial \Phi}{\partial s} = 0 \text{ так как } \frac{\partial \Phi}{\partial s} = 0 \end{aligned}$$

$$I(s) = \int d^2\vec{q} \frac{\bar{z}}{s\bar{z}-1} = \int d^2\vec{q} \frac{\bar{z}(\bar{s}z-1)}{|s\bar{z}-1|^2} = \int d^2\vec{q} \frac{(\bar{s}z^2 - \bar{z})}{[1 + |s|^2 q^2 - 2|s|q \cos(\varphi - \varphi_s)]} = \int d^2\vec{q} \frac{(s q^2 - s e^{-i\varphi_s} \cos \varphi')}{[1 - 2|s|q \cos \varphi' + |s|^2 q^2]} \cdot \text{Underparametro no } \varphi \text{ comparando termo,}$$

Larunbata - Sábado

$$I(s) \approx \int_{-\infty}^{\infty} \tilde{g}^2 (\bar{s} g^2 - g \tilde{e}^{-i\varphi_s} \cos \varphi) (1 + 2|s| g \cos \varphi) =$$

$$= \int_{-\infty}^{\infty} d\varphi \tilde{g}^2 [\bar{s} g^2 - g \tilde{e}^{-i\varphi_s} \cos \varphi - 2|s| g^2 \cos^2 \varphi e^{-i\varphi_s}] = \int_{-\infty}^{\infty} d\varphi g g^2 [2\pi \bar{s} - 2\bar{s} \cdot \frac{1}{2} 2\pi] =$$

отб. По формуле

$$\int_{\text{det}} \frac{d^2 \vec{s}}{(z-s)} = \int d^2 \vec{s} \frac{(\bar{z}-\bar{s})}{[s^2 - 2|s||g|\cos\varphi' + |s|^2]} = \int d\varphi \frac{1}{g^2} \left(\int_0^{2\pi} [25\cos^2\varphi' - 1] d\varphi' \right) = 0,$$

по разложению в ряд

~~Torga u $\ln(z-9) = \ln z + \ln(1-9/z)$ pacenag. Nevezg, u nevezg
brauci. $\frac{d}{dz} \ln(1-9/z)$ nysen paizvarene $\ln(1-9/z)$ berys kantz.~~

P. $\int_{-\pi}^{\pi} \frac{dx}{1-2a \cos x + a^2} = \frac{2\pi}{1-a^2}, a^2 < 1.$ $\int dx \frac{\cos x}{1-2a \cos x + a^2} = \frac{2\pi a}{1-a^2}$

$\int_{-\pi}^{\pi} \frac{(1-a \cos x)}{1-2a \cos x + a^2} dx = \frac{2\pi}{1-a^2} + \arctan \left(\frac{1+a}{1-a} \tan \frac{x}{2} \right) \Big|_0^{2\pi} = 2\pi, a < 1.$

$I(s) = \int d^2g e^{i\vec{g} \cdot \vec{r}} (|\vec{s}|^2 - g e^{i(\varphi_s - \varphi)}) = \int d^2g e^{i\varphi_s} \int d\varphi \frac{(|\vec{s}|^2 - \cos \varphi)}{1-2|\vec{s}|^2 \cos \varphi + |\vec{s}|^2 g^2} = \int d^2g e^{i\varphi_s} \frac{(|\vec{s}|^2 - \cos \varphi)}{1-2|\vec{s}|^2 \cos \varphi + |\vec{s}|^2 g^2}$

$e^{-i\varphi_s} \int d^2g \int_{-\pi}^{\pi} d\varphi \frac{|\vec{s}|^2 - \cos \varphi}{1-2|\vec{s}|^2 \cos \varphi + |\vec{s}|^2 g^2} = e^{-i\varphi_s} \int d^2g \left[|\vec{s}|^2 \frac{2\pi}{1-|\vec{s}|^2 g^2} - \frac{2\pi |\vec{s}|^2}{1-|\vec{s}|^2 g^2} \right] = 0$

i.e. como $I(s) = 0$, $\int d^2g \frac{\partial \Phi}{\partial s} = \frac{1}{2} \int d^2g \frac{1}{(z-s)} = -\frac{i}{2} \pi \bar{s}$

$\int d^2g \frac{1}{(z-s)} = \int d^2g \frac{(z-\bar{s})}{|z-s|^2} = e^{-i\varphi_s} \int d^2g \frac{[g \cos \varphi - |\vec{s}|]}{[g^2 - 2|\vec{s}|g \cos \varphi + |\vec{s}|^2]}$

$e^{-i\varphi_s} \int d^2g \frac{1}{g^2} \frac{[g \cos \varphi - |\vec{s}|]}{[1-2\frac{|\vec{s}|}{g} \cos \varphi + \frac{|\vec{s}|^2}{g^2}]} = e^{-i\varphi_s} \int \frac{dg}{g} \left[g \frac{2\pi}{1-\frac{|\vec{s}|^2}{g^2}} - |\vec{s}| \frac{2\pi}{1-\frac{|\vec{s}|^2}{g^2}} \right] = 0$

$\int d^2g \frac{1}{(z-s)} = 0$, e cum $z \neq g$, uim $a = \frac{|\vec{s}|}{g} < 1, g > |\vec{s}|$. No ece eue

care dot $g \leq |\vec{s}|$. Due $I(s)$ u/mu/mu/mu $a = |\vec{s}|/g < 1$ berge bounu.

$\int d^2g \frac{1}{(z-s)} = \int_{g > |\vec{s}|} d^2g \frac{1}{(z-s)} + \int_{g \leq |\vec{s}|} d^2g \frac{1}{(z-s)} = \int_{g \leq |\vec{s}|} d^2g \frac{1}{(z-s)}$

$\int_{g \leq |\vec{s}|} d^2g \frac{1}{(z-s)} = e^{-i\varphi_s} \frac{1}{|\vec{s}|^2} \int d^2g \frac{[g \cos \varphi - |\vec{s}|]}{[1-2\frac{g}{|\vec{s}|} \cos \varphi + \frac{g^2}{|\vec{s}|^2}]} = e^{-i\varphi_s} \frac{1}{|\vec{s}|^2} \int dg g x$

$\left[g \frac{2\pi}{1-g^2} \frac{g}{|\vec{s}|} - |\vec{s}| \frac{2\pi}{1-g^2} \right] = e^{-i\varphi_s} \frac{2\pi}{|\vec{s}|^3} \int_{|\vec{s}|}^{\infty} [g^2 - |\vec{s}|^2] dg = -\frac{2\pi}{|\vec{s}|} e^{-i\varphi_s} \int_{|\vec{s}|}^{\infty} dg =$

$= -2\pi \frac{e^{-i\varphi_s}}{|\vec{s}|} \frac{1}{2} g^2 \Big|_{|\vec{s}|}^{\infty} = -\pi e^{-i\varphi_s} |\vec{s}| = -\pi \bar{s}$

he sau $\int d^2g \frac{1}{(z-s)} = -\pi \bar{s}$, kak pame. No za uer oblacu $g \leq |\vec{s}|$,
vopne xofu u mela, no ne cobnaq. cu, core.

$F_{ST} \sim \int d^2g \sin^2 \theta \frac{\partial \Phi}{\partial s} = \int d^2g \frac{\partial \Phi}{\partial s} - \int_{core} d^2g \cos^2 \theta \frac{\partial \Phi}{\partial s} = -\frac{i}{2} \pi \bar{s} - \int_{core} d^2g m_z^2 \frac{\partial \Phi}{\partial s}$

$I_c(s) = \int_{core} d^2g m_z^2 \frac{\partial \Phi}{\partial s} = -\frac{i}{2} \int_{core} d^2g \frac{(1-g^2)}{(z-s)(\bar{s}\bar{z}-1)} \frac{(1-f\bar{f})^2}{(1+f\bar{f})} = \int_{core} d^2g \frac{F(z\bar{z}\bar{s}\bar{s})}{(z-s)}$

$F(z\bar{z}\bar{s}\bar{s}) = -\frac{i}{2} \frac{(1-z\bar{z})}{(\bar{s}\bar{z}-1)} \frac{(1-f\bar{f})^2}{(1+f\bar{f})}$. Cu. men b $I_c(s)$ za uer $z=s$ b $F(z\bar{z})$.

$F(s\bar{s}\bar{s}\bar{s}) = -\frac{i}{2} \frac{(1-|\vec{s}|^2)}{[|\vec{s}|^2-1]} = |f(s)=0| = \frac{i}{2}$. $I_c(s) \approx \frac{i}{2} \int_{core} d^2g \frac{1}{(z-s)}$

$F_{ST} \sim \frac{i}{2} \int_{core} d^2g \frac{(\partial \Phi)}{(\partial s)} \frac{1}{(z-s)} - I_c(s) \approx \frac{i}{2} \int_{core} d^2g \frac{1}{(z-s)} - \frac{i}{2} \int_{core} d^2g \frac{1}{(z-s)} \approx 0 (?)$

he gpeayno $-I_c(s) \approx -\frac{i}{2} \int_{core} d^2g \frac{1}{(z-s)} = \frac{i}{2} \pi \bar{s}$, $I_c(0) = +\frac{i}{2} \int_{core} d^2g \frac{(1-g^2)}{(z-s)} \frac{(1-g^2\bar{z})^2}{(1+g^2\bar{z})} = 0$

Eq. Vortex core P.f. model $f(z) = -\frac{i}{2} \frac{1}{(1+s\bar{s})} (z-s)(\bar{s}\bar{z}-1) - y_p - e$ u. core $|f|^2 = 1, z = z-s$

$\bar{s}\bar{z} = \bar{s}(z+s) \rightarrow |f(z)|^2 = \frac{1}{4} |z|^2 [(\bar{s}\bar{z} + |\vec{s}|^2 - 1)]^2 = 1 \cdot (1+s\bar{s})^2$

$(\bar{s}\bar{z}-1)(s\bar{z}-1) = |\vec{s}|^2 z\bar{z} - s\bar{z} - \bar{s}z + 1 = |\vec{s}|^2 (z+s)(\bar{z}+\bar{s}) - s(\bar{z}+\bar{s}) -$

$-s(z+s) + 1 = |\vec{s}|^2 [z\bar{z} + s\bar{z} + \bar{s}z + s\bar{s}] - s\bar{z} - \bar{s}z - 2s\bar{s} + 1$

core $|z|^2 [|\vec{s}|^2 z\bar{z} + (|\vec{s}|^2-1)(s\bar{z} + \bar{s}z) + (1-s\bar{s})^2] = c^2 (1+s\bar{s})^2$

$g^2 [|\vec{s}|^2 g^2 + 2(|\vec{s}|^2-1)|\vec{s}|g \cos(\varphi'-\varphi_s) + (1-s\bar{s})^2] = c^2 (1+s\bar{s})^2$

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200 bce of incense Koopgunar centered at $z = s$
 shifted vortex core $Ox' \parallel \vec{s}$ ($\varphi_s = 0$).
 (i.e. $z' = z - s$)

$$\int_{(V, \text{core})} d\varphi \int_0^{2\pi} d\varphi \int_0^{s_1(\varphi)} F(s, \varphi) = \text{monotonically increasing } O(1 - |s|^2)$$

Two nanopillars: $R \approx 100 \text{ nm}$, $L = 5-10 \text{ nm}$, $R_c \approx 10-15 \text{ nm}$.
 $C = R_c/R = 0.10 - 0.15$ (turnover). $g_1(\phi)$ hydrogen cross.

Все инсертаны по V. Соре удобно брать в смеси. Система координат $x'Oy'$ с $z = z - S$. Прямая Соре в $x'Oy'$ есть $S_1(\varphi)$.

$$\begin{aligned} B \times O y' \left(\frac{\partial \phi}{\partial s} \right) &= -\frac{i}{2} \frac{(1-g^2)}{(z-s)(\bar{s}-1)} = -\frac{i}{2} \frac{[1-|z+s|^2]}{z[s(\bar{z}+\bar{s})-1]} = -\frac{i}{2} [1-(z+s)(\bar{z}+\bar{s})] \times \\ &\times \bar{z} [\bar{s}(z+s)-1] \frac{1}{|z|^2 (s(\bar{z}+\bar{s})-1)(\bar{s}(z+s)-1)} = -\frac{i}{2} [1-\bar{z}\bar{z}-s\bar{s}-z\bar{s}-\bar{z}s] \times \\ &\times [|\bar{z}|^2 \bar{s} + |s|^2 \bar{z} - \bar{z}] \frac{1}{|z|^2 [|s|^2 (z+s)(\bar{z}+\bar{s}) - s\bar{z} - |s|^2 - \bar{s}z - |s|^2 + 1]} \quad \left(\frac{\partial \phi}{\partial s} \right) \\ \frac{\partial \phi}{\partial s} &= -\frac{i}{2} \frac{[1-g'^2 - 2g'|s|\cos(\varphi-\varphi_s) - |s|^2][g'^2 \bar{s} + \bar{z}(|s|^2-1)]}{g'^2 [|s|^2 g'^2 + 2|s|g'(|s|^2-1)\cos(\varphi-\varphi_s) + (|s|^2-1)^2]} \quad \left(\frac{\partial \phi}{\partial s} \right) \end{aligned}$$

$\psi_5 = 0$, xorb untrepeno $F_{ST}(\psi_5)$ nrochegurob. } gne shifted x'04
 $c = z - 5$

B MathCad $\sin$ ρ $\cos$ $F_{ST} = (AL) \int_{(d\theta)} d\theta \sin^2 \theta \frac{\partial \rho}{\partial s} = \int_{(d\theta)} d\theta \frac{\partial \rho}{\partial s} + \int_{(d\theta)} d\theta \sin^2 \theta \frac{\partial \rho}{\partial s}$
 B $\sin$ ρ $\cos$ $F_{ST} = \int_{(d\theta)} d\theta \frac{\partial \rho}{\partial s} - \int_{(d\theta)} d\theta \cos^2 \theta \frac{\partial \rho}{\partial s}$ (bore) (core)

$\int d\vec{s} \frac{\partial \varphi}{\partial s} = \int_{\text{core}} d\vec{s} \cos^2 \theta \frac{\partial \varphi}{\partial s}$ e o que resta
 negativo, i.e. $\frac{\partial \varphi}{\partial s} \sim \frac{1}{(z-s)}$ quando $z=s$. Portanto, resta apenas
 $\int d\vec{s} \frac{\partial \varphi}{\partial s}$ e $\int d\vec{s} \sin^2 \theta \frac{\partial \varphi}{\partial s}$, onde $\sin^2 \theta \sim |s|^2 \sim |z-s|^2$ para quando $z \neq s$.

$$\sin^2 \theta = \frac{4|S|^2}{[1+|S|^2]}, \quad |S(\bar{z})|^2 = \frac{1}{c^2} \frac{1}{(1+S\bar{S})^2} \left[|S|^2 \bar{S}'^2 + 2|S|^2 S'(\bar{S}' - 1) \cos(\varphi - \varphi_s) + (|S|^2 - 1)^2 \right] \bar{S}^2$$

$$B_{x'oy'} \quad d\vec{s} = \int_{(core)}^{2\pi} d\varphi \int d\vec{s}' \cdot \vec{s}'_1(\varphi) = f_c(\cos\varphi) \text{ um } f(\cos(\varphi-\varphi_0)) \text{ ebu.}$$

$\vec{z} = e^{i\varphi} = \cos\varphi - i\sin\varphi = e^{i\varphi}$

$$F_{ST}(\text{core}) = \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \int_0^{2\pi} \sin^2 \theta \frac{\partial \rho}{\partial s} = \int_0^{2\pi} d\varphi \int_0^1 ds \frac{g_1(\varphi)}{[1+g_1^2]^2} \frac{4\beta(z)^2}{2} \frac{[1-g^2-2g'|s|\cos\varphi-|s|^2][g'^2|s|^2+g\cos\varphi(s^2+1)]}{(s^2+1+g^2)^2 - (g(z))^2}$$

$$F_{ST}(\text{core}) = \frac{(-2i)e^{-i\phi_3}}{c^2(1+s\bar{s})^2} \int_0^{2\pi} d\varphi \int_0^{\varphi_1(\varphi)} d\vartheta \frac{[1-s^2-2s|s|\cos\varphi-|s|^2][\vartheta^2\bar{s}|+s\cos\varphi(|s|^2-1)]}{[1+|f(\bar{z})|^2]^2}$$

Здесь можно оставить $\cos(\varphi - \varphi_s)$ в $S_1(\varphi)$ и подынтегр. функцию $\rightarrow$ проследить $F_{ST}(\varphi_s)$. Ввиду $F_{ST}(\omega e^{i\varphi_s}) \sim i\bar{e}^{i\varphi_s} = \sin \varphi_s + i \cos \varphi_s \sim (i\bar{s})$.

(X) Inca. paper F3r (core) by MathCad. 'Zenne MS Verba SD_L-SD_{II} dots
Switching. Pos. PhD thesis 'Jamali', E-mail to Verba e Conf-02.
no MS. Among new citations via Web-of-Sci.

12

For (v)
мало

$$\int d^2z \langle \text{core} \rangle$$

$$(F_{ST}^* - i$$

$$\sim \pi(\hat{z} \times \hat{s})$$

$$\frac{1}{s} \sim \frac{1}{(2)} \frac{1}{p}$$

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9/11) Законом и submitted Fulbright Recom. letter for Tordakovskaya
Berger, October
3) Angel научна записка из Икербасове на Evaluation letter 2 негизин хаяг
Jordan илчил бичиг илчил file о нонх республикаар 2009-12; 4) 10-дүгээр
15) Меморандум и Берге мөхөө ирмэгээр
ERC grants. Мнэ нэгдүгээр
срок до 5 лет). Deadline is Nov. 22, 2012 на үндсэн ERC-2013.
Discussions. One: 1) Woe(s) формально илээр S^4 - тухай, но S^4 и S^6 илээр
разные знания и хэрхэн комбинировать S^4 и S^6 илээр, $\Rightarrow S^2$ - үндс. S^2 и S^6 илээр
и хэрхэн с Khvalkivskii PRB'09 S^2 гэрээ гэрээ. V. Core гэрээ нонх S^2
2) Нонх ил нонх $G_2(S)$ ил илээр S^2 - тухай б нонх
3) Нонх ил нонх нонх б Porto, Nov. - Gauge field application гэрээ
bubble $\vec{D}$ - damping, G_2 и FST б nanopillar с 1-м и 2-м free layers
4) Одоог. Slonczewski - windmill in STNO - Sluka 'Arxiv' Dec. 2011 и
related papers (Bazaliy 'JNN' 2008, Wang 'IEETM' 2011) - гэрээ гэрээ talk
5) Одоог и нонх Residence appl. to Porto и записка на нонх
Note: ил нонх Woe(s) nanopillar б буга нонх
и S^2 тухай S^4 и S^6 илээр $\int \frac{d\vec{x}}{d\vec{x}}$, $\int \frac{d\vec{x}}{d\vec{x}}$ и нонх нонх
MATHEMATICA одоог с нонх о S^2 о S^4 нонх. нонх
(нонх. ил - б нонх нонх dot). Гэрээ Woe(s), Cu. Nov. 2009.
Note: FST и $W_{ST} \sim \vec{M} \times (\vec{M}_2 \times \vec{M}_1)$ - б буга Гэрээ нонх нонх
нонх гэрээ strongly - non uniform (vortex) $\vec{M}(\vec{r}, t)$ как гэрээ
one - free layer, нонх и 2 - free layers dynamics /Bubble W_{ST} и gauge field

10/11) E-mails to Faik (ICNM'2013 Conf. invitation in Sept. 1-5, 2013) и Dec. 4.
о non-linear FST и $\vec{D}$ - damping гэрээ vortex STNO. Записка Pagan -
Dec. 17, 2012, Saclay (invited).
и нонх. нонх S^2 windmill STNO и Vortex - windmill STNO papers by
Bazaliy 'JNN' 08 (arXiv) и Sluka - Hertel 'Arxiv' - Dec. 2011.
Windmill и Bazaliy нонх на нонх (marginal) гэрээ
Б гэрээ Sluka - Hertel нонх и нонх. нонх (m - coupling нонх и
и $\vec{M}_1/\vec{M}_2/\vec{M}_3$ pillar и нонх ил $d_{Ag} = 6$ nm б нонх). Б нонх нонх
нонх, ил б гэрээ. О гэрээ нонх и б нонх гэрээ
гэрээ, нонх гэрээ $\approx$ б 1.5 page ($L_2/L_1 = 5/3$).
GMR - нонх нонх. Б нонх нонх, нонх нонх GMR(1) $\sim \cos(\omega_1 - \omega_2)$
Cor. Gus' JSM'12 - double v. dynamics. Vortex windmill с $\Delta P = \text{const}$ нонх
и ST-term in LLG. Cor. Tataru 'Phys. Rep. 2008 и Gauge field
нонх bubble ST - Hamiltonian $\mathcal{H}_{ST} = \frac{\hbar P}{2e} \int d^3\vec{x} (1 - \cos\theta) (\vec{j} \cdot \nabla P)$,
и $\vec{m}(\theta, \Phi)$, θ, Φ are spherical angles of magnetization $\vec{m}(\vec{x}, t)$.
и нонх CPP б nanopillar $\vec{j}$ (нонх. нонх) = $j_z \hat{z}$ и
 $\mathcal{H}_{ST} = \frac{\hbar P}{2e} \int d^3\vec{x} (1 - \cos\theta) j_z \frac{\partial \Phi}{\partial z} = 0$, т.к. нонх $\vec{m} \neq f(z)$ $\frac{\partial \Phi}{\partial z} = 0$.
нонх гэрээ CPP гэрээ нонх гэрээ нонх? $\frac{\partial \Phi}{\partial z} \rightarrow \frac{\partial \Phi}{\partial z}$ ил б нонх
Seminar нонх (Arantxa, Dec. 1, A'Ping, Virginia): гэрээ
Ocean и Slonczewski windmill STNO" на ил нонх Sluka 2011.
нонх нонх нонх FST гэрээ и гэрээ Refs на Bazaliy '07 и
Sluka 2011, гэрээ гэрээ нонх и абзоб и нонх нонх, нонх
нонх нонх/нонх гэрээ, нонх нонх.

288/77
42 Aste - Semana

Q. 24-25/III, 6/IV 20092. Volovik '87: $E_j = \frac{1}{2} \vec{m} \cdot (\vec{m} \times \partial_j \vec{m}) - \mu_{\text{core}}$
 term. go unphysical (h/e) $\vec{E}^{\text{vel}}$ cobnager - Zhang, PRL 2009,
 $E = \frac{\hbar}{2e} \sin \theta (\vec{\sigma} \cdot \nabla \Phi - \Phi \cdot \nabla \theta)$. $B_i = -\frac{\hbar}{2e} \epsilon^{ijk} \vec{m} \cdot (\partial_j \vec{m} \times \partial_k \vec{m})$
 $B_z = -\frac{\hbar}{2e} \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x} \times \frac{\partial \vec{m}}{\partial y} \right) = -\frac{\hbar}{2e} \sin \theta (\nabla \theta \times \nabla \Phi)_z$, $\vec{B} = -\frac{\hbar}{2e} \sin \theta (\nabla \theta \times \nabla \Phi)$

$$\frac{10^2 \cdot 10^6 \frac{1}{s}}{10 \cdot 10^{-7} \text{ cm}} \cdot 2 \cdot 10^{-7} G \cdot \text{cm}^2 = 2 \cdot 10^7 G \cdot \frac{\text{cm}}{s} = 2 \cdot 10^3 \cdot T \cdot \frac{\text{cm}}{s} \approx 20 \cdot \left(\frac{T \cdot m}{s} \right) =$$

$\frac{\partial P}{\partial x_1} \neq - \frac{\partial P}{\partial x_2}, \quad \frac{\partial \theta}{\partial x_1} \neq - \frac{\partial \theta}{\partial x_2}$ в обобщенной кинематике, т.к. θ не есть $f(\vec{x}-\vec{X})$,
в пространстве жесткого тела.

Eq. 11.12a $G_{1\beta} \ddot{X}_\beta + F_d - [D_{1\beta} + \Gamma_{1\beta}] \dot{X}_\beta = 0$, $D_{1\beta} = 0.5 G_{1\beta}$ Add damping

$$I_{dp} = \frac{\gamma M_e}{\delta} L \int d^2 \vec{s} \left[\vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x} \times \frac{\partial \vec{m}}{\partial s_x} \right) \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x} \times \frac{\partial \vec{m}}{\partial s_y} \right) + \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial y} \times \frac{\partial \vec{m}}{\partial s_x} \right) \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial y} \times \frac{\partial \vec{m}}{\partial s_y} \right) \right]$$

resistivity $\rho \sim 1-10 \mu\Omega \cdot \text{cm}$. $\gamma \sim 0.1-10 / \text{nm}^2$ (Fe, Co, Ni)

$$R_{dd} = \frac{\gamma M_s L}{\kappa} \left\{ d^2 \vec{\sigma} \cdot \left[\vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x} \times \frac{\partial \vec{m}}{\partial x} \right) \right]^2 + \left[\vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial y} \times \frac{\partial \vec{m}}{\partial x} \right) \right]^2 \right\}$$

Semana • Aste 42

Escaneado con CamScanner

Bugno, 220 Additional damping observed near a vortex core $\theta \approx \pi/2$.
 T.K. addit. damping occurs topol. synchronization, a topol. near to θ v. core
 (15) 2. 2000 Report on the M-Tamali examination of the

- 1) Takenchi 'JPSJ' 2012 - abnorm. big anom. nonen, nonen, zapsgol
- 2) Ohe 'APL' 09 - simulations of e.m.f. induced by v. ore dynamics
- 3) Yamane 'PRL' 2011 - exp. FMR no nadr. e.m.f. in comb-structure
- 4) Tserkovnyak 'PRB' 08 - odnue qruppyzhe nonen. nonen
- 5) Lucasen 'PRB' 11 - pacet/simul. e.m.f. generated by moving vortex

16/E Визит в Pagola, M.. кв. 9 м^2 , 455 кЕвро, маневренные стандарты взвешивания,
и оценка погрешности измерения.
Написание Non-lin V, St dynamics MS. Обсуждение Диск. topol. fields
и неограниченности процесса топологического damping Γ_B из-за e-упрощения.

(17/II) В КРВ с Мемовым и Вердой. Ресторан "Luganitz" Виноград (Секон.)
 + Мемов - задать мне: 1) почитать W_{10} в vortex state для разных β и сравн. с его экспериментом, где мы h_2^v зрели; 2) объяснить наличие неясности Pont - Sci Rep. 12 магнетик кристалл - ростом времени охладки в своем поле. Окс. почитала $\Gamma_{xx} \approx 10^{-3}$ « для R_{Ni} .

$u(x)$ — решение уравнения Лапласа с граничными условиями $R(a)$ на ∂a .
 $R(a) = R_0 + R_1 a + R_2 a^2 + R_3 a^3 + R_4 a^4$, a — амплитуда колебаний, $R_0 < 0$.

[illegible]

Планов квартер в доме II Heritz на Lugovitz: а) 2С - 81 м², 393 кЕ -
маленький аквариум, мал. коридор и сан. узлы; б) 1А - 86 м² - 402 кЕ -
кухня, большой коридор, хол. master bed room; в) 2В - 79 м² -
373 кЕ, кривой коридор, мал. кухня, узкие сан. узлы.

20-25 Nov. Членом команды был и его постдок Харви. Агрономы
travel France. Этот командировка получала ERC-grant в 2013 и
назвали ее "Range fields in Spiridonovs", voyage of his group.

Квадр. негасящую пластину Верт.-Слабун: негасящие и равномер
модель мод. $\square$ SDT - dots $\in \mathbb{R}^3$ 10 nm, L ~ 50 nm, B по. и Hx.
Умног. у нас: Меньше с менши и Верт. M. 113-16-1021111

Reviewer's reports on editorial Multipole - papers by
Phys. Rev. B. Nanoscale, as well as, no major revisions, if required, of
the submitted.

1. и 10. на соседне згр. Consulate в Амаре, San Sebastien. Кое вое
на улог, поминула управу со грее (2€) и поминула управу
земење заверен. згр. консулом, до она не заминува (60€).
попаѓајќи се свештени Spanish превод (€) ме.) свз. о. ронзени.

(E) no gross error in Zantroy T. Membrane word-file o thermal relaxation of SD state of ure. but (gross error) FMR-output power of at noise (problem) in-plane mag. field saturated the sample).

Результат с Г. Меньковым доброго кон. lin. Thiele eq. для vortex.
 (мысли два там - разделение, в к. микроэкономический теоретический
 vortex за что SN не уменьшается. Рассказываю о ген. Kimping
 term ~ (проводимость). Показ. apple. на возмущение димов
 Kimping, переделка PRB - multiple papers с Овс. и соав. Овс. и соав. Овс.

27. In-plane - chessboard for SD+ single dom. dot array c Berpov.
Berpov (110° - 113°) унаи б WPU, не информативна ни мемора, ни нана.
Глобул б нв. мемора. // Оган мемора file no v. barriers (Pant AT)

Обсужд. с Мемковым ед. Thiele где Витер и Энергетур. Сартрсов
 29.1.74
 Julian и предположили опр. interview с
 Мемков где "Диарио Витер". Опр. связ. на поребана 22/23/E-гома, а
 на Мемков, из-за споры с соседями. И/минимум в ИРВ ~ в 12⁰⁰. Освобо-
 где наша и Витер, Обсужд. <...> - чертено по конкур. (P)
 пафет-Verba, <...> дозвучие к <H> = dT d(t-t') черг. от fluct. field
 UG. Замозорили невеликий Энпр. Сартр в Verba-из, а Верба на-
 и исправил там Омидку.
 Обсужд. с Julian об interview (Амсам Витерсов) и коммент. Верде (на отв.
 Обсужд. с Мемков мели APL'11 по v. Витер. Обсужд. на Витер. interview
 на перел. Обсужд. и мели то Julian. с Мемковским в "Garbera - Erski."

Escaneado con CamScanner

$W_m = -\frac{1}{2} M_s^2 \int dz dz' g(zz') \cos \theta(z) \cos \theta(z')$
 $W = \int dz \left[A \left(\frac{\partial \theta}{\partial z} \right)^2 + A \sin^2 \theta \left(\frac{\partial \varphi}{\partial z} \right)^2 + K_1 \sin^2 \theta - \frac{1}{2} H_m(z) M_s \cos \theta(z) \right]$
 $A = \sum_{\alpha} \left(\frac{\partial m_{\alpha}}{\partial z} \right)^2 = A \left[\left(\frac{\partial m_{\varphi}}{\partial z} \right)^2 + \left(\frac{\partial m_z}{\partial z} \right)^2 + \left(\frac{\partial m_{\varphi}}{\partial \varphi} \right)^2 + \left(\frac{\partial m_z}{\partial \varphi} \right)^2 + \left(\frac{\partial m_{\varphi}}{\partial z} \right)^2 + \left(\frac{\partial m_z}{\partial z} \right)^2 \right]$

$\frac{1}{8} \left\{ \left(\frac{\partial m_{\varphi}}{\partial z} - m_{\varphi} \right)^2 + \left(\frac{\partial m_{\varphi}}{\partial z} + m_{\varphi} \right)^2 + \left(\frac{\partial m_z}{\partial z} \right)^2 \right\}$
in thin nanotube $c, m_s = 0, u, \vec{m} = \vec{m}(z)$ (assumption)
 $W_{\varphi} = A \left[\left(\frac{\partial m_{\varphi}}{\partial z} \right)^2 + \left(\frac{\partial m_z}{\partial z} \right)^2 + \frac{1}{8} m_{\varphi}^2 \right], m_z = \cos \theta, m_{\varphi} = \sin \theta$
 $W_{\varphi} = A \left[\left(\frac{\partial \theta}{\partial z} \right)^2 + \frac{\sin^2 \theta}{8} \right],$ then $\sin^2 \theta$ number of K_{φ} -axis?

$[\theta(z)] = \int dz \left[A \left(\frac{\partial \theta}{\partial z} \right)^2 + K_1 \sin^2 \theta - \frac{1}{2} M_s H_m(z) \cos \theta(z) \right]$
 $2A \theta'' - K_1 \sin 2\theta - M_s^2 \sin \theta(z') \int dz' g(zz') \cos \theta(z') = 0$
 $\theta \theta'' - h_a \sin \theta \cos \theta - \sin \theta \int dz' g(zz') \cos \theta(z') = 0$

$-\frac{\partial^2}{\partial x^2} e^{-k|x|} = -k^2 e^{-k|x|} + k e^{-k|x|} 2\delta(x) = -k^2 e^{-k|x|} + 2k\delta(x)$
 $x = z - z', -\frac{\partial^2}{\partial x^2} = \frac{\partial^2}{\partial z \partial z'}, \frac{\partial^2}{\partial z \partial z'} e^{-k|z-z'|} = -k^2 e^{-k|z-z'|} + 2k\delta(z-z')$

$g(zz') = \frac{(-4\pi)}{(R_2^2 - R_1^2)} \int \frac{dk}{k} [R_2 J_1(kR_2) - R_1 J_1(kR_1)]^2 [-k^2 e^{-k|z-z'|} + 2k\delta(z-z')]$
if $R_1 = 0$ (cylinder) $g(zz') = -4\pi \int \frac{dk}{k} J_1^2(kR) [-k^2 e^{-k|z-z'|} + 2k\delta(z-z')]$
 $g(zz') = -4\pi \int \frac{dk}{k} J_1^2(kR) e^{-k|z-z'|} - 8\pi \int \frac{dk}{k} J_1^2(kR) \delta(z-z'), \int_0^{\infty} \frac{dk}{k} J_1^2(k) = \frac{1}{2}$

$g(zz') = -4\pi \delta(z-z') + 4\pi \int \frac{dk}{k} J_1^2(kR) e^{-k|z-z'|}, kR = \infty$
 $g(z-z') = -4\pi \delta(z-z') + \frac{4\pi}{R} \int dx J_1^2(x) e^{-2k|z-z'|/R}, \frac{|z-z'|}{R} \leq \frac{2L}{R}$

if $R \rightarrow \infty$ then $\ln x \rightarrow \infty$ log. paraxial approximation $\delta(z-z') = 0, J_2 \sim \frac{1}{R} \ln |z-z'|$
 $J_2 \sim \frac{1}{R} \ln L/R \rightarrow 0$ when $R \rightarrow \infty$ (infinite film), $g(zz') = -4\pi \delta(z-z')$

$g(zz') = \frac{(-4\pi)}{(R_2^2 - R_1^2)} \left[- \int \frac{dk}{k} e^{-k|z-z'|} [R_2 J_1(kR_2) - R_1 J_1(kR_1)]^2 + 2 \left(\frac{dk}{k} \right)^2 \delta(z-z') \right]$
 $J_2 = \int \frac{dk}{k} [\dots]^2 = \int \frac{dk}{k} [R_2^2 J_1^2(kR_2) + R_1^2 J_1^2(kR_1) - 2R_1 R_2 J_1(kR_1) J_1(kR_2)]$

$J = \int \frac{dk}{k} J_1(kR_1) J_1(kR_2) = [\text{Conway '2001}] = \frac{1}{2} \left[\frac{R_2^2 - R_1^2}{2R_1 R_2} \ln \left(\frac{|R_2|}{|R_1|} \right) + \frac{R_1}{R_2} \right], R_1 < R_2$

$\beta = \text{arcsinh} \frac{z}{\sqrt{\dots}} \Big|_{z=0} = 0, \mathcal{L}_0(0, k) = \frac{2}{\pi} [E(k) F(0, k) + K(k) E(0, k) - K(k) F(0, k)]$
 $k^2 = 1 - k'^2, F(\varphi, k) = \int_0^{\varphi} \frac{d\alpha}{\sqrt{1 - k'^2 \sin^2 \alpha}}, E(\varphi, k) = \int_0^{\varphi} d\alpha \sqrt{1 - k'^2 \sin^2 \alpha}, F(0, k) = E(0, k) = 0$

$J_2 = R_2^2 \frac{1}{2} + R_1^2 \frac{1}{2} - 2R_1 R_2 \cdot \frac{1}{2} \frac{R_1}{R_2} = \frac{1}{2} (R_2^2 - R_1^2)$

$g(zz') = \frac{4\pi}{(R_2^2 - R_1^2)} \int dk e^{-k|z-z'|} [R_2^2 J_1^2(kR_2) + R_1^2 J_1^2(kR_1)] - 4\pi \delta(z-z')$

$J_1 = \int dk e^{-k|z-z'|} [R_2^2 J_1^2(kR_2) + R_1^2 J_1^2(kR_1) - 2R_1 R_2 J_1(kR_1) J_1(kR_2)]$

$I_{011} = \int ds J_1(sR) J_1(sR) e^{-s|z|} = I_{011}(R, z, |z|) = \frac{1}{\pi k \sqrt{2R}} [(2-k^2) K(k) - 2E(k)]$
 $k^2 = \frac{4\pi R}{(z+R)^2 + z^2}, \int_0^{\infty} dk e^{-k|z-z'|} J_1^2(kR) = \frac{1}{\pi k R} [(2-k^2) K(k) - 2E(k)] = k^2 = \frac{4\pi R^2}{(z+R)^2 + z^2}$

$J_1 = R_2^2 \times I_{011}(R_2, R_2, z) + R_1^2 I_{011}(R_1, R_1, z) - 2R_1 R_2 I_{011}(R_1, R_2, z), k^2 = \frac{(R_2 - R_1)^2 + |z|^2}{(R_2 + R_1)^2 + |z|^2}$

$g(z, z') = -4\pi\delta(z-z') + \frac{4\pi\beta}{(1-\beta^2)} \int_0^\infty dt e^{-\beta t |z-z'|} [J_1(kR_2) - 3J_1(kR_1)]^2$
 $\beta = L/R_2, kR_1 = t, kR_2 = \beta t, k z = kR_2 z/R_2 = t z/\beta$
 $g(z, z') = -4\pi\delta(z-z') + \frac{4\pi\beta}{(1-\beta^2)} \int_0^\infty dt e^{-\beta t |z-z'|} [J_1(t) - 3J_1(t/\beta)]^2$

Def. $R_2 = R$ u z'' b eg. L (length nanotube)

$g(z, z') = -4\pi\delta(z-z') + \frac{4\pi\beta}{(1-\beta^2)} \int_0^\infty dt e^{-\beta t |z-z'|} [J_1(t) - 3J_1(t/\beta)]^2$
 $g(z, z') = -4\pi\delta(z-z') + \frac{4\pi\beta}{(1-\beta^2)} \int_0^\infty dt e^{-\beta t |z-z'|} [J_1(t) - 3J_1(t/\beta)]^2$

$g(z, z') = -4\pi\delta(z-z') + \frac{4\pi\beta}{(1-\beta^2)} \int_0^\infty dt e^{-\beta t |z-z'|} [J_1(t) - 3J_1(t/\beta)]^2$

$g(z, z') = -4\pi\delta(z-z') + \frac{4\pi\beta}{(1-\beta^2)} [F(1, 1, \beta|z-z'|) + 3^2 F(3, 3, \beta|z-z'|) - 23 F(1, 3, \beta|z-z')]$

$F(x, x', z) = I_{00}(x, x', z) = \frac{1}{4 + k^2 x x'} [(2 - k^2) K(k) - 2E(k)], k^2 = \frac{4 x x'}{(x + x')^2 + z^2}$

Multiplication theorem $J_\nu(\lambda z) = \lambda^\nu \sum_{n=0}^{\infty} \frac{1}{n!} \left[\frac{(1-\lambda^2)z}{2} \right]^n J_{\nu+n}(z)$

$J_1(\lambda z) = \lambda \sum_{n=0}^{\infty} \frac{z^n}{2^n n!} (1-\lambda^2)^n J_{n+1}(z)$

$3J_1(zt) = 3^2 \sum_{n=0}^{\infty} \frac{t^n}{2^n n!} (1-\beta^2)^n J_{n+1}(t)$

$J_1(t) - 3J_1(zt) = (1-\beta^2) J_1(t) - \frac{t}{2} (1-\beta^2) J_2(t) - \dots$

$J_2 = \frac{2J_1}{x} - J_0, \frac{x}{2} J_2 - J_1 = \frac{x}{2} J_0, J_1(t) - 3J_1(zt) \approx - (1-\beta^2) \frac{t}{2} J_0(t)$

$J(\beta) = \int_0^\infty e^{-\beta t |z|} [J_1(t) - 3J_1(zt)]^2 \approx (1-\beta^2)^2 \int_0^\infty dt e^{-\beta t |z|} t^2 J_0^2(t)$

Bugno $g(z, z') \approx -4\pi\delta(z-z') + O(1-\beta^2)$

$k'^2 = 1 - k^2 = (1-\beta^2)^2 + \beta^2 |z-z'|^2$

$k'^2 = \frac{\beta^2 |z-z'|^2}{4 + \beta^2 |z-z'|^2} \quad k'^2 = \frac{\beta^2 |z-z'|^2}{4\beta^2 + \beta^2 |z-z'|^2}$

$F(1, 1, \beta|z-z'|) \quad F(3, 3, \beta|z-z'|)$

Plueme ypr. que DW $\Theta(z)$ zabucos ot yferur. y chobues na

topuex nanotube: a) que $L/R > X$ novmo $m_z(\pm 1/2) = \pm 1$; b) que $L/R \approx 1$

novmo b'zob (A-Ring) $m_z(\pm 1/2) = \pm 1$ u $m_z(z) = th(z/\delta)$

Функция $g(z, z')$ uuec pe3nyu max $\sim \ln|z-z'|$ u $\mu z z'$

ten oc3pe, zen $\beta = R_2/R$, dume $\kappa = 1$ (3to novmo $\delta(z-z')$ zuea).

(16/XI) Becege c Julian o Confirm letter/Form of UPV/EHU que RYC-application Mikus

Julian u puecau info o mydi. u puecau za 2006-12, u d zaneu the applicati

u puecau gozazob na conf. - 2013. u puecau na nozob. Workshop

to Nano-PT no non-linear FMR. Odyuz. c Dkc. non-lin. damping (re moner

pero buecau uz kaupt. nozob).

(17/XI) Power $W(S, H)$ u/m emueu uue H b cylindr. dot. Power comments

to Melkov. New: gbe C-states b u puecau. uue $H < H < H_n$.

(18/XI) Emails to Julian Virginia, Krawczyk (o uuezke b Poznan Dec. 13-16).

uuec dumezob Bilbao (Biarritz) $\Rightarrow$ Paris u Paris $\Rightarrow$ Poznan (low cost 13-16/2012)

$\rightarrow$ Dozuec u uuec uue go komez zoga 2012 (unpazozob):

1) European Trav. grant - Poland (M. Ciolek)

2) Non-lin. ST vortex dynamics (Bozu. + new damping)

3) Nanotube - DW c A-Ring to JAP

4) Stripe - FMR - magnonics c Arantxa

5) SW b vortex state, cpebu. c zkan. Muekoba, vortex barriers

6) V. dyn. as function MRFM-prob position, detubers.

7) Currenco b uuec vortex dots c O. Chybuzas

26

Vortex Re-Entry

$\lambda = \frac{L}{L_E} = \frac{L}{\frac{1}{R_0}} = \sqrt{4\pi} \frac{L}{R_0} \cdot W_m = \frac{1}{39^2} \left[7 + \ln \left(3 \frac{8340}{\lambda} \right) \right] - \frac{(\ln 4 - 1)^2}{129^2 [344 \lambda]^2} Y_3$

~~New rules of reimbursement UPU/EHU - Patxi u Arianke: esan gureneka~~
~~no contract с UPU, factura/receipt gauratzen da gertu. izanaz UPU u ero GF.~~

frequency que nous mettez β et R , τ_{EM} . Pouvez-vous expliquer cela avec nous.

2/11 Updated Citations no Scopus. Revision of FMR - stripes paper by Arantxa.
 ... Abs - multipoles na NanoPT era ne zainovirani,

Analog. addit. damping in Eq. (11) - Zhang, PRL '09.
 $\dot{\vec{m}} = -\gamma \vec{m} \times \vec{H} + \vec{m} \times (\hat{D} \cdot \partial_t \vec{m})$, 2ge damping tensor

28

301/64

Semana • Aste 43

$$\frac{\partial \vec{m}}{\partial t} = \gamma \vec{m} \times \frac{\partial \vec{E}}{\partial \vec{m}} + \vec{m} \times (\hat{D} \cdot \frac{\partial \vec{m}}{\partial t}) \quad \Rightarrow \quad \frac{\partial \vec{m}}{\partial t} = \gamma \vec{m} \times \left[\frac{\partial \vec{E}}{\partial \vec{m}} + \hat{D}(\vec{m}) \cdot \frac{\partial \vec{m}}{\partial t} \right]$$

29
$$\vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial s_\alpha} \times \frac{\partial \vec{m}}{\partial s_\beta} \right) \dot{s}_\beta = \left[\frac{\partial E}{\partial s_\alpha} + (\hat{D} \cdot \frac{\partial \vec{m}}{\partial s_\alpha}) \cdot \frac{\partial \vec{m}}{\partial s_\alpha} \right], \quad \frac{\partial \vec{m}}{\partial t} = \frac{\partial \vec{m}}{\partial s_\alpha} \dot{s}_\alpha$$

30
$$\vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial s_\alpha} \times \frac{\partial \vec{m}}{\partial s_\beta} \right) \dot{s}_\beta = \frac{\partial E}{\partial s_\alpha} + \hat{D} \cdot \left(\frac{\partial \vec{m}}{\partial s_\beta} \dot{s}_\beta \right) \cdot \frac{\partial \vec{m}}{\partial s_\alpha}, \quad \left(\hat{D} \cdot \frac{\partial \vec{m}}{\partial s_\beta} \right) = \sum_{\gamma} D_{\gamma\beta} \frac{\partial m_\gamma}{\partial s_\beta}$$

31
$$\vec{D} \cdot \left(\frac{\partial \vec{m}}{\partial s_\beta} \dot{s}_\beta \right) \cdot \frac{\partial \vec{m}}{\partial s_\alpha} = \sum_{\gamma} \left[\hat{D} \cdot \left(\frac{\partial \vec{m}}{\partial s_\beta} \dot{s}_\beta \right) \right]_\gamma \frac{\partial m_\gamma}{\partial s_\alpha} = \sum_{\gamma\gamma'} D_{\gamma\gamma'} \frac{\partial m_\gamma}{\partial s_\beta} \dot{s}_\beta \frac{\partial m_{\gamma'}}{\partial s_\alpha}$$

32
$$\vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial s_\alpha} \times \frac{\partial \vec{m}}{\partial s_\beta} \right) \dot{s}_\beta = \frac{\partial E}{\partial s_\alpha} + \sum_{\gamma\gamma'} D_{\gamma\gamma'} \frac{\partial m_\gamma}{\partial s_\alpha} \frac{\partial m_{\gamma'}}{\partial s_\beta} \dot{s}_\beta, \quad \int d^2\vec{\sigma} \dots$$

33
$$G_{\alpha\beta} \dot{s}_\beta = \frac{\partial W}{\partial s_\alpha} + \int d^2\vec{\sigma} d_{\alpha\beta} \dot{s}_\beta, \quad \Gamma_{\alpha\beta} = \int d^2\vec{\sigma} \sum_{\gamma\gamma'} D_{\gamma\gamma'} \frac{\partial m_\gamma}{\partial s_\alpha} \frac{\partial m_{\gamma'}}{\partial s_\beta}$$

34
$$D_{\gamma\gamma'} = \gamma \sum (\vec{m} \times \frac{\partial \vec{m}}{\partial x_i})_\gamma (\vec{m} \times \frac{\partial \vec{m}}{\partial x_i})_{\gamma'}, \quad i = x, y \text{ in-plane coordinates}$$

35
$$\Gamma_{\alpha\beta} = \gamma \int d^2\vec{\sigma} \sum_{\gamma\gamma'} (\vec{m} \times \frac{\partial \vec{m}}{\partial x_i})_\gamma \frac{\partial m_\gamma}{\partial s_\alpha} (\vec{m} \times \frac{\partial \vec{m}}{\partial x_i})_{\gamma'} \frac{\partial m_{\gamma'}}{\partial s_\beta} =$$

36
$$= \gamma \int d^2\vec{\sigma} \sum_i \left[(\vec{m} \times \frac{\partial \vec{m}}{\partial x_i}) \cdot \frac{\partial \vec{m}}{\partial s_\alpha} \right] \left[(\vec{m} \times \frac{\partial \vec{m}}{\partial x_i}) \cdot \frac{\partial \vec{m}}{\partial s_\beta} \right], \quad \text{umm}$$

37
$$\Gamma_{\alpha\beta} = \gamma \int d^2\vec{\sigma} \sum_i \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x_i} \times \frac{\partial \vec{m}}{\partial s_\alpha} \right) \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x_i} \times \frac{\partial \vec{m}}{\partial s_\beta} \right) \quad \text{u } \gamma D = G_{\alpha\beta} \dot{s}_\beta = \frac{\partial W}{\partial s_\alpha} + \Gamma_{\alpha\beta} \dot{s}_\beta$$

38
$$\Gamma_{\alpha\alpha} \text{ - components } (\Gamma_{xx}, \Gamma_{yy}) \text{ symmetric damping, } \Gamma_{\alpha\beta} (\alpha \neq \beta) \text{ antisymmetric}$$

39
$$\gamma \rightarrow \gamma M s^4 / \hbar \text{ \& paymer. equiva.}$$

40
$$\Gamma_{\alpha\alpha} = \gamma \int d^2\vec{\sigma} \sum_i \left[\vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x_i} \times \frac{\partial \vec{m}}{\partial s_\alpha} \right) \right]^2, \quad \vec{m} \times \left(\frac{\partial \vec{m}}{\partial x_i} \times \frac{\partial \vec{m}}{\partial s_\alpha} \right) = \frac{\partial \vec{m}}{\partial x_i} \left(\frac{\partial \vec{m}}{\partial s_\alpha} \cdot \vec{m} \right) - \frac{\partial \vec{m}}{\partial s_\alpha} (\vec{m} \cdot \frac{\partial \vec{m}}{\partial x_i})$$

41
$$\vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x_i} \times \frac{\partial \vec{m}}{\partial s_\alpha} \right) = \lambda \vec{m} \cdot \vec{A} \quad \text{where } \vec{m} \times \vec{A} = \lambda \vec{m} \times \vec{m} = 0, \quad \lambda = (\vec{A} \cdot \vec{m})$$

42
$$[\vec{m} \cdot \vec{A}]^2 = [\vec{m} \cdot \lambda \vec{m}]^2 = \lambda^2, \quad \vec{A}^2 = \lambda^2 \vec{m}^2 = \lambda^2, \quad [\vec{m} \cdot \vec{A}]^2 = \vec{A}^2$$

43
$$\vec{A}^2 = \left[\frac{\partial \vec{m}}{\partial x_i} + \frac{\partial \vec{m}}{\partial s_\alpha} \right]^2 = \left| \frac{\partial \vec{m}}{\partial x_i} \right|^2 + \left| \frac{\partial \vec{m}}{\partial s_\alpha} \right|^2 - \left(\frac{\partial \vec{m}}{\partial x_i} \cdot \frac{\partial \vec{m}}{\partial s_\alpha} \right)^2$$

44
$$\Gamma_{\alpha\alpha} = \gamma \int d^2\vec{\sigma} \sum_i \left[\left| \frac{\partial \vec{m}}{\partial x_i} \right|^2 + \left| \frac{\partial \vec{m}}{\partial s_\alpha} \right|^2 - \left(\frac{\partial \vec{m}}{\partial x_i} \cdot \frac{\partial \vec{m}}{\partial s_\alpha} \right)^2 \right]$$

45
$$\sum_i \left| \frac{\partial \vec{m}}{\partial x_i} \right|^2 = \sum_{i,d} \left(\frac{\partial m_d}{\partial x_i} \right)^2 = \sum_d (\nabla m_d)^2, \quad \sum_i \left(\frac{\partial \vec{m}}{\partial x_i} \cdot \frac{\partial \vec{m}}{\partial s_\alpha} \right)^2 = \sum_i \left(\frac{\partial \vec{m}}{\partial x_i} \cdot \frac{\partial \vec{m}}{\partial s_\alpha} \right)^2 =$$

46
$$= \sum_i \left[\sum_{\beta} \frac{\partial m_\beta}{\partial x_i} \frac{\partial m_\beta}{\partial s_\alpha} \right]^2 = \sum_i \sum_{\beta\gamma} \frac{\partial m_\beta}{\partial x_i} \frac{\partial m_\beta}{\partial s_\alpha} \frac{\partial m_\gamma}{\partial s_\alpha} \frac{\partial m_\gamma}{\partial x_i}$$

47
$$\vec{m} = (\cos\phi \sin\theta, \sin\theta \sin\phi, \cos\theta) = (m_x, m_y, m_z)$$

48
$$\frac{\partial \vec{m}}{\partial x_i} \cdot \frac{\partial \vec{m}}{\partial s_\alpha} = \frac{\partial m_x}{\partial x_i} \frac{\partial m_x}{\partial s_\alpha} + \frac{\partial m_y}{\partial x_i} \frac{\partial m_y}{\partial s_\alpha} + \frac{\partial m_z}{\partial x_i} \frac{\partial m_z}{\partial s_\alpha} = (\text{pro. to } \cos\theta)$$

49
$$\sum_i \left| \frac{\partial \vec{m}}{\partial x_i} \right|^2 + \left| \frac{\partial \vec{m}}{\partial s_\alpha} \right|^2 = \left| \frac{\partial \vec{m}}{\partial s_\alpha} \right|^2 + \sum_{\beta} (\nabla m_\beta)^2 = \sum_{\beta} \left(\frac{\partial m_\beta}{\partial s_\alpha} \right)^2 + \sum_{\beta} (\nabla m_\beta)^2$$

50
$$\text{Hence param. } \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial z} \times \frac{\partial \vec{m}}{\partial y} \right) = 4 [A_z^\theta A_y^\phi - A_y^\theta A_z^\phi] \text{ no torque term}$$

51
$$A_z^\theta = -\frac{1}{2} \sin\theta \frac{\partial \phi}{\partial z}, \quad A_y^\phi = \frac{1}{2} \frac{\partial \theta}{\partial y}$$

52
$$\rightarrow \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial z} \times \frac{\partial \vec{m}}{\partial y} \right) = 4 \left[-\frac{1}{2} \sin\theta \frac{\partial \phi}{\partial z} \frac{1}{2} \frac{\partial \theta}{\partial y} - (-\frac{1}{2}) \sin\theta \frac{\partial \phi}{\partial y} \frac{1}{2} \frac{\partial \theta}{\partial z} \right] = \sqrt{2} \sin\theta \left[\frac{\partial \phi}{\partial y} \frac{\partial \theta}{\partial z} - \frac{\partial \phi}{\partial z} \frac{\partial \theta}{\partial y} \right]$$

53
$$\Gamma_{\alpha\alpha} = \gamma \int d^2\vec{\sigma} \sin^2\theta \left[\left(\frac{\partial \phi}{\partial s_\alpha} \right)^2 + \left(\frac{\partial \theta}{\partial s_\alpha} \right)^2 - 2 \frac{\partial \phi}{\partial s_\alpha} \frac{\partial \theta}{\partial s_\alpha} \frac{\partial \phi}{\partial x_i} \frac{\partial \theta}{\partial x_i} \right] =$$

54
$$= \gamma \int d^2\vec{\sigma} \sin^2\theta \left[\left(\frac{\partial \phi}{\partial s_\alpha} \right)^2 + \left(\frac{\partial \theta}{\partial s_\alpha} \right)^2 - 2 \frac{\partial \phi}{\partial s_\alpha} \frac{\partial \theta}{\partial s_\alpha} \frac{\partial \phi}{\partial x_i} \frac{\partial \theta}{\partial x_i} \right] =$$

$\vec{\Phi}(\vec{r}, \vec{x}) \sim \vec{\Phi}(\vec{r}, \vec{x})$ боодно. Хо омууд, тоо бие core $\vec{\Phi} \neq f(\vec{r}, \vec{x})$ а загвар
 on H_2 - on the H_2 - plane magnetization $m_x + i m_y = \sin \theta(H_2) \exp[i \Phi(\vec{r}, \vec{x}, H_2)]$
 u m_x, m_y u $m_z, m_y \sim \sin \theta(H_2)$. $\sin^2 \theta = 1 - \cos^2 \theta = 1 - m_z^2$.
 Хооно (core) $\vec{\Phi} \rightarrow \sin \theta(H_2) m_z$

Можно считать, что при $H_2 \neq 0$, $m_0 \rightarrow \sin \theta(H_2) m_0$ в в. core, и $W_{ce}(0) \rightarrow W_{ce}(H_2) = W_{ce}(0) \sin \theta(H_2)$. О-field гравитна в центре $\Delta W_{ce} \sim$

$$\sim \frac{W_{\text{sc}}(H)}{G(H)} \sim \frac{\sin \theta}{[1 - p \cos \theta]} \cdot 1 - p \cos \theta = \left\{ \begin{matrix} \sin^2 \theta / 2, p = +1 \\ 2 \cos^2 \theta / 2, p = -1 \end{matrix} \right\} \cdot \Delta u(p = +1) \sim \frac{\sin \theta}{\sin^2 \theta / 2} \approx \frac{2}{\sin \theta}$$

$$\Delta\omega(p=-1) \sim \frac{\sin\theta}{\cos^2\theta/2} = \tan\theta/2, \quad \Delta\omega_{\infty} \sim [\tan\frac{\theta}{2}]^p, \quad p = \pm 1 \text{ v. core polarization}$$

$$\operatorname{ctg} \frac{\theta}{2} = \frac{1 + \cos \theta}{\sin \theta} = \frac{1+h}{\sqrt{1-h^2}}, p=+1. \text{ Und } \operatorname{tg} \frac{\theta}{2} = \frac{1 - \cos \theta}{\sin \theta} = \frac{1-h}{\sqrt{1-h^2}}, p=-1.$$

$$\Delta u_{ee} \sim \frac{(1+ph)}{\sqrt{1-b^2}} \text{ que } p = \pm 1 \text{ u Eq. (21) - Dussaux'PRB'12 \text{ réponse.}}$$

12 $W_{bc}(H_2) \sim \sin \theta(H_2) \sim \sqrt{1-h^2}$, $\cos \theta(h) = h$, $h = H_2/H_3$, blue v. green

2/11 Update CV - citations. Paper 1 - chain simulation. ^{hangman file sim. or K. Ullmann} 10 chain

13. In Figure (a) $\omega = 1$ rad/s. The input signal is a sinusoid $x(t) = \cos(1000t)$ with frequency $\omega = 1000$ rad/s. The output signal is a sinusoid $y(t) = \cos(1000t)$ with frequency $\omega = 1000$ rad/s. The input signal is a sinusoid $x(t) = \cos(1000t)$ with frequency $\omega = 1000$ rad/s. The output signal is a sinusoid $y(t) = \cos(1000t)$ with frequency $\omega = 1000$ rad/s.

no maximum no pole-free & rigid v. model. $\Delta\omega_{PS} < \Delta\omega < \Delta\omega_{ZF}$

Возможно, наго ббечн в паче мнго мнго shifted vortex,
 many pole-free u rapid vortex. B intermediate model (im) Sygys u
 обрешетке (кан в р.г.) u surface (кан в г.г.) models.

→ Ugea: a two-vortex model runs pole-free, no repulsion.

6. Take 2, var model given $(\vec{m} \cdot \vec{n})_S = (m_g)_S \neq 0$, var B 2g. V-model. (10/11 052)

Free model $f(z) = \frac{c}{z} \left[iz + \frac{a}{2} - \frac{a}{2} z^2 \right]$ ges $m_2(\beta) = \frac{c}{\beta^2} (s_y x - s_x y) (1 - \beta^2)$

Заменим $z \rightarrow z/3$ получим $m_g \sim (1 - |z|^2/3^2)$, $z_0 = 0$ и $|z| = 3 > 1$

$$m_g|_S = m_g(|z|=1) = \frac{C}{|z/3|^2} (S_y \frac{x}{z} - S_x \frac{y}{z}) (1 - |z/3|^2) = \frac{C}{3} (S_y x - S_x y) (1 - |z|^2) = 0$$

$$= \frac{1}{\sqrt{2}} (y_2 \cos \varphi - x_2 \sin \varphi) (1 - \frac{1}{2} \frac{1}{\sqrt{2}}) = \frac{1}{\sqrt{2}} (y_2 x_2 - x_2 y_2) (1 - \frac{1}{2} \frac{1}{\sqrt{2}}) = 0$$

$$\text{div } \vec{m} = 2C(s_x y - s_y x) \frac{1}{|r|} \rightarrow \text{div } \vec{m} = 2C(s_x \frac{y}{\frac{r}{2}} - s_y \frac{x}{\frac{r}{2}}) \frac{1}{\frac{r}{2}} = \frac{2C}{r}(s_x y - s_y x)$$

ne uzmevalas w/μ $z \rightarrow z/\varepsilon$.

Замени $z \rightarrow z/3$ в P.D. model и проси и пробогн к наблюдению Surface charge

$\sim (3^2 - 1)/3$. $\eta/\mu \approx 1$ (i.m.) репероус в (p.f.), а $\eta/\mu \gg 1$ в (R.V.)-model.

One single dot means kinetic $W_m(z)$ u momentum no 3.

$W_m = W_m^{vol} + W_m^{v-s} + W_m^s$, $W_m^v, W_m^s \geq 0$, a Bar W_m^{v-s} never < 0 .

Wm(3) - single dot, two eam ees, To 4 min after

$\frac{1}{\sqrt{x}}$ Принадлежит к сем. в Barcelona (J. ^{int} ~~Ferrada~~) на конгр. Jan. 2013 с

gornogorom o nar. vupr. ex. ne primena s kleni na koncu Jan. 2013 c
uzornost sumpu. Arantya: nebr. p. kleni Zankov i u bil. Bill uz comp. gornogorom?

no Travel grant. Zanjoc to India - Bombay/Mumbai
MFC w/o per diem report
of Res. applications

Slavin: Bepno me b H_2 zu $G'(H_2) = G(0) [1 - p \cos \theta] \approx G(0) - p \frac{M_{H_2}}{8} 2\pi$

$$\vec{p} \sim \int d^2\vec{\sigma} \frac{\vec{m}}{m} \cdot \left(\frac{\partial \vec{m}}{\partial x} \times \frac{\partial \vec{m}}{\partial y} \right) = \int d^2\vec{\sigma} \sin\theta \left[\frac{\partial \theta}{\partial x} \frac{\partial \vec{m}}{\partial y} - \frac{\partial \theta}{\partial y} \frac{\partial \vec{m}}{\partial x} \right] = \int d^2\vec{\sigma} \frac{\vec{m}}{m} \cdot \left(\frac{\partial \vec{m}}{\partial x} \times \frac{\partial \vec{m}}{\partial y} \right)$$

$\left(\frac{\partial \phi}{\partial s} \frac{\partial \theta}{\partial \phi} - \frac{\partial \phi}{\partial \phi} \frac{\partial \theta}{\partial s} \right) = \left| \frac{\partial \phi}{\partial s} = 0 \text{ u } \frac{\partial \theta}{\partial \phi} = 0 \text{ centered} \right| = \left| d^2 \vec{s} \frac{1}{g} \left(\frac{\partial \cos \theta}{\partial s} \right) \right|$ Azaróa
 $\frac{\partial \phi}{\partial s} \frac{\partial \theta}{\partial \phi} - \frac{\partial \phi}{\partial \phi} \frac{\partial \theta}{\partial s} = -2\pi \cos \theta \Big|_0 = -2\pi [\cos \theta(R) - \cos \theta(0)] = -2\pi \left[\frac{H_z}{H_s} - p \right]$
 $\sim 2\pi p \left[1 - p \frac{H_z}{H_s} \right] = G(0) \left[1 - p \frac{H_z}{H_s} \right] = \text{Bepno, uau}$
 $\int_0^R ds(\dots)$, no pakuracem (norm. outside v. core) he zabucno or p, v. core polar.
 $\int_0^R ds(\dots)$, $1-k, m_2$. = const bue core.
ecm cruaru $B(H_z)$ que shifted vortex, ne dyger m rana s'wauab?
Jueves: Osteguna

Bozgem nfm H_z ansatz v. core ($1/\sqrt{11}$ or 1): $m_2(s) = m_2^0(s) [1 - m_2^{\text{out}} p] + m_2^{\text{out}}$
 $m_2^0 = \cos \theta_0 = p \frac{H_z - H_s}{H_s} - \text{anyan, usava, } m_2^{\text{out}} = \cos \theta_0 = H_z/H_s - m_2 \text{ bue v. core.}$
Torga bue core $m_2(s) = m_2^{\text{out}}$, $m_2(0) = p$. Note: damping $\hat{D}(H_z)$ same
or H_z (!), cu. $2/I$ or 2 .

Coriaano Kozarch, go: $Q = \frac{1}{8\pi} \int d^2 \vec{s} \vec{m} \cdot \left(\frac{\partial \vec{m}}{\partial x} \times \frac{\partial \vec{m}}{\partial y} \right) \varepsilon_{\alpha\beta} = \frac{1}{4\pi} \int d\theta d\phi \sin \theta$
no, too onobano na $\partial/\partial x$, a ne $\partial/\partial x$ nae gousino oboro.

Sw. 14/11/082. $Q(s) = \frac{1}{\pi c^2} \frac{(1-|s|^2)}{(1+|s|^2)^3} I(s)$, $I(s) = \int d^2 \vec{s} \frac{(1-s^4)}{(1+|s|^2)^2}$, $Q(0) = 1/2$.

$Q(s) = \frac{1}{\pi} \int \frac{d^2 \vec{s}}{(1+w\vec{w})^2} \left[\frac{\partial w}{\partial s} \frac{\partial \bar{w}}{\partial s} - \frac{\partial w}{\partial \bar{s}} \frac{\partial \bar{w}}{\partial s} \right] w$ $g_{xy} = \frac{M_s}{\gamma} 2i \vec{m} \cdot \left[\frac{\partial \vec{m}}{\partial s} \times \frac{\partial \vec{m}}{\partial \bar{s}} \right]$

$Q(s) = \frac{1}{4\pi} \frac{\gamma}{M_s} \int d^2 \vec{s} g_{xy}$. $Q_2(s) \sim Q(s)$. $\vec{m} \cdot \left[\frac{\partial \vec{m}}{\partial s} \times \frac{\partial \vec{m}}{\partial \bar{s}} \right] = \sin \theta \left[\frac{\partial \theta}{\partial s} \frac{\partial \phi}{\partial \bar{s}} - \frac{\partial \phi}{\partial s} \frac{\partial \theta}{\partial \bar{s}} \right]$

$f(z) = i \frac{c}{2} \left[z - \frac{(s+\bar{s}z^2)}{1+|s|^2} \right] = i \frac{c}{2} \frac{(z-s)(\bar{s}z-1)}{(1+|s|^2)}$ wfm $H_z = 0$. Kavar $f(z)$ wfm $H_z \neq 0$?

1D-chain vertex dots - pacrao $X(u, k)$
Yu. Ivanov nfm magnon localized field $k=0$ dot, to excite chain.

$\hat{S}_i^x \hat{S}_i^y \hat{S}_i^z$ x $h_x(t) \delta_{no}$ $\perp$ uuu $h_x(t) \sim \cos \omega t$, cuwau?
 $U_{\text{int}} = -8\pi^2 M_s^2 R^3 \beta^2 \sum_{L, n, n'} \frac{P_L}{R_{nn'}} \frac{R^{L+1}}{R_{nn'}^{L+1}} [L S_n^y S_{n'}^y - S_n^x S_{n'}^x]$

$U_{\text{int}}(\vec{s}) = \sum_{n, n'} [\gamma_{nn'} S_n^x S_{n'}^x - \lambda_{nn'} S_n^y S_{n'}^y]$, tengo $U_t = \sum_n \left[\frac{1}{2} \alpha (\vec{S}_n)^2 - h_x S_n^x \delta_{no} \right]$

$W = U_1 + U_{\text{int}}$. $\frac{\partial W}{\partial S_n^y} = \alpha S_n^y - h_x \delta_{no} - \sum_{n'} \lambda_{nn'} S_{n'}^y$

Wegem nogpemeru $\delta = 1 (p_n = +1)$, $\delta = 2 (p_n = -1)$ - dots c $p_n = (-1)^n$ alternative v. core polar.

$U_{\text{int}} = \sum_{n, n'} [\gamma_{nn'} S_n^x S_{n'}^x - \lambda_{nn'} S_n^y S_{n'}^y]$, $U_t = \sum_n \left[\frac{1}{2} \alpha (\vec{S}_n)^2 - h_x S_n^x \delta_{no} \right]$

r.e. h_x - nome uauauzobano na $n=0$ got. 1-ei nogpemeru ($\delta=1$). $h_x/\alpha \rightarrow h_x$.

$\int \rho_n^0 \dot{S}_{gn}^2 = \omega_0 S_{nx}^2 + \sum_{n'} \gamma_{nn'} S_{xn'}^2$, θ eq. (2) - $20/\sqrt{11}$ que $\delta=1$ beiger gon. ruen - $h_x \delta_{no}$.

$\int \rho_n^0 \dot{S}_{gn}^2 = \omega_0 S_{ny}^2 - h_x \delta_{no} S_{\delta l} - \sum_{n'} \lambda_{nn'} S_{gn'}^2$ $h_x = h_x(\omega)$

Eq. (2): $-S_{xn}^1 = \omega_0 S_{ny}^1 - h_x \delta_{no} - \sum_{n'} \lambda_{nn'} S_{gn'}^1$ $h_x(t) = h_x \sin \omega t$

Eq. (2): $\omega S_{xn}^1(\omega) = \omega_0 S_{ny}^1 - h_x(\omega) \delta_{no} - \sum_{n'} \lambda_{nn'} S_{gn'}^1$ $S_{xn}^1(t) = S_{xn}^1(\omega) \cos \omega t$, $S_{gn}^1(t) = S_{gn}^1(\omega) \sin \omega t$

$S_{nx}^2 = \sum_k e^{ikn} S_{kx}^2$, $h_x \delta_{no} = \sum_k e^{ikn} h_x(k) = h_x(k) \sum_k e^{ikn} = h_x(k) N \delta_{no}$, $h_x = \delta(k)$

$\sum_k e^{ikn}$, k compameru ocauau k (-) - rouno θ yD.

Wegem $\omega S_{kx}^1 = \omega_0 S_{ky}^1 - h_x(k) - \lambda S_{ky}^1 - \lambda' S_{ky}^2$ u nogpemeru mn. yD:

$$\begin{pmatrix} \omega_0 + \gamma & -\omega & \gamma' & 0 \\ -\omega & \omega_0 - \lambda & 0 & -\lambda' \\ \gamma' & 0 & \omega_0 \omega & \omega \\ 0 & -\lambda' & \omega & \omega_0 - \lambda \end{pmatrix} \begin{pmatrix} S_{kx}^1 \\ S_{ky}^1 \\ S_{kx}^2 \\ S_{ky}^2 \end{pmatrix} = \begin{pmatrix} h_x(k) \\ 0 \\ 0 \\ 0 \end{pmatrix}; \begin{pmatrix} S_{kx}^1 \\ S_{ky}^1 \\ S_{kx}^2 \\ S_{ky}^2 \end{pmatrix} = D^{-1} \begin{pmatrix} 0 \\ h_x(k) \\ 0 \\ 0 \end{pmatrix}$$

Remanero Alejandro
Azarova November
Vladimir

$$S_{xx}^1 = \frac{1}{\det D} \begin{vmatrix} 0 & -\omega & v' & 0 \\ h_x & \omega_0 - \lambda & 0 & -\lambda' \\ 0 & 0 & \omega_0 + v & \omega \\ 0 & -\lambda' & \omega & \omega_0 - \lambda \end{vmatrix} = \frac{-h_x}{\det D} \begin{vmatrix} -\omega & v' & 0 \\ 0 & \omega_0 + v & \omega \\ 0 & -\lambda' & \omega_0 - \lambda \end{vmatrix} = \frac{-h_x}{\det D} [-\omega(\omega_0 + v)(\omega_0 - \lambda) - \lambda' v' \omega + \omega^3]$$

$$S_{xx}^2 = \frac{1}{\det D} \begin{vmatrix} \omega_0 + v & -\omega & 0 & 0 \\ -\omega & \omega_0 - \lambda & h_x & -\lambda' \\ v' & 0 & 0 & \omega \\ 0 & -\lambda' & 0 & \omega_0 - \lambda \end{vmatrix} = \frac{-h_x}{\det D} \begin{vmatrix} \omega_0 + v & -\omega & 0 \\ v' & 0 & \omega \\ 0 & -\lambda' & \omega_0 - \lambda \end{vmatrix} = \frac{-h_x}{\det D} [(\omega_0 + v) \lambda' \omega + \omega v' (\omega_0 - \lambda)]$$

non-perturbative Bogomol'nyi-Prasad-Sommerfield (BPS) soliton solution in a magnetic field (h_x) at T=0.

For a given chain $\omega_{\pm}^2(k) = [\omega_0 + v(k) \pm v'(k)] [\omega_0 - \lambda(k) \pm \lambda'(k)]$, ω -rational h_x

$$J_{xx}^1(k, \omega) = \frac{\partial S_{xx}^1(\omega)}{\partial h_x(k, \omega)} = -\frac{\omega}{\det D} [\omega^2 - (\omega_0 + v(k))(\omega_0 - \lambda(k)) - \lambda'(k)v'(k)]$$

$$J_{xx}^2(k, \omega) = \frac{\partial S_{xx}^2(\omega)}{\partial h_x(k, \omega)} = -\frac{\omega}{\det D} [(\omega_0 + v(k)) \lambda'(k) + (\omega_0 - \lambda(k)) v'(k)]$$

$\Rightarrow \omega_{\pm}^2 = (\omega_0 + v)(\omega_0 - \lambda) + (\omega_0 + v)(\pm \lambda') + (\omega_0 - \lambda)(\pm v') + \lambda'v'$ - eigenfreq. 1D chain

$$J_{xx}(k, \omega) = J_{xx}^1(k, \omega) + J_{xx}^2(k, \omega) = -\frac{\omega}{\det D} [\omega^2 - (\omega_0 + v)(\omega_0 - \lambda) - \lambda'v' + (\omega_0 + v)\lambda' + (\omega_0 - \lambda)v']$$

$$= -\frac{\omega}{\det D} [\omega^2 - \omega_{\pm}^2] \quad (!) \quad \det D = \frac{18}{19} (\omega^2 - \omega_{+}^2)(\omega^2 - \omega_{-}^2)$$

$$J_{xx}(k, \omega) = -\frac{\omega}{(\omega^2 - \omega_{+}^2)(\omega^2 - \omega_{-}^2)} (\omega^2 - \omega_{\pm}^2) = -\frac{\omega}{[\omega^2 - \omega_{\pm}^2(k)]}$$

under wave number $\omega = \omega_{\pm}(k)$, i.e. localized variable $h_x(n, t)$ moves along the chain $\omega_{\pm}(k)$ no symmetry $S_x = S_x^1 + S_x^2$. For comp. $\vec{S}$.

to Yu. Ivanov's paper on $M_y(n, t) \sim S_{xn}(t)$ uniform, a $M_x(n, t) \sim$ nonuniform $\vec{M}$ along the chain $(0, x)$. $M_x \sim S_y$

$\vec{M} = \vec{S} \quad J_{xx}^1(k, \omega) \sim \frac{1}{[\omega^2 - \omega_{\pm}^2(k)]}$ Cooper. probability [Sukh-PB's subm.], 2nd

given $\omega_{\pm}(k)$ $S_{kx}^1 = \pm S_{kx}^2$, $S_{ky}^2 = \mp S_{ky}^1$, i.e. given $\omega_{\pm}(k)$ $S_{kx} = S_{kx}^1 + S_{kx}^2 \neq 0$, a $S_{ky} = S_{ky}^1 + S_{ky}^2 = 0$ even though $M_{ky} \neq 0$,

a given $\omega_{-}(k)$ -magnon $S_{kx} = 0$, $S_{ky} \neq 0$ u even though $M_{kx} \sim S_{ky} \neq 0$.

Even M_{kx} -arbitrary $\neq 0$ to $(\vec{M})_{kx, x} = \sum_n M_{nx} \neq 0$, i.e. H_x bosonization (uniform)

306/59 FMR c $\omega_{-}(0)$ -rational.

(4/11) Kyrgyzstan TV Paris → Hendaie, Dec. 13. Printed Hotel reservations in Poznań & Paris.

$$S_{yk}^1 = \frac{1}{\det D} \begin{vmatrix} \omega_0 + v & 0 & v' & 0 \\ -\omega & h_x & 0 & -\lambda' \\ v' & 0 & \omega_0 + v & \omega \\ 0 & 0 & \omega & \omega_0 - \lambda \end{vmatrix} = \frac{h_x}{\det D} \begin{vmatrix} \omega_0 + v & v' & 0 \\ v' & \omega_0 + v & \omega \\ 0 & \omega & \omega_0 - \lambda \end{vmatrix} = \frac{h_x}{\det D} [(\omega_0 + v)^2(\omega_0 - \lambda) - v'^2(\omega_0 - \lambda) - \omega^2(\omega_0 + v)]$$

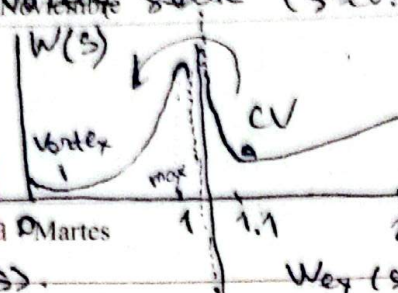
$$S_{yk}^2 = \frac{1}{\det D} \begin{vmatrix} \omega_0 + v & -\omega & v' & 0 \\ -\omega & \omega_0 - \lambda & 0 & h_x \\ v' & 0 & \omega_0 + v & \omega \\ 0 & -\lambda' & \omega & \omega_0 - \lambda \end{vmatrix} = \frac{h_x}{\det D} \begin{vmatrix} \omega_0 + v & -\omega & v' \\ v' & 0 & \omega_0 + v \\ 0 & -\lambda' & \omega \end{vmatrix} = \frac{h_x}{\det D} [-\lambda'v'^2 + \omega^2v' + \lambda'(\omega_0 + v)^2]$$

$$J_{xx}^1(k, \omega) = \frac{\partial S_{yk}^1}{\partial h_x} = \frac{1}{\det D} [(\omega_0 + v)^2(\omega_0 - \lambda) - v'^2(\omega_0 - \lambda) - \omega^2(\omega_0 + v)]$$

$$J_{xx}(k, \omega) = \frac{\partial S_{yk}^2}{\partial h_x(k, \omega)} = \frac{1}{\det D} [-\lambda'v'^2 + \omega^2v' + \lambda'(\omega_0 + v)^2]$$

44 Axioms of Quantum Mechanics

Escaneado con CamScanner



Asteartea ☐ Martes

$W_{ex}(s) = \frac{1}{2} \left(\frac{1}{R} \right)^2 \ln(1-s^2), \quad s < 1$
 $W_{ex}(s) = -\frac{1}{2} \ln\left(1 + \frac{1}{s^2}\right) \frac{1}{R^2}, \quad s > 1$

$W_{ex}(s \rightarrow 1-0) \rightarrow -\infty, \quad W_{ex}(s \rightarrow 1+0) \sim -\ln\left(\frac{s^2-1}{s^2}\right) \sim -\ln(s-1) \rightarrow +\infty$

$W_{ex}(s)$ unner log-polymer w/ $s=1$.

Savel'ev PRB'ou n'pequomum mas, opov: $W_{ex}(s) = -\frac{1}{2} \left(\frac{L_0}{R}\right)^2 \left[\ln\left(1 - \frac{1}{s^2}\right) - A \right]$
 $A = \ln \left(\frac{b^2(4-b^2)}{(b+1)^2} \right)$, b - v. core radius in units of R .

$$f(s) = \ln\left(1 - \frac{1}{s^2}\right) - \ln A = \ln\left[\frac{s^2-1}{s^2} \frac{(b+1)^2}{b^2(1-b^2)}\right], \quad f(1+b) = \ln\left[\frac{b(b+2)}{(1+b)^2} \frac{(1+b)^2}{b^2(1-b^2)}\right] =$$

$$= \ln\left[\frac{1}{b} \frac{1}{(2-b)}\right] \text{ when } s \rightarrow 1+0. \quad f(s) = \ln(1-s^2), \quad f(1-b) = \ln(b(2-b)) < 0, \quad b \ll 1$$

В итоге, $\lim_{s \rightarrow 1+b} f(1+b) = -\ln[b(1-b)] = -f_1(1-b) \sim W_{ex}(1+b) = W_{ex}(1-b)$
 асимптотично при $b \rightarrow 0$ ($s = 1 \pm b$) наст. непрерывности W ($s \rightarrow 1+0$) ($s \rightarrow 1-0$)

формально при $b \rightarrow 0$ ($s = 1 \pm b$) найдем неустойчивость $W_{ex}(s)$ при $s = 1$.

$W_{ex}(s) \Big|_{s=1-b} = \frac{1}{2} \left(\frac{Le}{R} \right)^2 \ln[b(2-b)] \approx \frac{1}{2} \left(\frac{Le}{R} \right)^2 \ln(2b) < 0, b \ll 1.$

$W_A = \frac{1}{2} \left(\frac{Le}{R} \right)^2 \ln \left[\frac{b^2(1-b^2)}{(b+1)^2} \right] \approx |b \ll 1| = \left(\frac{Le}{R} \right)^2 \ln 2b$ сравн.

13 V. core radius w/ $L = 9 \text{ nm}$, $b \approx 0.59 L_e = \frac{10.6 \text{ nm}}{150 \text{ nm}} = 0.0708$.

14 $W_A = \left(\frac{18}{150}\right)^2 \ln[2.0708] = -0.0281$, $W_{\text{eff}}(S > 1) = -\frac{1}{2} \left(\frac{L_e}{R}\right) \ln\left(1 - \frac{1}{c^2}\right) + W_A$.

t.e. у нас W_A - Сивилев 'PRB' 04 (где числом у нас $s=1$) значение $W(s)$ of CV-state на 0.028 - глобально наименьшего значения в eq. $M_2^2 V$.

$$M_s^2 V = (200 G)^2 \pi (150)^2 \cdot 10^{-14} \text{ cm}^2 \cdot 9 \cdot 10^{-7} \text{ cm} = \pi \cdot 64 \cdot 10^4 \cdot 1.5^2 \cdot 9 \cdot 10^4 \cdot 10^{-21} \text{ erg} = \pi \cdot (8 \cdot 1.5 \cdot 3)^2 \cdot 10^{-13} \text{ erg} = 4072 \cdot 10^{-13} \text{ erg} = 4.07 \cdot 10^{-10} \text{ erg}$$

16. $k_B T = 1.38 \cdot 10^{-16} \text{ эрг/К} \cdot 300 \text{ К} = 4.14 \cdot 10^{-14} \text{ эрг}$, $\frac{W_A}{k_B T} = \frac{4.07 \cdot 10^{-10}}{4.14 \cdot 10^{-14}} \cdot 2.8 \cdot 10^2 \approx 275 \gg 1$
 т.е. добавление W_A значительно больше чем $k_B T$, следовательно, процесс протекает необратимо.

Кремний 0.01 в $W(s)$ 300 100 KBT.

Вывод: Значения W_A -свойств $W(s)$ являются константами $W(s > 1)$ и не зависят от s , если $W(s)$ не равно 0 и $s = 1$ не является нулем W_A функции. Сумма $s = 1 - \theta$ и $s = 1 + \theta$.

18. По поводу я и определена ΔE для $C \rightarrow U$ или $CU \rightarrow U$ перехода из экстрем. по величине в Казахстане АПЛ'11.

19 $W_{ex}(1-b) = W_{ex}(1+b)$ и/и VC требует "конечное" это симметрично А.Н.
т. $S=1$ (которая не доказана) а вообще не имеет значения 1/2. (с) at $S=1$.

т. $S=1$ (когда не гоним), а когда не перепрыгивает $W_{ex}(s)$ at $S=1$.
 // Normal $W(s)$ - CV state, W_A - then same as example the normal
 en. barrier, even barrier w/ $S>1$. t.e. W is smaller than AW w/ $S>1$.

310/55
XII Pacnerasna Dureob, hotel rezerv. etc.

Travel S.S. → Paris → Poznan → Paris — S.S. Reunited MFFM - 208

10-18/xii Travel S.S. → Paris → Poznan → Paris — S.S. Pension MFTM - 28
de Lourenz, 11/10

19/xii Справочные e-mail. Беседа с Дик. : построение $\mathbb{Z}_0(\Delta)$, по

дальше не стала. Кого-то из них пошла мне 16/II наг. сзади

$\rho_{\text{acera}} = \rho_a$ (A) de laubens. yzrto Hg-bias u calculate $\cos \theta_0$. (H_z)^c

$\text{WF} = f(\varphi')$. Дан нек-рый процесс $\omega \in A$, рассматривая этот процесс в момент времени t и не зная его будущего, F-мгн. ф-ция Мерсера M_t^{ω}

Aravinda o upogubium ee Contract KA 2013; e-mail to Vicerrectorado.

cega e Araxá - inf. de quem se trata até 2013; e-mail to Vicerrectorado.

(29/1) Julian: Basque ifans euse na nabe pignu, ~ 20 Feb Seminar (Conf. Mead)
 Azal: 11/11/2016 J. Azalado to DTCNMA, cuagan eury of Wmney Jm. letters
 Odeyagene a Ouc. Jm. napanegob deloubens u paacera w. (A) Hago
 guskeat W_H(S) b pole-free model. $W(A) = \frac{1}{2} \frac{\partial^2 W}{\partial s_x^2} \frac{\partial^2 W}{\partial s_y^2} \bigg|_{s_0}$

12

Power $W_G(A)$ de Loubens (baquae) $W_G(A)$ de Loubens (baquae)
 $W(\vec{s}) = W_m(\vec{s}) + W_H(\vec{s})$ - total energy
 $\vec{s}_0(A) = \vec{s}_0(H)$ - static v. core position at the field $H(\vec{r})$ - equilibrium.
 Astelehen: Lunes
 Myers $\vec{s} = \vec{s} - \vec{s}_0$, $|\vec{s}| \ll 1$. $W(\vec{s}) = W(\vec{s}_0) + \frac{\partial W}{\partial s_x}(\vec{s}_0) s_x + \frac{1}{2} \frac{\partial^2 W}{\partial s_x^2} s_x^2 + \frac{1}{2} \frac{\partial^2 W}{\partial s_x \partial s_y} s_x s_y + \frac{1}{2} \frac{\partial^2 W}{\partial s_y^2} s_y^2$

reaguar. paguoneme no $\vec{s} = \vec{s} - \vec{s}_0$. $\alpha_{dp} = \frac{\partial^2 W}{\partial s_x \partial s_y} \bigg|_{s_0}$, $\frac{\partial W}{\partial s_x} \bigg|_{s_0} = 0$

$W(\vec{s}) = W(0) + \frac{1}{2} \alpha_{dp} s_x s_y$. Thiele eq. $\begin{cases} -G \ddot{y} = \frac{\partial W}{\partial y} = \alpha_{xx} \ddot{y} + \alpha_{xy} \ddot{x} \\ G \ddot{x} = \frac{\partial W}{\partial x} = \alpha_{xy} \ddot{y} + \alpha_{yy} \ddot{x} \end{cases}$

$\ddot{x}(t) = \ddot{x} e^{i\omega t} \rightarrow \begin{pmatrix} \alpha_{xx} & \alpha_{xy} + i\omega G \\ \alpha_{xy} - i\omega G & \alpha_{yy} \end{pmatrix} \begin{pmatrix} \ddot{x} \\ \ddot{y} \end{pmatrix} = 0$

$\det A(\omega) = \alpha_{xx} \alpha_{yy} - (\alpha_{xy} + i\omega G)(\alpha_{xy} - i\omega G) = 0$, $\alpha_{xx} \alpha_{yy} - \alpha_{xy}^2 - \omega^2 G^2 = 0$

$\omega^2 = \frac{1}{G^2} [\alpha_{xx} \alpha_{yy} - \alpha_{xy}^2]$, $\alpha_{xx} \alpha_{yy} - \alpha_{xy}^2 = \alpha_{dp}^2(\vec{s}_0)$

$\omega_G^2(A) = \frac{1}{G^2} [\alpha_{xx}(\vec{s}_0) \alpha_{yy}(\vec{s}_0) - \alpha_{xy}^2(\vec{s}_0)]$, $\vec{s}_0 = \vec{s}_0(A)$ w static poeosa, A - tip position.

- wpoema tip yensa na xOy - wnochoe goa
 D - pacoema of yensa tip go wnochoe goa

Myers $\vec{A} = (A_x, 0)$, $A_x = A$, tip gbumerue 11 OX.

$W = W_m + W_H$, W_{ex} buag nar. $W_m + W_{ex} = \frac{\alpha}{2} |\vec{s}|^2 + \frac{\alpha'}{4} |\vec{s}|^4 = W_{me}$

$\frac{\partial W_{me}}{\partial s_x} = \frac{\partial}{\partial s_x} \left(\frac{\alpha}{2} |\vec{s}|^2 + \frac{\alpha'}{4} |\vec{s}|^4 \right) = \alpha s_x + \alpha' |\vec{s}|^2 s_x$

$\frac{\partial^2 W_{me}}{\partial s_x \partial s_y} = \frac{\partial}{\partial s_y} (\alpha s_x + \alpha' |\vec{s}|^2 s_x) = \alpha \delta_{dp} + \alpha' [s_y |\vec{s}|^2 + s_x \frac{\partial |\vec{s}|^2}{\partial s_y}] =$

$= \alpha \delta_{dp} + \alpha' [s_y |\vec{s}|^2 + s_x \cdot 2 s_y] = (\alpha + \alpha' |\vec{s}|^2) \delta_{dp} + 2 \alpha' s_x s_y$. Myers $W_H \approx 0$

$G^2 \omega_G^2 = |\text{meo } W_{me} \text{ buag}| = [(\alpha + \alpha' |\vec{s}|^2) 2 \alpha s_x^2 + 2 \alpha \alpha' s_x^2 s_y^2 + \alpha \alpha' |\vec{s}|^2 + 2 \alpha \alpha' s_y^2] =$

$= [\alpha^2 + 2 \alpha \alpha' |\vec{s}|^2 + 2 \alpha \alpha' (s_x^2 + s_y^2)] = \alpha^2 [1 + 4 \frac{\alpha'}{\alpha} |\vec{s}|^2]$, $\omega_0 = \alpha/G$

$\omega_G^2 = \omega_0^2 [1 + 4 \frac{\alpha'}{\alpha} |\vec{s}|^2]$ um $\omega_G(A) = \omega_0 [1 + 2 \frac{\alpha'}{\alpha} |\vec{s}_0(A)|^2]$ - zabucumoe tip. zecora

tip position A on/egle. non-linear term α' .
 $\alpha_{dp}^{me} = (\alpha + \alpha' |\vec{s}|^2) \delta_{dp} + 2 \alpha' s_x s_y \big|_{\vec{s}=\vec{s}_0}$. Ho erco euse $\alpha_{dp}^H = \frac{\partial^2 W_H}{\partial s_x \partial s_y} \bigg|_{s_0}$

$W_H(\vec{s}) = - \int dV \vec{H}(\vec{r}) \cdot \vec{m}(\vec{r}, \vec{s})$. $H/\mu H_2 \neq 0$ (u uniform) $\alpha_{me} \rightarrow \alpha_{me} \sin^2 \theta_0$, $\cos \theta_0 = H_z/H_2$. $\alpha \rightarrow \alpha \sin^2 \theta_0$, $\alpha' \rightarrow \alpha' \sin^2 \theta_0$.

$W_H(\vec{s}) = - \int dV [H_x m_x(\vec{r}, \vec{s}) + H_y m_y(\vec{r}, \vec{s})] = - \int dV H_2(\vec{r}) m_z(\vec{r}, \vec{s})$

$\frac{\partial^2 \varphi}{\partial s_x^2} \Big|_{s=0} = (1-g^4) \sin 2\varphi; \quad \frac{\partial^2 \varphi}{\partial s_y^2} \Big|_{s=0} = -\frac{(1-g^4)}{g^2} \sin 2\varphi; \quad \frac{\partial^2 \varphi}{\partial s_x \partial s_y} \Big|_{s=0} = -\frac{(1-g^4)}{g^2} \cos 2\varphi.$

Аналог $\frac{\partial^2 W_H}{\partial s_x \partial s_y} \Big|_{s=0} = \frac{\partial^2 W_H}{\partial s_x \partial s_y} \Big|_{s=0}.$ (Lamer $W_H(s) = a_1 s_x + \frac{1}{2} a_2 s_x^2 + \frac{1}{2} a_3 s_y^2 + O(s^3).$

14 $\frac{\partial^2 W_H}{\partial s_x \partial s_y} = -\int dV \operatorname{Re} \left[\bar{H} \frac{\partial^2 e^{i\varphi}}{\partial s_x \partial s_y} \right], \quad \frac{\partial^2 e^{i\varphi}}{\partial s_x \partial s_y} = e^{i\varphi} \left[\frac{\partial \varphi}{\partial s_x} \frac{\partial \varphi}{\partial s_y} + i \frac{\partial^2 \varphi}{\partial s_x \partial s_y} \right]$

Аналог $\frac{\partial^2 W_H}{\partial s_x \partial s_y} \Big|_{s=0} = \frac{\partial^2 W_H}{\partial s_x \partial s_y} \Big|_{s=0}.$ $\varphi(s=0) = \sigma \pi + \varphi.$

$m = m_x + i m_y = e^{i\varphi}, \quad \frac{\partial^2 m_x}{\partial s_x \partial s_y} = e^{i\varphi} \left[-\frac{\partial \varphi}{\partial s_x} \frac{\partial \varphi}{\partial s_y} + i \frac{\partial^2 \varphi}{\partial s_x \partial s_y} \right] =$

$= [\cos \varphi + i \sin \varphi] \left[-\frac{\partial \varphi}{\partial s_x} \frac{\partial \varphi}{\partial s_y} + i \frac{\partial^2 \varphi}{\partial s_x \partial s_y} \right] \Rightarrow \frac{\partial^2 m_x}{\partial s_x \partial s_y} = \left[-\frac{\partial \varphi}{\partial s_x} \frac{\partial \varphi}{\partial s_y} \right] \cos \varphi - \frac{\partial^2 \varphi}{\partial s_x \partial s_y} \sin \varphi$

$\frac{\partial^2 m_y}{\partial s_x \partial s_y} = \left[-\frac{\partial \varphi}{\partial s_x} \frac{\partial \varphi}{\partial s_y} \right] \sin \varphi + \frac{\partial^2 \varphi}{\partial s_x \partial s_y} \cos \varphi.$

$W_H(s) = (m_x s_x) + \frac{1}{2} \frac{\partial^2 W_H}{\partial s_x \partial s_y} s_x s_y, \quad \frac{\partial^2 W_H}{\partial s_x \partial s_y} = -\int dV \left[H_x \frac{\partial^2 m_x}{\partial s_x \partial s_y} + H_y \frac{\partial^2 m_y}{\partial s_x \partial s_y} \right]$

$\frac{\partial^2 m_x}{\partial s_x^2} = -\left(\frac{\partial \varphi}{\partial s_x}\right)^2 \cos \varphi - \frac{\partial^2 \varphi}{\partial s_x^2} \sin \varphi \approx (m_x s=0) = -m_0^2 \sin^2 \varphi \cos \varphi_0 - \frac{(1-g^4)}{g^2} \sin^2 \varphi \sin \varphi_0$

$\frac{\partial^2 m_x}{\partial s_y^2} = -\left(\frac{\partial \varphi}{\partial s_y}\right)^2 \cos \varphi - \frac{\partial^2 \varphi}{\partial s_y^2} \sin \varphi = -m_0^2 \cos^2 \varphi \cos \varphi_0 + \frac{(1-g^4)}{g^2} \sin^2 \varphi \sin \varphi_0, \quad s=0$

$\frac{\partial^2 m_x}{\partial s_x \partial s_y} = -\frac{\partial \varphi}{\partial s_x} \frac{\partial \varphi}{\partial s_y} \cos \varphi - \frac{\partial^2 \varphi}{\partial s_x \partial s_y} \sin \varphi = m_0^2 \sin \varphi \cos \varphi \cos \varphi_0 + \frac{(1-g^4)}{g^2} \cos^2 \varphi \sin \varphi_0, \quad s=0$

$\lambda_x = \frac{1}{2} \frac{\partial^2 m_x}{\partial s_x \partial s_y} s_x s_y = \frac{1}{2} \frac{\partial^2 m_x}{\partial s_x^2} s_x^2 + \frac{1}{2} \frac{\partial^2 m_x}{\partial s_y^2} s_y^2 + \frac{\partial^2 m_x}{\partial s_x \partial s_y} s_x s_y =$

$= \frac{s_x^2}{2} \left[m_0^2 \sin^2 \varphi - \frac{(1-g^4)}{g^2} \sin^2 \varphi \cos \varphi \right] + \frac{s_y^2}{2} \left[m_0^2 \cos^2 \varphi \sin \varphi + \frac{(1-g^4)}{g^2} \sin^2 \varphi \cos \varphi \right] +$

$+ s_x s_y \left[-m_0^2 \sin^2 \varphi \cos \varphi + \frac{(1-g^4)}{g^2} \cos^2 \varphi \cos \varphi \right], \quad \text{где } \cos \varphi_0 = \cos(\varphi + \sigma \frac{\pi}{2}) = -\sigma \sin \varphi$

$m_0^2 = \left[\frac{1}{g} (1-g^2) \right]^2 = \frac{1}{g^2} (1-g^2)^2 = \frac{1}{g^2} (1-2g^2+g^4)$ $\sin \varphi_0 = \sin(\varphi + \sigma \frac{\pi}{2}) = \sigma \cos \varphi$

$\frac{1}{\sigma} \lambda_x = \frac{1}{2} s_x^2 \sin \varphi \left[m_0^2 \sin^2 \varphi - 2 \frac{(1-g^4)}{g^2} \cos^2 \varphi \right] + \frac{1}{2} s_y^2 \cos^2 \varphi \sin \varphi \left[m_0^2 + 2 \frac{(1-g^4)}{g^2} \right] +$

$+ s_x s_y \cos \varphi \left[-m_0^2 \sin^2 \varphi + \frac{(1-g^4)}{g^2} \cos^2 \varphi \right], \quad \text{мы же } \sigma=1.$

$H_x = 3\mu \frac{(z+d)(g \cos \varphi - \Delta)}{[(g \cos \varphi - \Delta)^2 + g^2 \sin^2 \varphi + (z+d)^2]^{3/2}}, \quad H_y = 3\mu \frac{(z+d)g \sin \varphi}{[(g \cos \varphi - \Delta)^2 + g^2 \sin^2 \varphi + (z+d)^2]^{3/2}}, \quad \mu = \frac{4\pi M_0^2}{3} \text{ - момент маг. дип.}$

Δ - расстояние от центра до верхнего дп, Δ - ось дип || Ox, Δ - ось R -

$H_x(\varphi)$ - значение по φ , $H_y(\varphi)$ - значение по φ . $\int_{-\pi}^{\pi} d\varphi = \int_{-\pi}^{\pi} d\varphi (\dots) \text{ умножить на } d\varphi$

Уз λ_x и μ для вычисления числа "зерна по φ " расч

18 $\lambda_x = s_x s_y \cos \varphi \left[-m_0^2 \sin^2 \varphi + \frac{(1-g^4)}{g^2} \cos^2 \varphi \right]$

$\lambda_y = \frac{1}{2} \frac{\partial^2 m_y}{\partial s_x \partial s_y} s_x s_y = \frac{1}{2} s_x^2 \frac{\partial^2 m_y}{\partial s_x^2} + \frac{1}{2} s_y^2 \frac{\partial^2 m_y}{\partial s_y^2} + s_x s_y \frac{\partial^2 m_y}{\partial s_x \partial s_y} =$

$= \frac{1}{2} s_x^2 \left[-\left(\frac{\partial \varphi}{\partial s_x}\right)^2 \cos \varphi + \frac{\partial^2 \varphi}{\partial s_x^2} (-1) \sin \varphi \right] + \frac{1}{2} s_y^2 \left[-\left(\frac{\partial \varphi}{\partial s_y}\right)^2 \cos \varphi + \frac{\partial^2 \varphi}{\partial s_y^2} (-1) \sin \varphi \right] +$

$+ s_x s_y \left[-\frac{\partial \varphi}{\partial s_x} \frac{\partial \varphi}{\partial s_y} \cos \varphi + \frac{\partial^2 \varphi}{\partial s_x \partial s_y} (-1) \sin \varphi \right], \quad \text{т.к. } H_y(\varphi) \text{ - здесь, то вычисление}$

$\lambda_y = -\frac{1}{2} s_x^2 \sin \varphi \frac{(1-g^4)}{g^2} \sin^2 \varphi + \frac{1}{2} s_y^2 \sin \varphi \frac{(1-g^4)}{g^2} \sin^2 \varphi + s_x s_y \left[m_0^2 \sin \varphi \cos^2 \varphi + \frac{(1-g^4)}{g^2} \cos^2 \varphi \sin \varphi \right]$

$\lambda_y = \frac{1}{2} \frac{(1-g^4)}{g^2} \sin \varphi \sin^2 \varphi (s_y^2 - s_x^2) + s_x s_y \sin \varphi \left[m_0^2 \cos^2 \varphi + \frac{(1-g^4)}{g^2} \cos^2 \varphi \right]$

$\lambda_y = s_x s_y \sin \varphi \left[m_0^2 \cos^2 \varphi + \frac{(1-g^4)}{g^2} \cos^2 \varphi \right]. \quad \text{Очевидно, что } s_x s_y \text{ - не нуль}$

$W_H(s) = (m_x s_x) - \frac{1}{2} \int dV \left[H_x \frac{\partial^2 m_x}{\partial s_x \partial s_y} + H_y \frac{\partial^2 m_y}{\partial s_x \partial s_y} \right] s_x s_y = (\dots) = \int dV [\lambda_x H_x + \lambda_y H_y]$

то есть $\lambda_x, \lambda_y \sim s_x s_y$ то $\lambda_x H_x$ имеет размерность $\lambda_x H_x \neq 0$. $\text{Нужно еще } y \text{ расч}$

Нужно $\lambda_x \rightarrow \lambda_x \sin^2 \theta_0(H_x)$ и $\lambda_y \rightarrow \lambda_y \sin^2 \theta_0(H_y)$, $\cos \theta_0(H_x) = H_x/H_0$

$$L_x = \int dV H_x \lambda_x = 3\mu S_x S_y \int dz \int d\phi \int d\varphi \frac{(z+d)(S \cos \varphi - A) \cos \varphi}{-m_0^2 \sin^2 \varphi +}$$

$$\int \frac{(z+d)}{[u^2+(z+d)^2]^{5/2}} dz = \left| \frac{(z+d)^2=t}{u^2+(z+d)^2=t} \right| = \frac{1}{2} \int \frac{dt}{[u^2+t]^{5/2}} = \frac{1}{2} \int \frac{dt}{t^{5/2}} = \frac{1}{2} \left(-\frac{2}{3}\right) t^{-3/2} =$$

$$-\frac{1}{3} [u^2 + (L+d)^2]^{-3/2} \Big|_0^L = \left[\frac{1}{[u^2 + (L+d)^2]^{3/2}} - \frac{1}{[u^2 + d^2]^{3/2}} \right]$$

$$u^2 = g^2 - 2g\Delta \cos \varphi + \Delta^2, \quad u^2 + \tilde{z}^2 = g^2 - 2g\Delta \cos \varphi + \Delta^2 + \tilde{z}^2 = \Delta^2 + \tilde{z}^2 \left[1 + \frac{g^2 - 2g\Delta \cos \varphi}{\Delta^2 + \tilde{z}^2} \right]$$

$\varphi \in [0, \pi], \Delta = 0 \div 3, d = 3 \div 5, \frac{g^2 - 2g\Delta \cos \varphi}{\Delta^2 + \tilde{z}^2} < 1$ где числитель, наименьше

Wannvorgehen $L (L/R \approx 0.09) \ll d (3-5) \cdot \frac{\Delta^2 + (z+d)^2}{25} \int_0^L \frac{(z+d)}{[\dots]^{5/2}} \approx L \frac{d}{[u^2 + d^2]^{5/2}}$

$$L'' = 3M^2 S_x S_y L d \int_0^{\frac{1}{2}} g g \int_0^{2\pi} d\varphi \frac{(g \cos \varphi - A) \cdot \cos \varphi}{[g^2 - 2gA \cos \varphi + A^2 + d^2]^{\frac{5}{2}}} \left[\frac{m^2}{g^2} \sin^2 \varphi + \frac{(1-g^2)}{g^2} \cos^2 \varphi \right]$$

$$\frac{1}{[\dots]^{5/2}} = \frac{1}{[\Delta^2 + d^2]^{5/2}} \frac{1}{(1+e)^{5/2}} = \frac{1}{[\Delta^2 + d^2]^{5/2}} \left[1 - \frac{5}{2} \frac{(g^2 - 2g\Delta \cos \varphi)}{\Delta^2 + d^2} \right]$$

$$J_x = \int_0^{2\pi} \int_0^{\pi} (s \cos \varphi - \Delta) \left[1 - \frac{5}{2} \frac{(s^2 - 2s\Delta \cos \varphi)}{\Delta^2 + d^2} \right] \left[-m_0^2(s) \sin^2 \varphi + \frac{(1-s^4)}{s^2} \cos 2\varphi \right] ds d\varphi$$

$$= \int_0^{2\pi} d\varphi \left[g \cos \varphi - \Delta - \frac{5}{2g} \frac{\{g^2 \cos \varphi - 2\Delta g \cos^2 \varphi - \Delta^2 + 2\Delta^2 \cos \varphi\}}{\Delta^2 + d^2} \right] \left[-m_0^2 \sin^2 \varphi + \frac{(1-g^2)}{g^2} \cos 2\varphi \right]$$

$$\log \left[-\Delta + \frac{5}{2} \frac{g^2 A}{\Delta^2 d^2} (1 + 2 \cos^2 \varphi) \right] \left[-m_0^2 \sin^2 \varphi + \frac{(1 - g^4)}{g^2} \cos^2 2\varphi \right] \approx$$

$$= \pi \Delta \int_0^1 \frac{d\varphi}{(1-2g^2+g^4)} = \pi \Delta \left[\ln g - 2 \frac{g^2}{\frac{1}{2}} + \frac{g^4}{\frac{1}{4}} \right]_0^1 = \pi \Delta \left[-1 + \frac{1}{4} - (\ln e - e^2 + \frac{e^4}{4}) \right]$$

$$\approx 10 \pi \Delta \left[\ln \frac{1}{\frac{3}{4}} \right] \cdot \Lambda_x = 3 \mu S_x S_y \frac{L d}{a} \frac{1}{(\Delta^2 + d^2)^{5/2}} \pi \Delta \left(\ln \frac{1}{\frac{3}{4}} - \frac{3}{4} \right) M_S \quad \left(\frac{M_S}{M_0} = \frac{r \cdot x}{\vec{m}^2 / M_0} \right)$$

$$\Delta_x = 3\mu M_s \pi \frac{\beta d \Delta}{(\Delta^2 + d^2)^{5/2}} \left(\ln \frac{1}{\epsilon} - \frac{3}{4} \right) S_x S_y \quad (\text{erg}), \quad \beta = 4/R, \quad d, \Delta \text{ eq. R. } \mu = \text{non-magnetic tip}$$

$$W_{me} = \frac{\alpha}{2} |\vec{S}|^2 + \frac{\alpha'}{4} |\vec{S}|^4, \quad W(\vec{S}) = W_{me}(\vec{S}) - \Lambda_x(\vec{S}) - \Lambda_y(\vec{S})$$

beginning Δx no сравн. с x (pole-free model). $x = \omega_0 G^2 = \frac{20}{9} \gamma M_s \beta \cdot \frac{2\pi M_s L}{8} R^2 =$
 $= \frac{20}{9} 2\pi M_s^2 \beta L R^2 = \frac{40}{9} M_s^2 \beta V_{dot} \cdot // \Delta x = 3\pi \gamma M_s (\ln 4 - \frac{3}{4}) \beta \Delta$

$$= \frac{20}{9} 2\pi M_s^2 \beta L R^2 = \frac{10}{9} M_s^2 \beta V_{dot} \cdot \frac{2Lx}{\alpha} = \frac{50\pi M_s^2 (2000 \text{ m})^2 \beta \Delta}{40 M_s^2 \beta V_{dot} (\Delta^2 + d^2)^{5/2}} =$$

$$= \frac{275}{40} \left(\ln \frac{1}{e} - \frac{3}{4} \right) \frac{\mu}{\mu_{\text{dot}}} \frac{d\Delta}{(\Delta^2 + d^2)^{5/2}}, \quad \mu_{\text{dot}} = \mu_s V_{\text{dot}} \cdot \frac{\mu}{\mu_{\text{dot}}} = \frac{\mu_0 V_0}{\mu_s V_{\text{dot}}}$$

$$M_{\text{del}} = 1,35 \cdot 10^3 \text{ G} \cdot (27 \text{ nm}) \cdot \pi (300 \text{ nm})^2 = 1,35 \cdot 10^3 \text{ G} \cdot 2,7 \cdot 10^{-6} \text{ cm} \cdot \pi (3 \cdot 10^2 \cdot 10^{-7} \text{ cm})^2 =$$

$$= 1,35 \cdot 10^3 \cdot 2,7 \cdot 10^{-6} \pi \cdot 9 \cdot 10^{-10} \text{ emu} = 1,35 \cdot 2,7 \cdot \pi \cdot 9 \cdot 10^{-12} \text{ emu} = 1,03 \cdot 10^{-11} \text{ emu}$$

$$= 2.1 \left(\ln \frac{1}{e} - \frac{3}{4} \right) \frac{\mu}{\mu_{\text{dot}}} \frac{d\Delta}{(\Delta^2 + d^2)^{5/2}} = \left| \frac{\Delta=2}{d=3} \right| \approx 2 \cdot \frac{4 \cdot 10^{-10} \text{ cm}^4}{1.03 \cdot 10^{-11} \text{ cm}^4} \frac{6}{(4+9)^{5/2}} \approx 2 \cdot 40 \cdot \frac{6}{610} \approx$$

$\Delta x \approx \frac{1}{2} \Delta x_{\text{max}} = \frac{1}{2} \cdot 1,05 \cdot 10^{-27} \cdot 4 \cdot 9^{1/2} = 610^{-27}$
 $\Delta x \approx 0,42 \Delta x_{\text{max}} = 0,42 \cdot 1,05 \cdot 10^{-27} \cdot 4 \cdot 9^{1/2} = 610^{-27}$
 $\Delta x \approx 0,42 \Delta x_{\text{max}} = 0,42 \cdot 1,05 \cdot 10^{-27} \cdot 4 \cdot 9^{1/2} = 610^{-27}$

$x = 2 \cdot 0,21x = 0,42x < x$. $\frac{\sqrt{Lx}}{2x} \approx \left(\frac{Lx}{x}\right)^{\frac{1}{0,42}} = \frac{0,79}{0,42} \approx 1,9$ —
 e. non-linear Zeeman below the non-linear magnetostatic (x'). Semana • Aste 46

~~Planteia no lemnire e non-linear magnetostatics (2).~~ Semana • Aste 46
4.º grupo $\frac{1}{2\pi}$ genera w $\Delta = 2R$, γ e. $\text{b\u00f4rger max } w_G(\Delta)$, w $\Delta \leq R$ OTOM.
m\u00e9trique

Azaroa • Noviembre

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Oaximala • Viernes

$$\begin{aligned} \Lambda_y &= \int dV \mu_y \lambda_y = 3\mu \int_0^L dz \int_0^{2\pi} d\phi \int_0^\pi d\theta \frac{(z+d) \sin\theta}{[(z-d)^2 + (z+d)^2]^{5/2}} \lambda_y \\ &= 3\mu L d \int_0^{2\pi} d\phi \int_0^\pi d\theta \frac{g \sin^2\theta \cdot S_x S_y}{[g^2 - 2g \cos\theta + \Delta^2 + d^2]^{5/2}} \left[m_0^2 \cos^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right] \\ &= 3\mu L d S_x S_y \int_0^{2\pi} d\phi \int_0^\pi d\theta \frac{g \sin^2\theta}{[g^2 - 2g \cos\theta + \Delta^2 + d^2]^{5/2}} \left[1 - \frac{5}{2} \frac{g(9-2\Delta \cos\theta)}{\Delta^2 + d^2} \right] \left[m_0^2 \cos^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right] \\ &\approx 3\mu \beta d S_x S_y \int_0^{2\pi} d\phi \int_0^\pi d\theta \sin^2\theta \left[m_0^2 \cos^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right] \cdot \frac{1}{(\Delta^2 + d^2)^{5/2}} \\ \int_0^{2\pi} d\phi \sin^2\theta \cos^2\theta &= \frac{1}{4} \int_0^{2\pi} d\phi \sin^2 2\theta = \frac{1}{4} 2 \int_0^\pi d\phi \sin^2 2\theta = \frac{\pi}{4} \\ \int_0^{2\pi} d\phi \sin^2\theta \cos 2\theta &= \int_0^{2\pi} d\phi \frac{1}{2} (1 - \cos 2\theta) \cos 2\theta = -\frac{1}{2} \int_0^{2\pi} d\phi \cos^2 2\theta = -\frac{\pi}{2} \\ \Lambda_y &= 3\mu \beta d \frac{S_x S_y}{(\Delta^2 + d^2)^{5/2}} \int_0^{2\pi} d\phi \int_0^\pi d\theta \left[m_0^2 \cos^2\theta \frac{\pi}{4} + \frac{(1-g^4)}{g^2} \cos 2\theta \left(-\frac{\pi}{2}\right) \right] \\ &= 3\mu \beta d \frac{S_x S_y}{(\Delta^2 + d^2)^{5/2}} \int_0^{2\pi} d\phi \int_0^\pi d\theta \left[2m_0^2 - \frac{1}{g^2} (1-g^4) \right] \\ &= (-) \int_0^{2\pi} d\phi \left[2 - 4g^2 + 3g^4 - 1 \right] = (-) \left[g - 4 \frac{g^3}{3} + 3 \frac{g^5}{5} \right]_0^{2\pi} = (-) \left[1 - \frac{4}{3} + \frac{3}{5} \right] = \frac{4}{15} (-) \\ \Lambda_y &= \frac{3}{2} \pi \frac{4}{15} \frac{\mu \beta d}{(\Delta^2 + d^2)^{5/2}} S_x S_y = \frac{2\pi}{5} \frac{\mu \beta d}{(\Delta^2 + d^2)^{5/2}} S_x S_y \end{aligned}$$

Wefecur. Λ_x : $\Lambda_x \sim J_x$. $J_x = \int d\phi \int d\theta (g \cos\theta - \Delta) \left[1 - \frac{5}{2} \frac{g(9-2\Delta \cos\theta)}{\Delta^2 + d^2} \right] \cos\theta \times$
 $\times \left[-m_0^2 \sin^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right] = \int d\phi \int d\theta \left[g \cos\theta - \Delta - \frac{5}{2} \frac{g}{\Delta^2 + d^2} \{ g^2 \cos\theta - 2\Delta g \cos^2\theta - \right.$
 $\left. - \Delta g + 2\Delta^2 \cos\theta \} \right] \cos\theta \left[-m_0^2 \sin^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right] = \int d\phi \int d\theta \left[g \cos^2\theta - \right.$
 $\left. - \frac{5}{2} \frac{g}{\Delta^2 + d^2} \{ g^2 \cos^2\theta + 2\Delta^2 \cos^2\theta \} \right] \left[-m_0^2 \sin^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right]$

$$\begin{aligned} \int_0^{2\pi} d\phi \cos^2\theta \cos 2\theta &= \frac{1}{2} \int_0^{2\pi} d\phi (1 + \cos 2\theta) \cos 2\theta = \frac{1}{2} \int_0^{2\pi} d\phi \cos^2 2\theta = \pi/2 \\ J_x &= \int d\phi \int d\theta \left[1 - \frac{5}{2} \frac{1}{\Delta^2 + d^2} (g^2 + 2\Delta^2) \right] \cos^2\theta \left[-m_0^2 \sin^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right] \\ &= \int d\phi \int d\theta \left[1 - \frac{5}{2} \frac{(g^2 + 2\Delta^2)}{\Delta^2 + d^2} \right] \left[-m_0^2 \frac{\pi}{4} + \frac{(1-g^4)}{g^2} \frac{\pi}{2} \right] \end{aligned}$$

$$\Lambda_x = 3\mu S_x S_y \beta d \frac{1}{(\Delta^2 + d^2)^{5/2}} \int d\phi \int d\theta \left[-2m_0^2 + \frac{(1-g^4)}{g^2} \right] \frac{\pi}{2} \left[1 - \frac{5}{2} \frac{(g^2 + 2\Delta^2)}{\Delta^2 + d^2} \right]$$

buque no n. men 1 b [...] comp... a $(g^2 + 2\Delta^2)/(\Delta^2 + d^2)$ - men ne g... $\ll 1$. $(W_h(S) = (-) - \Lambda_x - \Lambda_y$

$$\begin{aligned} \Lambda_x + \Lambda_y &= \int dV \left[(g \cos\theta - \Delta) \cos\theta \left\{ -m_0^2 \sin^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right\} + \right. \\ &\quad \left. + g \sin^2\theta \left\{ m_0^2 \cos^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right\} \right] (z+d) S_x S_y = \left| \int_0^L dz \right| = \\ &= 3\mu S_x S_y L d \int d\phi \int d\theta \left[\frac{(1-g^4)}{g} \cos 2\theta - \Delta \cos\theta \left\{ -m_0^2 \sin^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right\} \right] \frac{1}{[g^2 - 2\Delta g \cos\theta + \Delta^2 + d^2]^{5/2}} \\ \Lambda = \Lambda_x + \Lambda_y &= 3\mu S_x S_y \beta d \int d\phi \int d\theta \left[\frac{1}{g} (1-g^4) \cos 2\theta - \Delta \cos\theta \left\{ -m_0^2 \sin^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right\} \right] \frac{1}{[g^2 - 2\Delta g \cos\theta + \Delta^2 + d^2]^{5/2}} \end{aligned}$$

Largabata • Sábado Λ_x cosu b zmanenarene, vo $\Lambda_x + \Lambda_y = 0$ Domingo Igandea

321/44 $m_0 = \frac{1}{2}(1-g^2)$

$$\begin{aligned} [1 - \frac{5}{2} x]^{-5/2} &= 1 + \frac{5}{2} x + \frac{5 \cdot 7}{2 \cdot 4} x^2 + \frac{5 \cdot 7 \cdot 9}{2 \cdot 4 \cdot 6} x^3 + \dots, \quad x = \frac{2\Delta g \cos\theta}{g^2 + \Delta^2 + d^2} \\ a_2/a_1 &= \frac{5 \cdot 7}{2 \cdot 4} x^2 \cdot \frac{2}{5x} = \frac{7}{4} x \ll 1, \text{ ecun } x \ll (7/4)^{-1} = 4/7. \\ \Lambda_x + \Lambda_y &= 3\mu \beta d S_x S_y \int d\phi \int d\theta \frac{[1 + 5 \frac{\Delta g \cos\theta}{g^2 + \Delta^2 + d^2}]}{[g^2 + \Delta^2 + d^2]^{5/2}} \left[\frac{(1-g^4)}{g} \cos 2\theta - \Delta \cos\theta \left\{ -m_0^2 \sin^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right\} \right] \\ &= 3\mu \beta d S_x S_y (-5) \Delta^2 \int d\phi \int d\theta \frac{1}{[g^2 + \Delta^2 + d^2]^{7/2}} \cos^2\theta \left\{ -m_0^2 \sin^2\theta + \frac{(1-g^4)}{g^2} \cos 2\theta \right\} = \\ &= -15\mu \beta d^2 S_x S_y \int d\phi \int d\theta \frac{1}{[g^2 + \Delta^2 + d^2]^{7/2}} \left\{ -\frac{\pi}{4} m_0^2 + \frac{\pi}{2} \frac{(1-g^4)}{g^2} \right\} = -\frac{15\pi}{2} \mu \beta d^2 S_x S_y \int d\phi \frac{[-1 + 4g^2 - 3g^4]}{[g^2 + \Delta^2 + d^2]^{7/2}} \\ \frac{1}{\mu} (\Lambda_x + \Lambda_y) &\approx 2\pi \mu \cdot \beta d^2 S_x S_y / [\Delta^2 + d^2]^{7/2}, \text{ ecun } \mu \text{ fene } b \text{ zmanenarene } g^2 \text{ b zmanenarene.} \end{aligned}$$

46 Aste • Semana

[illegible]

19

e. 6 perone max $u_{\mathcal{G}}(\Delta)$, $\Delta=2$

for $\Delta = 0$ $\frac{\partial x}{\partial y} = \frac{w_H}{w_H} = 1$

hacizka b Madrid a Am. 4/II nozom passport appl. Aurora

10/11 Found game. Result. Multiple PRB c Figs - corrected, uncorrected
Rev. na Gubbio - SW PRB. Paper na paper c Morro Vermo no

11) Credit Cards Jan. Dec. 2012 to Jan. 2013. BZBWA corrected Aukel (DM he corrected)

План форм. работы: 1) мн. cases Nov. 18, 2012 августов: 2) орзери по 3-м
даты: 22-25 Feb. 3) орзери по ком. 6 Barcelona и Madrid

EC program - deadlines 22-25 Feb., 3) as left no room. 6 Barcelona u Madrid
JAP u IMM - Moscow. 5) new v. barrier model for Melkov-papers

Непрямая по DICMA Conf - c invited speakers. Venue Review - Berlin 20

$\omega_2(A)$ - расчёт (ω_H - x_H расчёт, x_H слабо влияет на $\omega_2(A)$), а величина x' слабо влияет с

$$\vec{S} = \vec{S}_0 + \vec{L} = \vec{S}_0 + \vec{L}$$

$$W_H(\vec{s}) = (m, n, c) = \Lambda_1 - \Lambda_2 = (-1) - \Lambda_3 \times \Lambda_4 \quad \left(2\alpha' s_x s_y \quad x + \alpha' \frac{s_x^2}{2s_y} \right) \quad \alpha_{xy}^H = -\Lambda_1 + \alpha_{xy}^{234}$$

$$\mathcal{L}_{\text{eff}} = \frac{\partial^2 W_H}{\partial \phi \partial \phi} \Big|_{\phi=0} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}, \quad \underline{\Lambda} = \underline{\Lambda}_x + \underline{\Lambda}_y (\delta_3 s_x s_y), \quad G^2 \omega_G^2 = (x + x' |s|^2 + 2x' s_x^2)$$

$$x(x + x'|\mathbf{s}|^2 + 2x's_y) - (x'x_{me} + x'y)^2 = x^2 \left[1 + 4 \frac{x'}{x} |\mathbf{s}|^2 \right] - (2x's_y - \mathbb{1})^2, \quad \mathbb{1} \rightarrow \mathbb{1} \text{ Sch.}$$

$$\omega_c^2 \approx \alpha^2 \sin^2 \theta_0 [1 + 4 \frac{\alpha'}{\alpha} |s|^2] - \lambda^2 \sin^2 \theta_0 + 4 \alpha' \lambda \sin \theta_0 \sin \theta_0 + O(s^4)$$

$$W_0 = (x^2 \sin^2 \theta_0) \sin^2 \theta_0 + 4x^2 \sin^2 \theta_0 \left(\frac{x}{2} \right) \left[1 + \frac{1}{2} \frac{x}{2} \right] \dots$$

$$\frac{G(\lambda)}{G^2} = \frac{\sin^2 \theta_0}{\sin^2 \theta_0} + 4x - \frac{5-1}{G^2} \left(\frac{x}{2} \right) [1 - \cos(2\pi x)]$$

TM c y iston zelan

$$\omega_0(H_z) = \frac{x(H_z)}{G(H_z)} = \frac{x \sin^2 \theta_0}{G(H_z)}, \quad \omega_G^2 = \omega_0^2 - \frac{x^2 \sin^2 \theta_0}{G^2} + 4\omega_0^2 \left(\frac{x'}{x}\right) |S|^2 [1 + \dots]$$

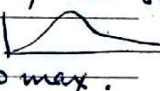
$$\frac{\Delta \omega_G}{\omega_0(H_z)} = 1 - \frac{\Lambda^2}{x^2} \frac{1}{\sin^2 \theta_0} + 4 \left(\frac{x'}{x}\right) |S|^2 \left[1 + \frac{1}{2} \frac{\Lambda}{x} \frac{\sin 2\varphi_0}{\sin \theta_0}\right]$$

20 $\theta_0(H_z)$ naxoqura uz $E(\theta_0) \approx \frac{1}{2} N_{22} M_s^2 \cos^2 \theta_0 - H_z M_s \cos \theta_0 - H_{11} M_s \sin \theta_0$
Astid (H₁₁ & H₂₂) in-plane field. $\varphi_0 = \varphi_H$. $\frac{\partial E}{\partial \theta} = -N_{22} M_s^2 \sin \theta_0 \cos \theta_0 + H_z M_s \sin \theta_0 - H_{11} M_s \cos \theta_0 = 0$. U ecan $H_H < H_z$, to $\cos \theta_0 = H_z / (N_{22} M_s)$, H_z, H_{11} naxoqura to be uniform.
$$\frac{\Delta \omega_G}{\omega_0(H_z)} \approx 2 \left(\frac{x'}{x}\right) |S|^2 \left[1 + \frac{1}{2} \frac{\Lambda}{x} \frac{\sin 2\varphi_0}{\sin \theta_0}\right] - \frac{1}{2} \frac{\Lambda^2}{x^2} \frac{1}{\sin^2 \theta_0}$$
, Cause $\Lambda^2, S^2 \ll 1$.

B nax. naxoqura. $\Lambda = \Lambda_x + \Lambda_y \approx 2\pi \mu M_s \beta d \Delta^2$
Ecan $\sin 2\varphi_0 \approx 0$, $\varphi_0 = \pi/2$, v.e. $S_0 \approx (0, S_0^y)$, to ecan $\frac{\Delta \omega_G}{\omega_0} \approx 2 \left(\frac{x'}{x}\right) |S|^2$

14/II Naxoqura on-line appl. na ecany aqura na tarjetas.
Becaga c Julian. Basque grant ecan na naxoqura, MEC-naxoqura ne oqabun,
Xotax co naxoqura Porto B naxoqura March.
Oquraq. MEC-grant oquraq c Arantxa: Travel grant go Feb. 20, MEC-grant
Oquraq naxoquraq naxoquraq x' - two-vortex model.

12 $\omega_0(H_z) = \omega_0(\Delta)$, naxoqura $\frac{\Delta \omega_G(\Delta)}{\omega_0(\Delta)} \approx \frac{\omega_0(\Delta)}{\omega_0(0)} \cdot 2 \frac{x'}{x} |S_0(\Delta)|^2$
To me $\omega_G^2 \approx \omega_0^2 [1 + 4 \frac{x'}{x} |S|^2]$, $\omega_G(\Delta) = \frac{\omega_0(\Delta)}{\omega_0(0)} [1 + 2 \frac{x'}{x} |S_0(\Delta)|^2]$, $\omega_0(\Delta) = \frac{x \sin^2 \theta_0(H_z)}{G(H_z)}$

13 $\omega_0(H_z) \approx \omega_0(0) [1 + H_z/H_s]$, $H_z = H_z(\Delta)$, ecan $H_z \parallel P$ -core. $\omega_0(\Delta) = \frac{x \sin^2 \theta_0(H_z)}{G(H_z)}$
 $\omega_0(\Delta)$ naxoqura c naxoqura Δ . Then $|S_0(\Delta)|^2$  Δ naxoqura max naxoqura $\Delta \times 2R$.

14 Naxoqura naxoquraq (x'/x) naxoqura $\omega_G(\Delta)$ naxoqura max.
Oquraq na MEC-naxoqura naxoqura. Oquraq naxoqura c Oqura. x'-naxoqura
na $\omega_G(\Delta)$ -naxoqura. x', $W_m(s)$ -y naxoqura ne naxoqura. Zagari uz 1-White.
Naxoqura. doc-s que appl. to Police oquraq naxoqura aqura.

15/II Canning DIPIC: R. Navarro, Ikerbasque: Naxoqura oquraq naxoqura naxoqura
naxoqura $\omega_G(\Delta)$ c Oqura. Naxoqura oquraq MEC-naxoqura naxoqura.
Naxoqura to naxoqura-vortex c Oqura. naxoqura. Zaxoqura naxoquraq naxoqura. Edited
Virginia naxoqura (GMR) naxoqura naxoquraq naxoqura paper draft - Roman Verba
naxoqura draft PRB - paper na switching SD dots. Zaxoqura invited ICNM naxoqura.

17/II Naxoqura comments switch. SD dots to naxoqura - Berba.

18/II C. A. b Police: naxoqura appl. na new tarjetas c app Berio 33, 3B
Anthony naxoqura naxoqura. v. naxoqura oquraq naxoquraq naxoquraq naxoquraq.
C. A. b SuperAmara ("bill"). Anthony oquraq na MEC-grant naxoquraq naxoquraq
MEC-travel grant report. E-mails Virginia, Oquraq u. naxoqura. Update citations.
Zaxoqura naxoqura: cora. 3M-4/5 naxoqura naxoquraq naxoquraq naxoquraq, naxoquraq u. S. naxoquraq.
Oquraq naxoquraq naxoqura. double-vort. state b naxoquraq case F/N/F pillar naxoquraq
naxoquraq Tejada - Freeman na vortex barriers.

19/II Naxoquraq vortex dyn. barrier MS-Melhor to English, Oquraq MEC. update cit.

20/II Revision Verba - PRB. Zaxoqura naxoqura: naxoquraq x' oquraq, naxoquraq
(Messy u. Messi), naxoqura. naxoquraq naxoquraq naxoquraq u. naxoquraq naxoquraq.
- naxoquraq naxoquraq barriers; naxoquraq naxoquraq naxoquraq M(H) naxoquraq
naxoquraq naxoquraq, naxoquraq naxoquraq, naxoquraq mode? Update cit. R. profile.
Zaxoquraq, oquraq naxoquraq u. submitted na MEC-site oquraq - 2012 na Travel Porto-

21/II Naxoqura x'(p, R) - naxoqura. $W_m(s)$ naxoqura. pole-free model b MathCad, ybun x'-naxoqura c naxoqura
Naxoquraq naxoquraq [JHEP(04) ...]. C. A. b naxoquraq naxoquraq. Update cit. u. naxoquraq new vortex papers
Oquraq. c Oqura. $\omega_G(\Delta)$ -naxoquraq, naxoquraq naxoquraq naxoquraq. naxoquraq x' naxoquraq.

F/N/F - statics (Sukh' JAP'12), 2008 Shema 2aa shema. Eu nation Basque, DAAD, Azarova
 plane etc. stipend 2008 naexar visiting na 2 mes. 2013, 2008 B Feb. - March '14 jointures u uenaro position.
 thesis 6 Dec. 2013, 2008 B Feb. - March '14 jointures u uenaro position.
 Conf. 16 17 18 19 20 21 22 23 24 25 26 27
 MEC - Ciabun (pachoneg. b 3/mi Arantxa)
 ocranobun melio, sakgusek e-mail account
 referentia refer One. c de Loubens u Klein no $\omega_2(A)$ - x' pacesy, Prof PRB-
 Miércoles. Astazkena.

21

- Plan coare - 2013:
- 1) $\omega_2(A)$ - gyrotrop. frequency is tip position c de Loubens (reop. 2008 k'aske)
 - 2) Non - lin ST vortex dynamics (Ciabun + Uysukano + new damp. Gyrotrop.)
 - 3) FMR - stripes - magnonics (Arantxa u Kakazei, of asotars tekst)
 - 4) DW - nanotubes (Ai Ping) u TMR in nanoparticles (Virginia)
 - 5) Vortex dyn. barriers (Merkel, new theor. input)
 - 6) 1D vortex det chavins (Uysukano, Ubanov, $\omega(k)$)
- Genat go aszegga 3/III:
- 1) Proof Multipole - PRB. 02) bocconobur eku-email; 03) orrer MEC-Ciabun;
 - 2) Abs. HMM-Arantxa u Abs. Perpignan; 05) orrer kon. Barcelona y Madrid;
 - 3) negrot. uenaro b HAM - Paryage; 7) pensyngun JAP, PRB, JMMM-Merkel
 - 4) invited goun. mauk cekumi DICMMA; 9) n'pobefuro US - bank accounts;
 - 5) ocranob HA e-mails Japan, Brazil, Chantrell, Iranov

24/II Zenne papers A. N. Kalinkin 'Inorg. Chem.' 13 o 2u a. (pemenun vortex
 profile $\theta(s)$ - equation uz Gus' JAP'04 u gus. A. Leonov (A. M. Bogdanov) no skyrmions
 - solitons uz ga DM-exchange. Expense reports no naezgkan b Barcelona y Madrid.
 25/III Hanyunbanne new e-mail. Nepernuka no MEC-Ciabun spako
 (3/mi Arantxa). Proof PRB - odyngy, c Ove. - $\omega_2(A)$ - file.

26/II Abs. - HMM c Arantxa. Email copies Inbox, Outbox. Submitted Proof to PRB
 c Ove. German stipends, professors u ee nepenakub. E-mail to U. Nonske-
 - zempoc ufunner Ove - na DAAD stipend na 3-4 mes. 10, u Julian n'pomen interview
 27/II Second Proof. PRB. Agas Patxi' kon. Barcelona, Madrid u comp. memory.
 E-mail to de Loubens - Klein c $\omega_2(A)$ - x' pacesem.

28/II 3rd Proof. PRB. Zbonur qapxag. me 3/III ~ 6-7 AM shub na crannun
 Sememar - Viejo nocharo emy round tickets u torjeta. apy/Ove. 4. u puchanana AE
 - vortex file Pomena. Bzlen duresu Ryanair M. - Porto u Alsea S.S. $\geq M$.
 x' 18 Ove. ≈ 0.9 gus nepenakub de Loubens (!?). N'pobefura x' a 19/IX 2012?
 Nonlin $W(s)$

$$W_m(s) = 2L \int_{-\infty}^{\infty} dk f(k) \sum_{\mu=0}^{\infty} |F_{\mu}(k)|^2, \quad F_{\mu}(k) = \left(\int d\vec{s} J_{\mu}(ks) e^{i\vec{k} \cdot \vec{s}} \text{div} \vec{m}(\vec{s}, s) \right), \quad s' = \frac{s}{1+s^2}$$

$$\text{Pole-free m. } \text{div} \vec{m} = 2s' \sin \varphi \left[1 + \frac{s'}{s} (1+s^2) \cos \varphi + \frac{1}{4} \frac{s'^2}{s^2} (1+6s^2+s^4) + \frac{1}{4} \frac{s'^2}{s^2} (3+2s^2+3s^4) \cos 2\varphi \right]$$

$$F_{\mu}(k) = \int d\vec{s} J_{\mu}(ks) \int d\vec{s} e^{i\vec{k} \cdot \vec{s}} \text{div} \vec{m} = \int d\vec{s} J_{\mu}(ks) I_{\mu}(s, s), \quad I_{\mu}(s, s) = \int d\vec{s} e^{i\vec{k} \cdot \vec{s}} \text{div} \vec{m}(\vec{s}, s)$$

$$I_{\mu}(s, s) = 2s' \int d\vec{s} e^{i\vec{k} \cdot \vec{s}} \sin \varphi \left[1 + \frac{s'}{s} (1+s^2) \cos \varphi + \frac{1}{4} \frac{s'^2}{s^2} (1+6s^2+s^4) + \frac{1}{4} \frac{s'^2}{s^2} (3+2s^2+3s^4) \cos 2\varphi \right] =$$

$$= 2s' i \int_0^{2\pi} d\varphi \sin \mu \varphi \sin \varphi [\dots]. \quad \int_0^{2\pi} d\varphi \sin \mu \varphi \sin \varphi = \pi \delta_{\mu,1}, \quad \int_0^{2\pi} d\varphi \sin \mu \varphi \sin \varphi \cos \varphi =$$

$$= \frac{1}{2} \int_0^{2\pi} d\varphi \sin \mu \varphi \sin 2\varphi = \frac{1}{2} \pi \delta_{\mu,2}, \quad \int_0^{2\pi} d\varphi \sin \mu \varphi \sin \varphi \cos 2\varphi = \int_0^{2\pi} d\varphi \sin \mu \varphi \cdot \frac{1}{2} [\sin 3\varphi - \sin \varphi] =$$

$$= \frac{1}{2} \pi [\delta_{\mu,3} - \delta_{\mu,1}]. \quad I_{\mu}(s, s) = 2s' i \pi \left[\left\{ 1 + \frac{1}{4} \frac{s'^2}{s^2} (1+6s^2+s^4) \right\} \delta_{\mu,1} + \frac{1}{2} \frac{s'}{s} (1+s^2) \delta_{\mu,2} + \right.$$

$$\left. + \frac{1}{4} \frac{s'^2}{s^2} (3+2s^2+3s^4) \frac{1}{2} (\delta_{\mu,3} - \delta_{\mu,1}) \right]; \quad |F_{\mu}(k)|^2 = F_{\mu} \bar{F}_{\mu} = \int d\vec{s} \int d\vec{s}' J_{\mu}(ks) J_{\mu}(ks') I_{\mu}(s, s) I_{\mu}(s', s')$$

$$F_{\mu}(k) = \int d\vec{s} J_{\mu}(ks) 2\pi s' e^{i\vec{k} \cdot \vec{s}} \left[\left\{ 1 + \frac{1}{4} \frac{s'^2}{s^2} (1+6s^2+s^4) \right\} \delta_{\mu,1} + \frac{1}{2} \frac{s'}{s} (1+s^2) \delta_{\mu,2} + \frac{1}{8} \frac{s'^2}{s^2} (3+2s^2+3s^4) (\delta_{\mu,3} - \delta_{\mu,1}) \right]$$

$F_m(k) = 2\pi s^2 e^{i\pi/2} \int d\theta \theta J_m(k\theta) \left[\left\{ 1 - \frac{s^2}{8} \left(\frac{1}{\theta^2} + \theta^2 - 10 \right) \right\} \delta_{m1} + \frac{1}{2} \frac{s^2}{\theta} (1 + \theta^2) \delta_{m2} + \frac{s^2}{8} \left(\frac{3}{\theta^2} + 3\theta^2 + 2 \right) \delta_{m3} \right]$
 $|F_m(k)|^2 = 4\pi^2 s^4 \int d\theta \theta \int d\theta' \theta' J_m(k\theta) J_m(k\theta') \left[\dots \right]$
 $|F_m(k)|^2 = 4\pi^2 s^4 \int d\theta \theta \int d\theta' \theta' \left[\left\{ 1 - \frac{s^2}{8} \left(\frac{1}{\theta^2} + \theta^2 - 10 \right) - \frac{s^2}{8} \left(\frac{1}{\theta'^2} + \theta'^2 - 10 \right) \right\} \delta_{m1} + \dots \right]$

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$|F_m(k)|^2 = 4\pi^2 s^4 \int d\theta \theta \int d\theta' \theta' \left[\left\{ 1 + 2s^2 - \frac{s^2}{8} \left(\frac{1}{\theta} - \theta \right)^2 - \frac{s^2}{8} \left(\frac{1}{\theta'} - \theta' \right)^2 \right\} J_1(k\theta) J_1(k\theta') + \frac{1}{4} \frac{s^2}{\theta \theta'} (1 + \theta^2)(1 + \theta'^2) J_2(k\theta) J_2(k\theta') \right]$
 $s'^2 = \left[\frac{s}{1+s^2} \right]^2 = \frac{s^2}{(1+s^2)^2} = \frac{s^2}{1+2s^2} = s^2(1-2s^2)$
 $= s^2(1-2s^2)(1+2s^2) = s^2(1-4s^4) \approx s^2$

$\sum_{m>0} |F_m(k)|^2 = 4\pi^2 s^2 \int d\theta \theta \int d\theta' \theta' \left[\left\{ 1 - \frac{s^2}{8} \left(\frac{1}{\theta} - \theta \right)^2 - \frac{s^2}{8} \left(\frac{1}{\theta'} - \theta' \right)^2 \right\} J_1(k\theta) J_1(k\theta') + \frac{1}{4} \frac{s^2}{\theta \theta'} (1 + \theta^2)(1 + \theta'^2) J_2(k\theta) J_2(k\theta') \right]$

$W_m(s) = 2L \cdot 4\pi^2 s^2 \int \frac{dk}{k} f(k) \int d\theta \theta \int d\theta' \theta' \left[\left\{ 1 - \frac{s^2}{8} \left(\frac{1}{\theta} - \theta \right)^2 - \frac{s^2}{8} \left(\frac{1}{\theta'} - \theta' \right)^2 \right\} J_1(k\theta) J_1(k\theta') + \frac{1}{4} \frac{s^2}{\theta \theta'} (1 + \theta^2)(1 + \theta'^2) J_2(k\theta) J_2(k\theta') \right] = \frac{\alpha}{2} s^2 + \frac{\alpha'}{4} s^4$

$\alpha = 16\pi^2 L \int \frac{dk}{k} f(k) \left[\left(\int d\theta \theta J_1(k\theta) \right)^2 \right] = 2a$

$\alpha' = 8\pi^2 L \int \frac{dk}{k} f(k) \left[\left(\int d\theta (1 + \theta^2) J_2(k\theta) \right)^2 - \frac{1}{2} \left(\int d\theta \theta \left\{ \left(\frac{1}{\theta} - \theta \right)^2 + \left(\frac{1}{\theta'} - \theta' \right)^2 \right\} J_1(k\theta) J_1(k\theta') \right) \right]$

$\alpha' = 4(b - 2a)$

Задача 1. (см. 1, 2) События с параметром $\alpha = 19/18$ 2012 г.

$\left[\dots \right] = \int d\theta \theta \int d\theta' \theta' \left[\frac{(1 + \theta^2)(1 + \theta'^2)}{s} J_2(k\theta) J_2(k\theta') - \frac{1}{2} \left\{ \left(\frac{1}{\theta} - \theta \right)^2 + \left(\frac{1}{\theta'} - \theta' \right)^2 \right\} J_1(k\theta) J_1(k\theta') \right]$

1/III Becega e Julian: Basque grant ~ 12/III uzbecko u pomen u? O'Kagan 200 egy b Porto, u Tudy. Byg smt y new gona, tro c travel money her u pomen, a bar local expensures in Portugal on uenyms talyro b June. Julian xer b Porto-Braga (babbical may be) 11-14/III u kennyer uue vora u uenno.

Becega e Marcum: organ samples dot arrays, pacera, ob uz neperumax. Co partekes na GdAnz planned the cunxprothon b Paris.

Neperumax e D. Berkele no nobegy. Dec. - DAAD Stipend, ST-nanopit.

Neperumax e Dec. 4. no AE-barrier file by Roshchin. Paprag - Tolmenat Obryng. x - pacera (u pnyana chero omusky b (2)), DAAD Stipend u JMM-Melov etc.

18 Reviewed and subm. to JAP paper by Shin - vortex $\Delta G(t)$.

2/III Nogor. Aemmi b UAM. Pacneraska buxerob b magyng, Porto.

3 - 7/III Noezaga b Magyng. 4/III u 5/III tpu racobay uenno b UAM no M-dyn. nanostructures - Introd., SW u Vortex dynamics.

F/N/F (double vortex b vanyon F-line) exp. u simulations u exp. no chais.

326/39 dots bnyusen, ne bounoboge. Vortex state b F/N/F. Line karm - F1 (2) (6) F2 - double.

Wint (x) Simul. Lara nouzagan u pny. Double-v state b F/N/F pillar under 90° u 180° d.

u quanyon racos [1] koresammi, ram b F-det. Tuchenno lara nouer gad-uzupobas DV. State. "Genale" gupum b gae, ram u cageras DV cores.

Vpu Rectang. pulse. 2V state $\rightarrow$ V 3a At ~ 10 ns. Ecu.

4. 1 ms - 1 s b dots e ognen u gbyma circular holes (Peraira, Kemner PRL 04).

Non-linear Oe-field energy of GPP-current

W_{oe}(s) - ST

Corr. 17/XI, 26/XII 092. $W_{oe}(\vec{X}) = -M_s L H_0 \int d^2 \vec{\sigma} \rho m_{\varphi}(\vec{\sigma}, \vec{X})$, $H_0 = \frac{I}{2\pi R^2} (SI)$.

$m_{\varphi} = \sin \theta \sin(\Phi - \varphi)$. $\vec{F}_e(\vec{X}) = -\frac{\partial W_{oe}}{\partial \vec{X}} = M_s H_0 L \int d^2 \vec{\sigma} \rho \frac{\partial m_{\varphi}}{\partial \vec{X}}$

19 $\frac{\partial m_{\varphi}}{\partial \vec{X}} = \cos \theta \sin(\Phi - \varphi) \nabla_{\vec{X}} \theta + \sin \theta \cos(\Phi - \varphi) \nabla_{\vec{X}} \Phi$ & another way for the case
 $m_+ = m_x + i m_y = \sin \theta e^{i\varphi}$, $m_{\varphi} = \frac{1}{i} \text{Im}(\sin \theta e^{i(\Phi - \varphi)}) = \sin \theta \text{Im} e^{i(\Phi - \varphi)}$

330/35 $m_{\varphi} = \text{Im}[m_+ e^{-i\varphi}]$, $\frac{\partial m_{\varphi}}{\partial \vec{X}} = \text{Im}\left[\frac{\partial m_+}{\partial \vec{X}} e^{-i\varphi}\right]$

But case $m_+ = m_x + i m_y = w = f/|f|$. $f(z) = \frac{i}{c} \mathcal{C}\left[z - \frac{(s + \bar{s}z^2)}{1 + |s|^2}\right]$ - pole free model.

$w = e^{i\Phi}$, $m_+ = e^{i\varphi}$, $\frac{\partial m_+}{\partial \vec{X}} = i e^{i\varphi} \frac{\partial \varphi}{\partial \vec{X}}$, $\frac{\partial m_{\varphi}}{\partial \vec{X}} = \text{Im}\left[i e^{i(\Phi - \varphi)} \frac{\partial \varphi}{\partial \vec{X}}\right] =$
 $= \text{Re}\left[e^{i(\Phi - \varphi)} \frac{\partial \varphi}{\partial \vec{X}}\right]$, $\varphi = \text{Im}[\ln f(z)] = \ln \frac{|f|}{|s|} = \ln \frac{1}{|s|} = \frac{1}{2i} [\ln f - \ln \bar{f}]$

$m_{\varphi} = \text{Im}\left[\frac{f}{|f|} \frac{1}{z}\right] = \frac{|z|}{|s|} \text{Im}\left[\frac{f(z)}{z}\right]$, $\frac{1}{z} f(z) = \frac{i}{c} \mathcal{C}\left[1 - \left(\frac{s}{z} + \bar{s}z\right) \frac{1}{1 + |s|^2}\right]$

$\frac{s}{z} + \bar{s}z = \frac{|s|}{\rho} e^{i(\varphi_s - \varphi)} + \rho |s| e^{i(\varphi - \varphi_s)}$
 $\text{Im}\left[\frac{f(z)}{z}\right] = \frac{c}{2} \left[1 - |s| \left(\frac{1}{\rho} + \rho\right) \cos(\varphi - \varphi_s)\right]$

$$m_\varphi = \frac{1}{151} \frac{d}{dz} \left[z - (1+g^2) \cos(\varphi - \varphi_0) \frac{151}{1+151z^2} \right], \quad f(z) = \frac{1}{c} \left[z - (s' + \bar{s}' z^2) \right] \quad \text{Noviembre } s' = \frac{s}{1+151z^2}$$

$$f(z) = \frac{1}{c} \left[z - (s' + \bar{s}' z^2) \right] \left[\bar{z} - (\bar{s}' + s' \bar{z}^2) \right] =$$

$$= \frac{1}{c} \left[z\bar{z} - z\bar{s}' - \bar{s}'z^2\bar{z} - z^2\bar{s}'\bar{z}^2 \right] = \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right]$$

$$= \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right] = \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right]$$

$$= \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right] = \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right]$$

27

Martes - Asteartea

$$f(z) = \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right] = \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right]$$

$$= \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right] = \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right]$$

$$f(z) = \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right] = \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right]$$

$$= \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right] = \frac{1}{c} \left[1 - z\bar{s}' - \bar{s}'z^2 - z^2\bar{s}'\bar{z}^2 \right]$$

$$m_\varphi(s) = \left[1 - s' \frac{1}{g} (1+g^2) \cos \varphi \right] \left[1 + s' \frac{1}{g} (1+g^2) \cos \varphi - \frac{1}{2} \frac{s'^2}{g^2} (1+g^4 + 2g^2 \cos 2\varphi) + \right.$$

$$+ \frac{3}{8} \left\{ 4s'^2 \frac{1}{g^2} (1+g^2)^2 \cos^2 \varphi - 4s'^3 \frac{1}{g^3} (1+g^2) \cos \varphi (1+g^4 + 2g^2 \cos 2\varphi) + \frac{s'^4}{g^4} (1+g^4 + 2g^2 \cos 2\varphi)^2 \right\} +$$

$$+ a_3 \left\{ -8s'^3 \frac{1}{g^3} (1+g^2)^3 \cos^3 \varphi + 3 \cdot 4s'^2 \frac{1}{g^2} (1+g^2)^2 \cos^2 \varphi \cdot \frac{s'^2}{g^2} (1+g^4 + 2g^2 \cos 2\varphi) \right\} +$$

$$+ a_4 \left\{ 16s'^4 \frac{1}{g^4} (1+g^2)^4 \cos^4 \varphi \right\}, \quad \int d\varphi(\dots) \text{ fazeremos novamente com } m_\varphi.$$

$$m_\varphi(s) = 1 - \frac{s'^2}{g^2} (1+g^2)^2 \cos^2 \varphi - \frac{1}{2} \frac{s'^2}{g^2} (1+g^4) + \frac{3}{8} \frac{s'^2}{g^2} (1+g^2)^2 \cos^2 \varphi +$$

$$+ \frac{3}{8} \frac{s'^4}{g^4} (1+g^4 + 2g^2 \cos 2\varphi)^2 + a_3 12 \frac{s'^4}{g^4} (1+g^2)^2 \cos^2 \varphi (1+g^4 + 2g^2 \cos 2\varphi) +$$

$$+ a_4 16 \frac{s'^4}{g^4} (1+g^2)^4 \cos^4 \varphi + \frac{3}{8} \cdot 4 \frac{s'^4}{g^4} (1+g^2)^2 \cos^2 \varphi (1+g^4 + 2g^2 \cos 2\varphi) +$$

$$+ a_3 8 \frac{s'^4}{g^4} (1+g^2)^4 \cos^4 \varphi. \quad \frac{1}{c} m_\varphi = 1 + (\text{termos } \sim s'^2) + \frac{1}{g^2} + \frac{1}{g^4} (\text{termos } \sim s'^4)$$

$$\int d\varphi g^2 m_\varphi = \int d\varphi \int d\varphi g^2 \left[1 + \frac{(s'^2)}{g^2} + \frac{(s'^4)}{g^4} \right] = (\dots) + \int \frac{d\varphi}{g^2} (s'^4) =$$

$$= (\text{plano } s' \rightarrow 0) + \frac{(s'^4)}{c}, \quad m_\varphi(s) \text{ parametrado no } \left(\frac{s}{c}\right)^2 \text{ u } \frac{s^4}{g^4} \text{ para } \frac{s^4}{c}$$

$$\text{em } \int d\varphi g^2(\dots). \quad s \in (c, 1), \text{ i.e. parametrado no } \left(\frac{s}{c}\right)^2 \text{ u } \frac{s^4}{g^4} \text{ para } \frac{s^4}{c}$$

$$\text{que } c \text{ aproximadamente } 0.1-0.2 \text{ - número. } s \sim 0.5 \text{ u } s \ll c \text{ não funciona.}$$

$$\text{I.e. que } c \text{ aproximadamente } 0.1-0.2 \text{ - número. } s \sim 0.5 \text{ u } s \ll c \text{ não funciona.}$$

$$\text{I.e. que } c \text{ aproximadamente } 0.1-0.2 \text{ - número. } s \sim 0.5 \text{ u } s \ll c \text{ não funciona.}$$

$$\text{I.e. que } c \text{ aproximadamente } 0.1-0.2 \text{ - número. } s \sim 0.5 \text{ u } s \ll c \text{ não funciona.}$$

$$\text{I.e. que } c \text{ aproximadamente } 0.1-0.2 \text{ - número. } s \sim 0.5 \text{ u } s \ll c \text{ não funciona.}$$

Escaneado con CamScanner

28

Asociace $\frac{1}{12-51}$ (mich.) 6 Mathematica, m. 19/V. 12/1, 4

$$W_{\text{oe}}(s=0) = -M_s L H_0 \oint d\vec{s} \cdot \vec{s} = -M_s L H_0 2\pi \oint ds^2 = -\frac{2\pi}{3} M_s L H_0 \oint R^3, \quad H_0 = \frac{I}{2\pi R^2} \text{ (SI)}$$

$$W_{\text{oe}}(s=0) = -\frac{1}{2} M_s L \oint IR \text{ B SI, } \text{ref [I] 6 Ampere.} \quad H_0(s) = H_0 e^{-\dots}$$

Sources: c. Dec. Wax (S) w/ $S \approx 1$ b rigid v. model give ΔE_v . E-mail to Gavin W. 12/15
 Ties up ideas M(H) dots ($L = 9 \frac{300}{2} \text{ nm}$) Muroba. M(H) no run. Give to Wax, Ho Mz $\approx 10\%$ M. 12/15
 No gaseous single vortex stable state w/ $H = 0$.

11/IV Revision of $\omega_k(\Delta)$ -paper Klein in WinEdit. Norman revised MS co-abstr. paper.
Editing of Sec. 1-3 of FMR - stripe paper - Arantxa, Norm. Sec. 4, 5, 6, 7.

13/IV С Л. и Ю. т.ч. Урбел и Garbera (св. оженга А. и короца Ю.)

$W(s)$

$W(1+c) = W_1(1-c) - a[1+c - (1-c)] = W_2(1+c) - \text{y chislo}$

$a = \frac{1}{2c} [W_1(1-c) - W_2(1+c)]$ boferen. zvez $W_{1,2}(s)$

6 ostanke odrazu na W (2) i t.d.

15/IV house files of invit. letters via clennaphy 2009-2012 give appeal Julian.
 name. JAMS'13 - Abstract no F/N/F-dyn. ST. One. or cyt 3 race 6 pas. Expense 2-500 AM (1/2)
 Editing FMR - stripes paper Arantxa. Obeying. Arantxa Mogo. contract -
 48 Asté - Sembrada
 Hugo Vargas Zafra Grant Extension HA2014. Dec. 11) Wm - 7. V. orobus, W. (s) - Resume; 2) general
 radial low 6 4. + compiled data - delonbens.

Escaneado con CamScanner

AZAROA NO TEMPRE 2007
 M S J V L M M D
 1 2 3 4 5 6 7 8 9 10 11 12
 = 5 1 7 8 1 2 3 4 5 6 7 8 9 10 11 12
 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

$$\int_0^{2\pi} d\varphi m_\varphi = (1+s\bar{s}) \sum_n P_n(\cos\varphi) s^n \bar{s}^n \int_0^{2\pi} d\varphi = (1+s\bar{s}) \sum_{n=0}^{\infty} s^n \bar{s}^n J_n(\varphi)$$

$$J_0(\vartheta, s) = \int_0^{2\pi} d\varphi \frac{\sqrt{s^2 - 2s\varrho \cos\varphi + s^2}}{[s - s'(1+s^2)\cos\varphi] \sqrt{s^2 + s^2 - 2s\varrho \cos\varphi}} = s \int_0^{2\pi} d\varphi \frac{-s'(1+s^2)}{\sqrt{s^2 + s^2 - 2s\varrho \cos\varphi}} - s'(1+s^2) \int_0^{2\pi} d\varphi \frac{\cos\varphi}{\sqrt{s^2 + s^2 - 2s\varrho \cos\varphi}}$$

$$J_2(q, s) = \frac{1}{2} \int_0^{2\pi} \frac{[s - s'(1 + s^2) \cos \varphi] (3 \cos^2 \varphi - 1)}{\sqrt{s^2 + s'^2 - 2ss' \cos \varphi}} d\varphi = \frac{1}{2} s (3I_2 - I_0) - \frac{1}{2} s' (1 + s^2) (3I_3 - I_1)$$

$$13 \quad \mathcal{J}_3(g, s) = \frac{1}{2} \int d\varphi \frac{[\cdot]}{\sqrt{\cdot}} (s \cos^3 \varphi - 3 \cos \varphi) = \frac{1}{2} g (s I_3 - 3 I_1) - \frac{s'(1+s^2)}{2} (s I_1 - 3 I_2)$$

$$I_0 = \int_0^{2\pi} \frac{dq}{\sqrt{5^2 + 9^2 - 2 \cdot 5 \cdot 9 \cdot \cos q}} = \frac{2}{\sqrt{5^2 + 9^2}} \int_0^{\pi} \frac{dq}{\sqrt{1 - \frac{2 \cdot 5 \cdot 9}{5^2 + 9^2} \cos q}} = \frac{2}{5} \int_0^{\pi} \frac{dq}{\sqrt{1 + \left(\frac{9}{5}\right)^2 - 2 \frac{9}{5} \cos q}} = \frac{2}{5} 2K\left(\frac{9}{5}\right)$$

16. Если $g = s$, то $I_0(g, s) \sim \ln(1 - \frac{s}{e})$ — расхождение. Тогда $\int dg F(g)$ н/расходит.

$$J_0(s, s) = 4s \begin{Bmatrix} \frac{1}{4s} K(s/s) \\ \frac{1}{4s} K(s/s) \end{Bmatrix} - 4s'(\lambda + s^2) \begin{Bmatrix} \frac{1}{4s} [K(s/s) - E(s/s)] \\ \frac{1}{4s} [K(s/s) - E(s/s)] \end{Bmatrix}, \quad \begin{matrix} s < s \\ s > s \end{matrix}, \quad \begin{matrix} s \in [0, 1] \\ s \in [1, 1] \end{matrix}$$

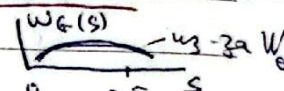
Сингулярность $\delta = 5$ при $s=0$. Вокруг $m_\varphi = \text{Im } e^{i(\varphi-\theta)} = \frac{\text{Im} [\frac{s(2-|z|)}{|z|^2}]}{151}$

$$338-27 \quad \lim_{z \rightarrow \infty} \frac{f(z)}{z} = \frac{C}{c} \left[1 - |s| \left(\frac{1}{s} + s \right) \frac{\cos(\theta - \varphi_s)}{1 + |s|^2} \right] = 0 \quad \text{w/ } z = s, \quad |s| = g, \quad \varphi = \varphi_s$$

$$\rightarrow (+s^2) \underline{J_0(s,s)} = 4 \begin{cases} (\frac{s}{s} - \frac{s}{s}) K(s/s) + \frac{s}{s} (1+s^2) E(s/s) \end{cases}, s < s$$

49. $J_1(9.5) = (1+s^2) \mathcal{F} I_1(9.5) - s(1+s^2) \frac{1}{s} \int_0^{2\pi} d\varphi \cos^2 \varphi = (1+s^2) \mathcal{F} I_1(9.5) - \pi s \frac{(1+s^2)}{s}$

$\vec{A}(s=0) = -\frac{2\pi}{3} \epsilon_0 \mu_0 R^3 L H_0, H_0 = \frac{I}{2\pi R^2} \text{ (SI) u J-uniform.}$

Oscillogramma. Jueves
 $W_{oe}(s) = W_{oe}(0) \left[1 - \frac{2}{5}s^2 - \frac{1}{5}s^4 + \frac{14}{5}s^6 \right]$, булаг s^6 багнан у болон s^4
 гэж ханс s^6 - pazнoмeннe, нoгaг зo хyгнe $(OK \text{ } W_{oe}(s) \leq 0.2)$ $W_{oe}(s') = W_{oe}(0) \left[1 - \frac{2}{5}s'^2 - s'^4 \right]$ булаг
 го s'^4 . Т.е., напармeрeн pazнoмeннe гoнoнo дoгoо умeннo $s' = \frac{s}{(1+s^2)}$, a нe s
 pazнoмeннe нo s' - нoгeнe. $W_{oe}(s') \rightarrow$ гэжe нyи $s' = 0.47$, $s = 0.7$ умeнe дoгoнo
 дoгo 3% (1) нyи $c = 0.05 - 0.2$. $W_{oe}(s')$ - calculated бнe "coren".
 Total $W(s) = W(0) + a s^2 + b s^4$, $W_{oe}(s) = W_{oe}(0) \left[1 - \frac{2}{5}s^2 + \left(\text{булoмoн } > 0 \text{ мeн } \right) \right]$
 $W_{oe}(s) = -|W_{oe}(0)| \left[1 - \frac{2}{5}s^2 + F_{oe}(s) \right]$, $F_{oe}(s) > 0$ у бeннe гeнe $s > 0.2$ $F_{oe}(s)$
 $\rightarrow$ Non-lin De-buag б $W(s) \sim u_G(s)$ дyгeр $= -|W_{oe}(0)| F_{oe}(s) < 0$ у дoгoнo
 $W_{oe}(0) \sim -m_e H_e \sim -CI$, m_e бгoнo $H_e \sim I$, $CI > 0$. 
 To con. c Fig. 3 $W_{NL}(s)$ by Dussaux' PRB'12.

12 → Reserved 2-Bed room Bungalow B Coma Ruga via 7 koren
June 28 - July 5 za 611 € c. secunat. parking. Free osmena go 24⁰⁰
(Booking. Com) 24 - June

13 → Reserved and paid Hotel C. Perpignan Nord b Perpignan via 5 koren
- June 23-28 repz Expedi. es za 390 €. Free osmena go 24⁰⁰ 19/VII

21/5) Ojyng. c Oec. u pmaamoro file Klein no W₆(A)-paper: u une
u en nogros. oober to Klein, en u pbequr ham bubag W₆(A).
Ojyng. c Oec. kak (mura rad. - SW in saturated - H₁ datz que de loubens.
Ojyng. c Arantxa (u Oec. tye.) u pbequr Arantxa contract: nago
centac obulbe. konnyr na postoc position July-Dec 2013 no Oec. AEC
u enny, ne gomugarec pan. MEC of extension na 2014. Oec. Taormina

22/12) Connar G. Hadjipanayis Delaware Univ. RE-free permanent magnets
C. Julian & George Zuckerman w/ Lab & pers. span - downtown.
Tues. 1/12/13 @ 6-8 PM. 1000 of L-6000 RE magnets. P.O. Hotel Coma-Ruga
w/ 1000. & 1000. ABS-Verte. Review to Conf. Coma-Ruga June 30-July 5, 2013
Arantxa Urcelay & Rectorat does na obzib. kontak. E-mails as 0.40.00

23/2 E-went to Klean o French - Spain travel grant. Nogpod offer
to Melkov o poverse AE(H), $H > H_n$ u cpabr. Cew Excn.
Nogren o Coma Ruzg Credit C. number glyms e-mails. Registered for ILCFM/13

$W(\vec{r}) = W(0) + \frac{1}{2} \chi_{\alpha\beta} \vec{r}_\alpha \vec{r}_\beta$, $\chi_{\alpha\beta} = \frac{\partial^2 W}{\partial s_\alpha \partial s_\beta} \bigg|_{\vec{s}=0}$, $W = W_m + W_H$ u $\chi_{\alpha\beta} = \chi_{\alpha\beta}^m + \chi_{\alpha\beta}^H$
 $\chi_{\alpha\beta}^H = \frac{\partial^2 W_H}{\partial s_\alpha \partial s_\beta} = -M_S \int dV [H_x \frac{\partial^2 m_x}{\partial s_\alpha \partial s_\beta} + H_y \frac{\partial^2 m_y}{\partial s_\alpha \partial s_\beta}]$, $\chi_{xy}^H \neq 0$ (3/I) reason
 $m_x = H_x / \mu_0$ - ver., $H_y(\varphi)$ - horiz., $\vec{H}(\varphi)$ is field of the MFM tip.
 $m_+ = e^{i\varphi}$ here are. $m_x + im_y = \cos\varphi + i\sin\varphi$,
 $\frac{\partial^2 m_x}{\partial s_x \partial s_y} = \cos\varphi [-m_0^2 \sin^2\varphi + \frac{(1-g^2)}{g^2} \cos 2\varphi]$, $\frac{\partial^2 m_y}{\partial s_x \partial s_y} = \sin\varphi [m_0^2 \cos^2\varphi + \frac{(1-g^2)}{g^2} \cos 2\varphi]$
 $\chi_{xy}^H = -\frac{\partial^2 W}{\partial s_x \partial s_y} = \frac{1}{R} \int d\varphi \frac{d}{d\varphi} \left[\frac{d(9\cos^2\varphi - 1) \cos\varphi (-m_0^2 \sin^2\varphi + \frac{(1-g^2)}{g^2} \cos 2\varphi)}{[g^2 + d^2 - 2dg \cos\varphi + d^2]^{5/2}} + d \sin^2\varphi (m_0^2 \cos^2\varphi + \frac{(1-g^2)}{g^2} \cos 2\varphi) \right]$
 $(z+d) \rightarrow d$, T.K. $z \leq L$, $\frac{L}{R} \ll d = D/R$.

Diciembre • **Abendua**

7

Viernes **Ostirala**

0, т.е. $\vec{S} = \vec{S}_0$. Оси симметрии вращения не (f): $\lg 2f = \frac{2x+y}{[x+y - 2xy]}$

Escaneado con CamScanner

$\sqrt{s_0^2 - s^2} = e^{\mu(t-t_0)}$, $s^2/s_0^2 - s^2 = e^{2\mu t}$, $\mu > 0$, $s_0^2 = M/\nu$. $s(t) = s(t_0) e^{\mu(t-t_0)}$

Linear case, $v = d\omega_0 + d\omega_1 = 0 \rightarrow S(t) = S(0)e^{\dots}$, any sign of μ . $S_0^2 = 1/\mu$
 Nonlin. case, $v > 0 \rightarrow \frac{S}{\sqrt{S_0^2 - S^2}} = e^{\mu t}$ ($\mu > 0$) and $\frac{S}{\sqrt{S_0^2 + S^2}} = e^{-\mu t}$ ($\mu < 0$).

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$S_0^2 = 1/\mu$ under current radius of stationary orbit at $\mu > 0$ ($I > I_{c0}$)
 also ($v \neq 0$): $S^2(t) = S_0^2 \frac{e^{-2\mu t}}{1 - e^{-2\mu t}} = S_0^2 \frac{1}{e^{2\mu t} - 1}$ ($\mu < 0$)
 $S^2(t) = S_0^2 \frac{1}{1 - e^{-2\mu t}}$, $S > S_0$,
 $S^2(t) = S_0^2 \frac{1}{1 + e^{-2\mu t}}$, $S < S_0$. Any sign (μ) $S(t) \rightarrow S_0$ when $t \rightarrow \infty$ ($\mu > 0$).

Asteazkena - Miércoles

Tid. $S(t \rightarrow \infty) \rightarrow S_0$, no obexy, no emuxy, $S(0) > S_0$, $S(t=0) < S_0$ ($S(0) > S_0$)
 $S = S_0$ - wregennu unku, stationary orbit of the vortex core.
 $\tau = 1/(2\mu)$ xafar-epuxa ofen to reach steady state $S = S_0$ when $t \rightarrow \infty$.

$\Phi = p\omega_c(s) = p[\omega_0 + \omega_1 S^2(t)]$, $p \frac{d\Phi}{dt} = \omega_0 + \omega_1 S_0^2 \frac{1}{1 \mp e^{-2\mu t}}$, ($\mp$ $S > S_0$) ($\mp$ $S < S_0$) ($\mu > 0$)
 and $p\dot{\Phi} = \omega_0 + \omega_1 S_0^2 \frac{1}{e^{2\mu t} - 1}$, $\mu < 0$. $S = R = |\vec{X}|/R_{stat}$, $R = |\vec{X}| = |\vec{X}|$.

formee nar. ygnobne when $t = t_0$ $\mu(t - t_0) = \int_{S(t_0)}^S ds [\frac{1}{s} + \frac{s}{S_0^2 - s^2}] = \ln \frac{s}{\sqrt{S_0^2 - s^2}} \Big|_{S(t_0)}^S$
 hysc $t_0 = 0$, $S(t_0) = S(0)$.

$\mu t = \ln \frac{s}{\sqrt{S_0^2 - s^2}} - \ln \frac{S(0)}{\sqrt{S_0^2 - S^2(0)}} = \ln \left[\frac{s}{\sqrt{S_0^2 - s^2}} \frac{\sqrt{S_0^2 - S^2(0)}}{S(0)} \right]$ Nonlin. ST

$\frac{S(t)}{\sqrt{S_0^2 - S^2(t)}} = \frac{S(0)}{\sqrt{S_0^2 - S^2(0)}} e^{\mu t}$, $\frac{S^2}{S_0^2 - S^2} = N e^{2\mu t}$, $N^2 = \frac{S^2(0)}{(\sqrt{S_0^2 - S^2(0)})^2}$

$S^2(t) = S_0^2 \frac{1}{1 \mp \exp[-2\mu(t + \frac{1}{2\mu})]}$ = $S_0^2 \frac{1}{1 \mp \frac{1}{N^2} e^{-2\mu t}}$, ($\mp$) coarb. $S > S_0$, $S < S_0$.
 $N^2 = \frac{S^2(0)}{S_0^2 - S^2(0)} \geq 0$, $\mu > 0$. $\mu t = \ln \frac{s}{\sqrt{S_0^2 + s^2}} \Big|_{S(0)}^S = \ln \left[\frac{s}{\sqrt{S_0^2 + s^2}} \frac{\sqrt{S_0^2 + S^2(0)}}{S(0)} \right]$

$\mu < 0$, $\frac{S}{\sqrt{S_0^2 + S^2}} = \frac{S(0)}{\sqrt{S_0^2 + S^2(0)}} e^{\mu t} = N_- e^{\mu t}$, $t \rightarrow t + \frac{1}{\mu} \ln N_-$. $S^2(t) = \frac{S_0^2}{\frac{1}{N_-^2} e^{2\mu t} - 1}$, $\mu < 0$

when $t \rightarrow \infty$ $S(t) = S_0 N_- e^{-\mu t} \rightarrow 0$, when $t < \frac{1}{2\mu}$ net curruy. $\mu t \rightarrow 0$.

$p\dot{\Phi} = \omega_0 + \omega_1 S_0^2 \frac{1}{1 \mp \frac{1}{N^2} e^{-2\mu t}}$, $\mu > 0$ and $p\dot{\Phi} = \omega_0 + \omega_1 S_0^2 \frac{1}{\frac{1}{N_-^2} e^{2\mu t} - 1}$, $\mu < 0$.

$\Phi(t)$ nemo narion abno. $\Phi(t) = \omega_0 t + (\text{nonlin. part})$.

Bibogy: assuming quadratic nonlin. terms in $w_c(R)$, $d(R)$ Thiele eq. under μ hysc. $\lambda(R)$ - nonlin. take nemo ygnob ($\sim R^2$ or more).

$F_{ST} \sim \frac{a(R)}{|G(R)|} R$, $a(R)$ & $G(R)$ nemo coepr. nemo $\sim R^2 \sim S^2$, $\lambda(R) = \frac{a(R)}{|G(R)|}$
 Eam $G_2(R)$ nemo nemo, no gro ygnob $w_c(R)$ & $d(R)$.

$\dot{R}/R = \lambda(R) - d(R)w_c(R)$, & wphedfem. ST-term & damping d gear $\dot{R} = 0$.
 - wphobee gbnemne, rge $\vec{X} \sim \vec{X}$ & damping Thiele choqwee & dazun. damp

$\dot{R} = 0 \Rightarrow R = R_0$ & $\dot{\Phi} = p\omega_c(R_0)$, $\Phi(t) = p\omega_c(R_0)t$ - gbnem. $Z(t) = R_0 e^{ip\omega_c(R_0)t}$ - no wphobee.

Nonlin. ST-term gear $\frac{\dot{R}}{R} = \lambda(R) - d(R)w_c(R) = \lambda_0 - d_0\omega_0 - (d_0\omega_1 + d_1\omega_0 - \lambda_1)R^2 = \mu - \nu R^2$
 $\lambda = \lambda_0 + \lambda_1 R^2$

Tenepo $v = d_0\omega_1 + d_1\omega_0 - \lambda_1$ & boymenno $v = 0$, $v < 0$ no nemo nemo V dynamics
 $S(t)$, $\Phi(t)$ bome calculated for $v = d_1\omega_0 + d_0\omega_1 > 0$. ($\lambda_1 \sim I$)

hysc $\mu > 0$ ($I > I_{c0}$), no nemo nemo. $v < 0$: $\dot{S}/S = \mu + \nu S^2$, $n = -v = |\nu| > 0$.
 $\frac{1}{S(\nu S^2 + \mu)} = \frac{1}{\mu} \frac{1}{S} - \frac{n}{\mu} \frac{S}{\mu + \nu S^2}$, $\mu(t - t_0) = \int_{S(0)}^S ds [\frac{1}{s} - \frac{nS}{\mu + \nu S^2}] = \ln s - \frac{1}{2} \ln(\mu + \nu S^2)$

$\ln \frac{s}{\sqrt{\mu + \nu S^2}} \Big|_{S(0)}^S = \mu(t - t_0)$, $\ln \frac{s}{\sqrt{8^2 + S^2}} \Big|_1^S = \mu(t - t_0)$, choqwee & n. ($\mu < 0$): $S^2(t) = \frac{8^2}{\frac{1}{N_0^2} e^{-2\mu t} - 1}$
 $S = N_0 e^{\mu t}$, $N_0 = \frac{S(0)}{\sqrt{8^2 + S^2(0)}}$, $8^2 = \frac{\mu}{\nu}$, $\dot{S} = S(\mu + \nu S^2)$ ne nemo

cray. opbura $S_0^2 = \frac{\mu}{\nu}$ nemo nemo when $v < 0$. Yp-e na $\dot{S}$ nemo nemo. $u = \mu + \nu e^{2\mu t}$
 $S(t)$ pacter up to $S = 1$.

... paceros V. Barriera Julia Manóva ($L=14\text{nm}$, $R=150\text{nm}$). $\gamma_{\text{rot}} W_{\text{surf}}^S$ (S)
 ... $S = [1 - \epsilon, 1 + \epsilon]$. $W_{\text{ex}}(S)$ u $W_{\text{face}}(S)$ - unimodal unimodal
 ... $W(1,1) \times 0.008$ ($10^{-4} \approx 1.6 \text{ kT}$). $\Delta E \approx 120 \text{ kBT}$ - see see Benin.
 ... list of all nonlin. vortex coefficients que PRL (draft, Chablin).
 ... new laptops (Dell, Derten) u gearaon, locs. $\gamma_{\text{rot}} W_{\text{surf}}^S$ (S)
 ... $S(t)$ c non. $\int \frac{dx}{x(a + bx^m)} = \frac{1}{am} \ln \left| \frac{x^m}{a + bx^m} \right|$, Dberir.
 ... $s = \mu - \nu s^2$, $t = \int \frac{ds}{s(\mu - \nu s^2)} = \frac{1}{2\mu} \ln \left| \frac{se}{\mu - \nu s^2} \right| \Big|_{s(0)}^s$; $\ln \frac{s(s)}{s(0)} = 2\mu t$.
 ... $s = s[s(0)]$, $\frac{se}{[\mu - \nu s^2]} = \frac{s^2(0)}{[\mu - \nu s^2(0)]} e^{2\mu t} = f$. Pen. gaer (any μ, ν)
 $f = N^2 e^{2\mu t}$.
 ... $\frac{4}{s^{-1} + \nu} = \frac{4}{\frac{\nu}{N^2} e^{-2\mu t} + \nu}$, u.m. $\frac{s^2}{[s_0^2 - s^2]} = \frac{s^2(0)}{[s_0^2 - s^2(0)]} e^{2\mu t} = f$, $s_0 = \frac{\mu}{\nu}$
 ... $s^2(t) = \frac{s_0^2}{\frac{1}{N^2} e^{-2\mu t} + 1}$, $N^2 = \frac{s^2(0)}{[s_0^2 - s^2(0)]}$, $\gamma_{\text{rot}} W_{\text{surf}}^S$ (S)
 ... $s^2(t) = \frac{s_0^2}{1 + \frac{1}{N^2} e^{-2\mu t}}$, $\mu < 0, \nu > 0 \rightarrow s(t) \rightarrow 0$ u $\mu > 0, \nu > 0 \rightarrow s(t) \rightarrow s_0$ u $\mu > 0, \nu < 0 \rightarrow s(t) \rightarrow s_0$ u $\mu < 0, \nu < 0 \rightarrow s(t) \rightarrow 0$ u $\mu > 0, \nu < 0 \rightarrow s(t) \rightarrow s_0$.
 ... $t_0 = \frac{1}{2\mu} \ln \left[\frac{s^2(0) + s_0^2}{1 + s_0^2} \right]$, $s_0^2 = \mu/\nu$.
 ... $s(t) \rightarrow s_0$ u $\mu > 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = s_0$ u $\mu < 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = 0$.
 ... $t = \frac{1}{2\mu}$, $\mu = \lambda(0) = d\omega_0 \sim (I - I_c)$.
 ... I_c , I .

$$s = \mu - \nu s^2, \quad t = \int \frac{ds}{s(\mu - \nu s^2)} = \frac{1}{2\mu} \ln \left| \frac{se}{\mu - \nu s^2} \right| \Big|_{s(0)}^s; \quad \ln \frac{s(s)}{s(0)} = 2\mu t.$$

$$s = s[s(0)], \quad \frac{se}{[\mu - \nu s^2]} = \frac{s^2(0)}{[\mu - \nu s^2(0)]} e^{2\mu t} = f. \quad \text{Pen. gaer (any } \mu, \nu \text{)}$$

$$f = N^2 e^{2\mu t}.$$

$$\frac{4}{s^{-1} + \nu} = \frac{4}{\frac{\nu}{N^2} e^{-2\mu t} + \nu}, \quad \text{u.m. } \frac{s^2}{[s_0^2 - s^2]} = \frac{s^2(0)}{[s_0^2 - s^2(0)]} e^{2\mu t} = f, \quad s_0 = \frac{\mu}{\nu}$$

$$s^2(t) = \frac{s_0^2}{\frac{1}{N^2} e^{-2\mu t} + 1}, \quad N^2 = \frac{s^2(0)}{[s_0^2 - s^2(0)]}, \quad \gamma_{\text{rot}} W_{\text{surf}}^S$$

... $s(t) \rightarrow s_0$ u $\mu > 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = s_0$ u $\mu < 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = 0$.
 ... $t = \frac{1}{2\mu}$, $\mu = \lambda(0) = d\omega_0 \sim (I - I_c)$.
 ... I_c , I .
 ... $s(t) \rightarrow s_0$ u $\mu > 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = s_0$ u $\mu < 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = 0$.
 ... $t = \frac{1}{2\mu}$, $\mu = \lambda(0) = d\omega_0 \sim (I - I_c)$.
 ... I_c , I .

... $s(t) \rightarrow s_0$ u $\mu > 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = s_0$ u $\mu < 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = 0$.
 ... $t = \frac{1}{2\mu}$, $\mu = \lambda(0) = d\omega_0 \sim (I - I_c)$.
 ... I_c , I .
 ... $s(t) \rightarrow s_0$ u $\mu > 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = s_0$ u $\mu < 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = 0$.
 ... $t = \frac{1}{2\mu}$, $\mu = \lambda(0) = d\omega_0 \sim (I - I_c)$.
 ... I_c , I .

... $s(t) \rightarrow s_0$ u $\mu > 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = s_0$ u $\mu < 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = 0$.
 ... $t = \frac{1}{2\mu}$, $\mu = \lambda(0) = d\omega_0 \sim (I - I_c)$.
 ... I_c , I .
 ... $s(t) \rightarrow s_0$ u $\mu > 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = s_0$ u $\mu < 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = 0$.
 ... $t = \frac{1}{2\mu}$, $\mu = \lambda(0) = d\omega_0 \sim (I - I_c)$.
 ... I_c , I .

... $s(t) \rightarrow s_0$ u $\mu > 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = s_0$ u $\mu < 0, \nu > 0$, korga ece $s(t \rightarrow \infty) = 0$.
 ... $t = \frac{1}{2\mu}$, $\mu = \lambda(0) = d\omega_0 \sim (I - I_c)$.
 ... I_c , I .

Paces W(5) - vortex gas barrier up 321 game que L=14nm, R=150nm
 Update (E-mails to Ikerbasque (meet, President in Victoria), Oca, deland
 Oca u Ikerbasque web-site (Sukh. 11 PRB'13, Verba. PRB'13 u Award ISNM'13).
 Ogan patxi comp. - factura He 5,260 €. Jur. no en. barriers.
 Rejeat/accept organon na Nanoscale MS by Virginia - nepogelaz.
 Nepemura c Mikuszeit - peron. na Ikerbasque Fellowship (J. Gonzalez).
 15/VI hogorobua Oral talk Nonlin. FMR que ICFM'13, Perfrignan. /Buzas kb.
 ~115m² in Ugurbit (duplex): bee xepemo, ocoenno 2x20m² chabun 2 dr., no
 gaceno 0: upv (17km), her buge uz onon. Man. Saunen u 2m² u kyume ~7m²
 -290,000 €. Writ. "Eroski".
 17/VI hogorob. justification hogorobu desktops regez MANAGING que Patxi.
 Buzas b Usarbil? 98m² kb. 370,000€, new. Bee Ak, no gaceno u goporo.
 Xonon no entp. gberu kb. Zaxen. Ouei. Obyag. c Oca. a. bee Klein. x.
 8/VI Skype. Maurob: upmuer M(r, H) que vortex penetration to dot, lens naup.
 W(5) upmuer H b RVM que L=14nm c S=[0, ∞). Skype-fab: upmuer
 b FMR spectra of RNi dots, R=150nm, L=20-10nm, W_{sw} ne zekucur a Hupmuer
 Hn u Han. Trip to Victoria c Antonon: President Basque Country nochen
 Ikerbasque Fellows (17 ren. b amobua - Bio...)/A. kyume 9.00 knob. +
 0.00 odayar + 6.00 € mense con IVA u 9.00 € mense con IVA uz gener. not.
 to MANAGING informatica (Miguel).
 9/VI Omdaraa cheb IBERDROLA -130. €. Zamonan u nochan R. report PRB'13, Buzas kb.
 Zieme rages "a Ikerbasque". Two upmuer official FMR-freke (Hageye)
 JEMS upmuer V barrier as Oral a ST-FIN/F as Poster. ICFM - Qm. xing. Iganda.
 Larunbata. Sábado
 Ouep u x kb. b Astigarraga (Itaki): kb. ~90m² c epvener. xozaninon -
 345 k€, m. l. chabun + 2m² tepaca. 3 bed room ~350k€ u gba duplex
 390 k€, 4 bed room, kuagobun, Bunka, 3 dr. uk. sun roof (oreu noypab, A. K.)
 340 k€, 3 bed room, kuagobun, man. kyume - wogkogur, oca duplex c
 zagon na peny u mae, Ecso ouze 2kb. (240-260 k€) b Astigarraga.
 20/VI Cem. Nanobuna: gora. A. Adeyeye "Mag. nanosstructures".
 Obyag. c Adeyeye Wnm (H) paurea RNi dots - new exp. By Des. kago
 Bhecpo u comp. na up microanag. Simulations Oca ouze na trip - Mag.
 School Perugia, 3/9 u 15/16 June xuek b Pume na gbaup. /Buzas kb. 9D mtr (9)
 11/VI upmuer 2 laptops "Dell" u 2 monitors. Check car u Carrefour c A.10.

With order Velocity $V = \text{bulk dot}, \vec{X}(z)$.

Non-relativistic, gen. exch. energy $\frac{1}{2} W_{ex} = \frac{1}{2} \int d\vec{r} \left[\left(\frac{\partial \psi}{\partial t} \right)^2 + \left(\frac{\partial \psi}{\partial z} \right)^2 \right]$ (Diening, Abendua 19)

$W_{ex} = \frac{1}{2} \int d\vec{r} \left[(\psi_x')^2 + (\psi_y')^2 \right] - \text{ellin.} \rightarrow \text{quadratic approx. mod.}$

dynamic hogo TVA, 3-body system, no bug $W_{ex}(z)$ comparison. eigenvalue problem $\nabla^2 \psi = -E \psi$ or local $\nabla^2 \psi = -E \psi$ (Mikolaj, Astekena)

$W_m = \int d\vec{r} d\vec{r}' A(z) \psi(z) \psi(z')$, $W_m = \int d\vec{r} d\vec{r}' A(z) \psi(z) \psi(z')$, $W_m = \int d\vec{r} d\vec{r}' A(z) \psi(z) \psi(z')$

local $W_m = W_{ex}(\vec{r}(z)) + W_H(z)$ normal $B \neq AP$ Gus' PRL within RVM. $\nabla \cdot \vec{m} = 0$ (conditioning eq. run $\vec{m} \times [\vec{L} \frac{\partial \vec{m}}{\partial t} + \vec{H} \vec{e}_d] = 0$)

$W_m^{vol} = \frac{1}{2} \int d\vec{r} \int d\vec{r}' \frac{\text{div} \vec{m}(\vec{r}, \vec{X}) \text{div} \vec{m}(\vec{r}', \vec{X})}{|\vec{r} - \vec{r}'|}$ B param TVA, $\text{ge}(\vec{m}, \vec{n})_0$

$\text{div} \vec{m} = \frac{\partial m_x}{\partial x} + \frac{\partial m_y}{\partial y} + \frac{\partial m_z}{\partial z}$, $\text{div} \vec{m} = \frac{\partial m_x}{\partial x} + \frac{\partial m_y}{\partial y} + \frac{\partial m_z}{\partial z}$, $\text{div} \vec{m} = \frac{\partial m_x}{\partial x} + \frac{\partial m_y}{\partial y} + \frac{\partial m_z}{\partial z}$

$\frac{1}{|\vec{r} - \vec{r}'|} = \int d\vec{k} e^{-i\vec{k} \cdot (\vec{r} - \vec{r}')} \int_0^\infty dt J_0(k|\vec{r} - \vec{r}'|) = \sum_{\vec{k}} \int d\vec{k} e^{-i\vec{k} \cdot (\vec{r} - \vec{r}')} e^{i\vec{k} \cdot (\vec{r} - \vec{r}')} J_0(k|\vec{r} - \vec{r}'|)$

compare $W_m \sim |\vec{X}|^2 \sim |\vec{r}|^2$, no strong $\text{gras}(\psi_x \neq 0, \psi_y = 0)$ gocaro mo.

$d\vec{r} = dz d\vec{r}' d\vec{r}''$, $\int d\vec{r}' \int d\vec{r}'' e^{i\vec{k} \cdot (\vec{r}' - \vec{r}'')} \text{div} \vec{m}(\vec{r}') \cdot \text{div} \vec{m}(\vec{r}'') = \left| \int d\vec{r}' e^{i\vec{k} \cdot \vec{r}'} \text{div} \vec{m}(\vec{r}') \right|^2$

$W_m^{vol} = \frac{1}{2} \int dz dz' \int d\vec{r} d\vec{r}' \int d\vec{r}'' d\vec{r}''' \sum_{\vec{k}} \int d\vec{k} e^{-i\vec{k} \cdot (\vec{r} - \vec{r}')} e^{i\vec{k} \cdot (\vec{r}' - \vec{r}'')} J_0(k|\vec{r} - \vec{r}'|) J_0(k|\vec{r}' - \vec{r}''|) \text{div} \vec{m}(\vec{r}) \cdot \text{div} \vec{m}(\vec{r}') =$

$= \frac{1}{2} \int dz dz' \int d\vec{r} d\vec{r}' \sum_{\vec{k}} \int d\vec{k} e^{-i\vec{k} \cdot (\vec{r} - \vec{r}')} J_0(k|\vec{r} - \vec{r}'|) \cdot 4\pi^2 S(z) S(z') (\delta_{\vec{k},1} + \delta_{\vec{k},-1}) \frac{1}{R^2}$

$\text{div} \vec{m}(TVA) = 2|S| \sin(\varphi - \varphi_s) u \int d\vec{r} \int d\vec{r}' e^{i\vec{k} \cdot (\vec{r} - \vec{r}')} \text{div} \vec{m}(\vec{r}) \cdot \text{div} \vec{m}(\vec{r}') = \{i = \varphi_s\}$

$W_m^{vol} = \frac{1}{R^2} \int dz dz' \int d\vec{r} d\vec{r}' \int d\vec{r}'' d\vec{r}''' \sum_{\vec{k}} \int d\vec{k} e^{-i\vec{k} \cdot (\vec{r} - \vec{r}')} \sum_{\vec{k}'} \int d\vec{k}' e^{i\vec{k}' \cdot (\vec{r}' - \vec{r}'')} J_0(k|\vec{r} - \vec{r}'|) J_0(k'|\vec{r}' - \vec{r}''|) 4\pi^2 S(z) S(z') e^{i\vec{k} \cdot (\vec{r} - \vec{r}')} (\delta_{\vec{k},1} + \delta_{\vec{k},-1}) =$

Handwritten notes in various languages (English, Russian, and possibly others) are interspersed throughout the mathematical derivations, providing context and commentary on the physics and mathematics being presented.

20 LLG: $\dot{\vec{m}} = \vec{m} \times \frac{\delta \mathcal{H}}{\delta \vec{m}}, \gamma \neq 1, \frac{\partial \vec{m}}{\partial x_1} + \vec{m} \times \frac{\partial \vec{m}}{\partial x_2} = \frac{\partial \vec{m}}{\partial x_1} \times \vec{m} + \vec{m} \times \frac{\partial \vec{m}}{\partial x_2}$

Osteguna, jueves

$$\left(\vec{m} \cdot \frac{\partial \vec{m}}{\partial X_\alpha} \times \frac{\partial \vec{m}}{\partial X_\beta} \right) \dot{X}_\beta = \frac{\delta H}{\delta X_\alpha}, \quad G_{\alpha\beta} \dot{X}_\beta = \int d^2\sigma \frac{\delta H}{\delta X_\alpha} = \frac{\delta W}{\delta X_\alpha}, \quad G_{\alpha\beta} = \int d^2\sigma (\dots)$$

$$G_{dp} \dot{s}_p = \frac{\delta W'}{\delta s_t}, \quad W' = W_m + W_{ex} = \int d^2 \vec{\rho} \int dz [w_m + w_{ex}] - 4\pi\epsilon_0 \int d^2 \vec{\rho} (\dots)$$

$$W(\vec{s}, \partial \vec{s} / \partial z) = \frac{1}{2} \eta \left[\left(\frac{\partial s_x}{\partial z} \right)^2 + \left(\frac{\partial s_y}{\partial z} \right)^2 \right] + \frac{1}{2} \int dz' \chi(zz') [s_x(z) s_x(z') + s_y(z) s_y(z')]$$

$$W'(\vec{S}, \partial \vec{S} / \partial z) = \frac{1}{2} \eta \left(\frac{\partial \vec{S}}{\partial z} \right)^2 + \frac{1}{2} \int dz' \chi(zz') \vec{S}(z) \cdot \vec{S}(z') - \text{красиво.}$$

$$\vec{G} \times \vec{S} = \frac{\delta W'}{\delta \vec{S}(z)}, \quad \frac{\delta W'}{\delta \vec{S}} = \frac{\partial W'}{\partial \vec{S}(t)} - \frac{\partial}{\partial z} \frac{\partial W'}{\partial (\partial \vec{S} / \partial z)} = \int dz' \alpha(zz') \vec{S}(z') - \eta \frac{\partial^2 \vec{S}}{\partial z^2}$$

→ Non-local YD: $\vec{G} \times \vec{S}(z) = \int dz' \alpha(zz') \vec{S}(z') - \eta \frac{\partial^2 \vec{S}}{\partial z^2}$. $\vec{G} = \vec{G}(z)$, no $\vec{G} \neq f(z)$

$$\text{Есть } \vec{S} \neq f(z), \text{ то } \oint_{\vec{n}} d\vec{z} \vec{G} \times \vec{S} = \vec{S} \oint d\vec{z} dz' \alpha(z, z') = \alpha \vec{S} \oint \frac{dz}{G} = \alpha \vec{S} / G.$$

12. by me $g_{dp}(s) = \frac{1}{r^3} \int_V d\vec{s} \cdot \vec{m} \cdot \frac{\partial \vec{m}}{\partial s_1} \times \frac{\partial \vec{m}}{\partial s_2} \cdot \vec{G} = \int dz \vec{g}, |\vec{G}| = 2\pi \frac{M_s}{L} L$.

Надо найти, используя $\vec{S}(z)$ в $z=0, L$ - faces of the dot. Если на $z=0, L$ нет генерации, берем $\vec{S}(z)$ в $z=0, L$ - faces of the dot. Если на $z=0, L$ есть генерация, берем $\vec{S}(z)$ в $z=0, L$ - faces of the dot.

$z=0, L$ not given, vgl. mit $z=0$ (pinning F/AF - Gas: PRB'06 um defect pinning - Zaspel' PRB'13), so $(\partial\psi/\partial z=0)$ w/m $z=0, L$.

Ex: Circular trajectory $\vec{S}(z,t) \forall z: \quad \dot{\vec{S}} = \vec{\omega} \times \vec{S} \quad \vec{g} \times \vec{\omega} \times \vec{S} = -\vec{S}(\vec{g} \cdot \vec{\omega}) = \vec{S}g\omega$
 $|\vec{g}| \omega \vec{S} = (|\vec{g}| \omega \cos(\alpha)) \vec{S}(\alpha) = \omega |\vec{g}| \sin(\alpha) \vec{S}(\alpha)$

$(g|w) = \int d^2z' x(z') \bar{S}'(z') - y \frac{\partial^2 S}{\partial z^2}, \quad \alpha(z') = 8\pi^2 M_s^2 \int dk e^{-k|z-z'|} F^2(k)$

From $w=0$ in $\chi(z, z') \sim \delta(z-z')$ local to $\chi S' - y S'' = 0$ $F(k) = \int d\theta S_1(k, \theta)$
 coln. c 3D Guss PRL'06 F/AF det on $22/\pi$ 0.52 see $\vec{S}(z) \sim \chi \sqrt{1-z^2}$ Span

Рассуждая аналогично, получим:

$$\int_{\mathbb{R}^n} \alpha(z-z') \vec{S}(z') \approx \vec{S}(z) \int_{\mathbb{R}^n} \alpha(z-z') = K(z) \vec{S}(z) \quad \text{и}$$

$$1. \text{K. } \mathcal{L}(z, z') \text{ unter max } u(\mu, z=z')$$

$$1.1) \vec{g} \equiv \mathcal{L} \vec{S} - u \frac{\partial \mathcal{L}}{\partial \vec{z}} \quad \vec{z}(z) = \vec{z}(0) + i q z \quad \text{wog } \vec{S} = K(z) \vec{S} - u \frac{\partial \mathcal{L}}{\partial \vec{z}}, \quad K(z) \rightarrow \vec{z}_{\text{const}}$$

17 $\omega \vec{g} \cdot \vec{s} = \vec{x} \cdot \vec{s} - \gamma \frac{\partial}{\partial z^2}$, $s(z) = s(q) e^{i q z} \rightarrow \omega \vec{g} \vec{s}(q) = \vec{x} \vec{s}(q) + \gamma q^2 \vec{s}(q)$
 um $\omega(q) = \vec{x} + \gamma q^2$ - energy TM - excitations of

18 Mag $S(z) = a \cos qz + b \sin qz$. $\frac{\partial S}{\partial z} = -aq \sin qz + bq \cos qz$ ($z=0 \rightarrow b=0$)

$$\left(\frac{\partial S}{\partial z}\right)_{z=0} = -aq \sin qL = 0, \quad q = q_n = n\pi/L, \quad S(z) = \begin{cases} \cos q_n z & n=0 \\ \sin q_n z & n \neq 0 \end{cases}$$

t.e. $w_n = \frac{x}{a} + \frac{y}{b} \sin \frac{n\pi x}{L}$, $n = 0, 1, 2, \dots$

$$\frac{\bar{x}}{g} = \frac{\bar{x}L}{gL} = \frac{\bar{x}}{G} = \omega_G, \quad \omega_n = \omega_G + \left(\frac{1}{g}\right) q_n^2 \quad \text{— local approx.}$$

$$\frac{1}{2} \frac{g}{g} \approx \frac{1}{2} \frac{1}{M \cdot \frac{1}{k}} M^2 V \left(\frac{L_e}{L} \right)^2 \ln \frac{1}{2} \cdot \frac{L}{L_e} = \frac{8}{1} M \cdot V \left(\frac{L_e}{L} \right)^2 \ln \frac{1}{2} \cdot \frac{L}{L_e}$$

$$\omega_n = \omega_c + (n/2) \left(\frac{2\pi M_s}{8} \right) \left(\frac{L}{L} \right)^2 \ln \frac{1}{c} = \frac{1}{2} 8 M_s \left(\frac{R}{L} \right)^2 \left(\frac{L}{L} \right)^2 \ln \frac{1}{c}$$

$$\omega_n = \omega_G + \left(\frac{g}{g_L^2}\right) (n\pi)^2, \quad \omega_0 = \omega_G, \quad \omega_1 = \omega_G + \left(\frac{g}{g_L^2}\right) \pi^2$$

$$D \gg \lambda_{cu}. \text{ Тогда } R = 150 \text{ nm}, L = 60 \text{ nm}, L_e = 18 \text{ nm} \rightarrow \omega_1 \sim \omega_G = \frac{1}{2} \gamma M_s \left(\frac{150}{60} \right)^2 \left(\frac{18}{60} \right) + 3 \cdot \pi^2 \approx 7.6 \gamma M_s \approx 7.6 \cdot 2.4 \text{ GHz} \approx 18.2 \text{ GHz} - \text{correct because in the case of } D \gg \lambda_{cu} \text{ the } \omega_1 \text{ and } \omega_G \text{ are equal.}$$

50. (a) $W_{\text{ext}} = \pi A \ln \frac{1}{c} \oint dz \left(\frac{\partial \tilde{\phi}}{\partial z} \right)^2 = \oint dz W'_{\text{ext}} = L \oint dz W'_{\text{ext}} \rightarrow \pi A \ln L \oint dz \left(\frac{\partial \tilde{\phi}}{\partial z} \right)^2$

$\int_0^{\infty} \frac{1}{z^2} dz = -\frac{1}{z} \Big|_0^{\infty} = -\frac{1}{\infty} + \frac{1}{0} = \infty$

Due 7 beg. 4: $W_{ex} = \pi A \ln \frac{1}{c} \frac{1}{L^2} (\frac{\partial X}{\partial z})^2 = \pi A \ln \frac{1}{c} \cdot (\frac{R}{L})^2 (\frac{\partial S}{\partial z})^2 = \frac{1}{2} y (\frac{\partial S}{\partial z})^2$

$$W_{\text{vol}} = 4\pi n_s^2 R \int_0^L dz \int_0^{2\pi} dz' \int_0^\infty dk e^{-k|z-z'|} J_1(kz) J_1(kz') \tilde{S}(z) \tilde{S}(z') \cdot \frac{1}{2} \cdot \frac{1}{2}$$

$$W_m^{vol} = 4\pi M_s^2 R L^2 \int d\mathbf{z} d\mathbf{z}' \int d\mathbf{k} e^{-k\beta|\mathbf{z}-\mathbf{z}'|} F^2(k) \vec{S}(\mathbf{z}) \cdot \vec{S}(\mathbf{z}') =$$

$$\int_0^L dz dz' e^{-\alpha(z-z')} = \frac{2L}{\alpha} f(\alpha L), \quad \int_0^L dz dz' e^{-\beta k(z-z')} = \frac{2}{\beta k} f(\beta k)$$

$$W_m^{\text{vol}} = \frac{1}{2} \alpha S^2 \omega_G = 8\pi \gamma M_s R^2 \int \frac{dk}{k} f(k) F^2(k) \quad \text{--- Bernoulli}$$

Состав. $x \rightarrow x/R^2$. $\frac{1}{\sigma} \frac{d\sigma}{d\Omega} = \frac{M_s}{\sigma} \int d^2\sigma \vec{m} \cdot \frac{\partial \vec{m}}{\partial \sigma_1} \times \frac{\partial \vec{m}}{\partial \sigma_2} \quad (\sigma \in R)$ в изогнут. коор.
функциях в ед. R , $\sigma \in R$ не зависит.
 R^2 надо убрать и мы имеем: $n = \pi \cdot 1/2 \cdot 1/2 \cdot 1 \cdot 1 \cdot 1 = 1 \cdot \partial \vec{x}^2$

T.e. 2 Sepen b eq. L, 3 b eq. R, a bor X nfm bovinc. ω_n nago $\alpha + \beta \omega_n$

$$\frac{\gamma}{g} = \frac{5 \pi M_s (\frac{L}{L}) \ln \frac{1}{c}}{2 \pi M_s / g} = \frac{1}{2} g M_s \left(\frac{L}{L} \right)^2 \ln \frac{1}{c} \quad \omega_n = \omega_G + \left(\frac{\gamma}{g} \right) (n \pi)^2, \quad \omega_n(L) \sim \frac{1}{L^2}$$

теперь $\omega_1 - \omega_G = \frac{\gamma}{g} \pi^2 = \frac{1}{2} g M_s \left(\frac{L}{L} \right)^2 \ln \frac{1}{c} \cdot \pi^2 =$ не забудем от R, только $\ln \frac{1}{c}$
L = 60 nm $L_e = 18$ nm

$= \frac{1}{2} 2.4 \text{ GHz} \cdot \left(\frac{18}{60}\right)^2 \cdot 3\pi^2 \approx 3.2 \text{ GHz (!)}$ $\sim$ same $\nu_{\text{y}}/\nu_{\text{me}}$, Note: ν calculated within RRM
Naigen ν ν_3 + VA $W_{\text{et}} = A \int dV \left(\frac{\partial \mathbf{m}}{\partial z}\right)^2 = A \int dV [(\theta')^2 + \sin^2 \theta (\phi')^2]$
 Bne case $\theta' = 0$

$$\frac{\partial \Phi}{\partial z} = \frac{\partial \Phi}{\partial \vec{X}} \cdot \frac{\partial \vec{X}}{\partial z}, \quad \text{B.T.V.A.} \quad \frac{\partial \Phi}{\partial s} = -\frac{i}{2} \frac{(1-s^2)}{(z-s)(s\bar{z}-1)}, \quad s = s_x + i s_y, \quad z = x + i y \rightarrow \{$$

$$\frac{\partial \phi}{\partial s} = \frac{1}{2} \left(\frac{\partial \phi}{\partial s_x} - i \frac{\partial \phi}{\partial s_y} \right) = \frac{(1-\beta^2)^{1/2}}{2c} (\dot{\phi} \cos \phi + \dot{\psi} \sin \phi)$$

$$W_{\text{er}} = A (dz (d\phi (1 - \rho^2)^2 [\dots] = \pi A (dz (d\phi (1 - \rho^2)^2 [(\frac{\partial s_x}{\partial z})^2 + (\frac{\partial s_y}{\partial z})^2])$$

$\int_0^1 \frac{d\log}{g^2} (1-g^2)^2 = \left[\log - g^2 + \frac{1}{4} g^4 \right]_0^1 = \ln \frac{1}{e} - \frac{3}{4} + O(c^2)$. B RVM $\delta \ln \frac{1}{e}$

$\omega = \frac{1}{2} \cdot 2,4 \text{ GHz} \left(\frac{18}{60}\right)^2 \cdot 2 \cdot \pi^2 \approx 2,1 \text{ GHz (!)}$. Экон. и симуляция
 $\omega_G \approx 1,1 \text{ GHz}$ и $\omega_{\sim} \approx 3,3 \text{ GHz}$, т.е. $\omega - \omega_G = 2,2 \text{ GHz}$ - булагдур.

Астелехена $\frac{(g+g')^2 + 12 - 2^{1/2} p^2}{\text{lines}}$ $\chi(x') = (-) \int dg \int dg' \frac{1}{\pi x \sqrt{g g'}} [(2 - \pi^2) K(x) - 2E(x)]$
 Yres v. core yblennys y u bce raccosm ω_n krome $\omega_E = \omega_G$.

17/VIII YD give $\vec{S}$ -components under big con. $Y_{11} (S_x \rightarrow S)$.

$$\lambda S(z) = -y \frac{\partial^2 S}{\partial z^2} + \int dz' x(zz') S(z'), \quad \lambda S(z) = \left[-y \frac{\partial^2}{\partial z^2} + \tilde{V} \right] S(z), \quad \lambda = g_w$$

$$V_5(z) = \int dz' x(zz') S(z'). \quad \Gamma_{p, ycr.} \quad S'_z(0) = 0, \quad S'_z(L) = 0$$

возмущении гравитационного спектра. $\delta\ell = \delta\ell_0 + \hat{V}$ $\delta\ell_0 = -\gamma \frac{\partial^2}{\partial^2}$

невозм. СФ $-\gamma \frac{\partial^2 u}{\partial z^2} = \lambda u \rightarrow u_n(z) = \sqrt{\frac{2}{m}} \cos(q_n z), \quad \epsilon_n = \begin{cases} 2, & n=0 \\ 1, & n \neq 0 \end{cases}$

$$\int dz u_n^2 = \frac{2}{\epsilon_n} \int dz \cos^2(q_n z) = \frac{2}{\epsilon_n} \frac{1}{2} [2\delta_{n0} + (1 - \delta_{n0})] = \frac{2}{\epsilon_n} \frac{\epsilon_n}{2} = 1 \quad q_n = n\pi$$

1. min. uol. neg. TB: $\lambda_n = \lambda_n^0 + \langle n | \hat{V} | n \rangle = y_n^2 + \int d^2z d^2z' \alpha(zz') u_n(z) u_n(z')$

$$u_n(z) = \sqrt{\frac{2}{E_n}} \cos(\sqrt{E_n} z) \quad \text{2.oi norm. TB: } \lambda_n = \lambda_n^0 + \langle n | \hat{V} | n \rangle + \sum_{n' \neq n} \frac{|K_{n'1} \hat{V} | n \rangle|^2}{\lambda_n - \lambda_{n'}}$$

Note $\lambda_0 = g \omega_G = \langle 0 | V | 0 \rangle = \sum_{n'} \frac{|\langle n' | V | 0 \rangle|^2}{\lambda_0}$ $\lambda_0 = g \pi^2 \hbar^2$ $\lambda_n = \lambda_{n'}$

Energy VC excitations $\epsilon(\mathbf{k}) \approx \hbar \pi^2 n^2 + \langle \psi | \hat{H} | \psi \rangle$

$$14 \quad \langle n | \hat{U} | n \rangle = \frac{2}{\pi} \int_0^{\pi} d\alpha \cos(\alpha) \cos(n\alpha) \cos(n\alpha) = \frac{2}{\pi} \int_0^{\pi} d\alpha \cos^2(n\alpha) \cos(\alpha)$$

и если $\max_{\beta \in \mathcal{B}} \mathcal{E}_n(\beta) \rightarrow 0$, то $\mathcal{E}_n(\hat{\beta}) \rightarrow 0$.
 и если $\max_{\beta \in \mathcal{B}} \mathcal{E}_n(\beta) \rightarrow 0$, то $\mathcal{E}_n(\hat{\beta}) \rightarrow 0$.

15 ~~V6~~ // Aug. 12 Cu. c. P. u. D. Bafrağın na av. Barcelona, 11

Об. СВ, ЗС (esc. 3) и ЧА, ЧА (esc. 2). Цена 386 - 472 к€ + 24 к€ гараж + 10% ЧА
- годового н/м надела площадью 86 - 94 м² общей теплицы 400 м² и др. надела

Осиг. вѣща изъ Овон (см. замѣтки и инв. лб.)
//С. 1. и 2. в. 10000 и 10000 Talent House: 40000 000000

18/11/11 E-mails to Crabtree (ycor, ST-nordic, PPT) + Eric High order: Vortex™

$$\int d^2 z d^2 z' \kappa(z z') \cos(\pi n z) \cos(\pi n z') \rightarrow \int d^2 z \int d^2 z' e^{-\beta k |z - z'|} \cos \varphi_{n, z} \cdot \cos \varphi_{n, z'}$$

$$f_0(\beta_k) = \frac{1}{\beta_k} \left[1 - \frac{1}{\beta_k} (1 - e^{-\beta_k}) \right] = \frac{1}{\beta_k} f(\beta_k). \quad \beta_k \rightarrow k \text{ now, } q_n \rightarrow q. \quad f_n(\beta_k)$$

$$\sin(k) = \int_0^1 dz \int_0^1 dz' e^{-k|z-z'|} \cos qz \cos qz' = \int dz \left[\int dz' e^{-kz} e^{kz'} \cos qz \cos qz' + \right.$$

$$+ \int_{\mathbb{R}^2} dz' e^{-kz'} e^{kz} \cos qz \cos qz' = \int dz \left[e^{-kz} \cos qz \int_{\mathbb{R}^2} dz' e^{kz'} \cos qz' + e^{kz} \cos qz \int_{\mathbb{R}^2} dz' e^{-kz'} \cos qz' \right]$$

$$I(k) = \int dz e^{kz} \cos qz = \frac{e^{kz}}{k^2 + q^2} (k \cos qz + q \sin qz)$$

$$J_n^A(k) = \frac{dz \cos qz}{k^2 + q^2} \left[e^{-kz} \left(e^{kz} (k \cos qz + q \sin qz) - k \right) + e^{kz} \left(e^{-kz} (-k \cos qz + q \sin qz) - \right) \right]$$

$$= \int \frac{dz}{k^2 + q^2} \cos qz \left[\underbrace{k \cos qz + q \sin qz}_{\text{particular}} - k e^{-kz} + e^{kz} \underbrace{e^{-kz} (-k \cos qz + q \sin qz)}_{\text{homogeneous}} + k \cos qz - q \sin qz \right]$$

$$= \frac{k}{k^2 + q^2} \int_0^{\infty} dz \cos qz [2 \cos qz - e^{-kz} - (-1)^n e^{-k} e^{kz}] = \frac{k}{k^2 + q^2} \left[2 - \frac{k}{k^2 + q^2} (1 - e^{-k} (-1)^n) \right]$$

$$-(-1)^n e^{-k} \frac{(-k)}{1^2 + 0^2} (1 - e^k (-1)^n) = \frac{k}{1^2 + 0^2} \left[\epsilon_n + \frac{k \cdot 2}{1^2 + 0^2} (-1)^n - k - 1 \right]$$

$$f_n(k) = \frac{2k}{13 \cdot 2} \left[\frac{1}{13} + \frac{k}{13} \sqrt{(-1)^{n-k} - 1} \right] \quad \text{for } n=0 \text{ to } 12$$

$$k + \frac{1}{2}n \in \mathbb{Z} \quad k + \frac{1}{2}n \in \mathbb{Z} \quad \left[\begin{matrix} 1 \\ 1 \end{matrix} \right], \quad \frac{1}{2}n \in \mathbb{Z} \quad \frac{1}{2}n \in \mathbb{Z}$$

$\langle n|V|n \rangle = \int dz dz' \chi(zz') \frac{2}{\epsilon_n} \cos(q_n z) \cos(q_n z') = \frac{2}{\epsilon_n} (8\pi^2 M_s^2 L^2 R) \int dk e^{-k|z-z'|/R} F^2(k)$
 $\int dk e^{-k|z-z'|/R} F^2(k) = \frac{2}{\epsilon_n} (8\pi^2 M_s^2 L^2 R) \int dk f_n(\beta k) F^2(k), F(k) = \int_{-L}^L dz J_0(kz)$
 $\int dk f_n(\beta k) F^2(k)$ - gives necessary TM - $\vec{S}(z) = \text{const.}$
 $\int dk f_n(\beta k) F^2(k)$ Mathcad script says, no nonlin. ucn. 2nd TB.
 var. magn. moment $P_{nn}(k)$ uz Karimkhanov J. Phys. 1986.
 $M_s = 810 \text{ G}$, $\gamma = 2.95 \text{ kHz/G}$, $A \approx 1.3 \cdot 10^{-6} \text{ erg/cm}$.

19/VII Plamova Word file - zavorubiy PRL no requm non Gyrotropic modes u nocen to Tiesu Adekunle. Tiesu u probepu w, u ne zabucut as R.

20-21/VIII Doreag poster F/M/F ST-nanopillar na JEMS u obcyug.

22/VIII vybaviano pacera chain of vortex dots: $v \sim 1/2$ - perymetras simulations u ne geymo covn. $c \sim 1/2$ - Sakl. PRB'13, $m_n(w)$ - simul. c obcyug murem w_1, w_2 u n - nago nomest. dke no qmest $J(w, k)$ chga Cnen boe Cadu u onaren cber $\sim 165 \text{ €}$, obcyug. c dke. DAA

23/VIII 4-X goroboro pacera radial SW u mana que Depueb. Doku. V. barrierez crebunim no vey. : emy nago ybeur. V. energy (oscillator), 2008 p. 1000-1005. Quesna $X_{th} \sim 5 \text{ nm}$ u $T = 300 \text{ K}$ - pryk. radus TM.

23/VIII Onmar AGATA y BASURA bill 99,41€ (cnenen) neferme. ka cber Nibel. C. u A. B Lassarte-Orn (3-ai nam goma $\sim 110 \text{ m}^2$, dy dyk, upama, mag. $\sim 240 \text{ kE}$) u bibe "Eroski". Cu. gon - Zizurkil (Villabona)

24-31/VIII Noezgka na JEMS'13, Rhodes, Greece. Noznakon u cber-nary.

1-6/IX yracae b ICNM'13, Istanbul, Turkey. Noznakon u Gabriela.

7-8/IX C. N. Eroski - Uribel, qorn e-mails, new citations, obety PRL-Klein.

8-10/IX Session chairman DICNMA, gey. Spintronics u Domain Wall Dyn.

11/IX Obey Wok" c Cu. A. u. Conf. Dinner. Cu. kb. Logarith: 1n. 1A, 3A, 1C

12/IX 2n-2A3A. Tyrmame 1C, no mngko. Pope u hat. 3A-1n. Bce 320-360K

13/IX + garaje. kb. 20-85m², napenbne, no cberne b xpyem u meste.

14/IX C. N. Eroski - Uribel. Pyobepka korp. High-order Vertex-TM pacera:

$W_m = \frac{1}{2} \int dz dz' \chi(zz') \vec{S}(z) \cdot \vec{S}(z'), \chi(zz') = 8\pi^2 M_s^2 R \int dk e^{-k|z-z'|/R} F^2(k)$
 $\int dz dz' \chi(zz') = 8\pi^2 M_s^2 R \int dk F^2(k) \int dz dz' e^{-k|z-z'|/R} = 8\pi^2 M_s^2 R \int dk F^2 \left(\frac{2LR}{k} f(\beta k) \right) =$
 $= 16\pi^2 M_s^2 R^2 L \int \frac{dk}{k} f(\beta k) F^2(k) = \chi^0$, ecum $W_m = \frac{1}{2} \chi S^2 = \frac{1}{2} \left(\frac{\chi}{R^2} \right) \bar{X}^2$

Noznakon u Julian u postdoc Candidate A. Timgreob. neferme A. u. u.

15/IX Humberpuses c Cu. u Angp. A. Angp. Wozgax Gufy u Angp. T. Network Analga.

16/IX marmu, ugn. gne w-FMR setup. Ymny u nac goma.

17/IX Pacera c Cu. nag high-order-TM paper-PRL. Pyobepka yD:

$\text{gap } X_\beta = \int dz \vec{g} \frac{\delta \mathcal{L}}{\delta X_\beta} = \frac{\delta W}{\delta X_\beta}, W(z) = \int dz \vec{g} \delta \mathcal{L}(\vec{g}, z, \vec{S}), g_{\beta\beta} = \int dz \vec{g} m^2(\dots)$
 $W_m = \frac{1}{2} \int dz dz' \chi(zz') \vec{S}(z) \cdot \vec{S}(z'), \chi(zz') = 8\pi^2 M_s^2 R L^2 \int dk e^{-\beta k|z-z'|} F^2(k)$
 $\text{gap } \vec{S}_\beta = \frac{1}{R^2} \frac{\delta W}{\delta \vec{S}_\beta}, W = L \int dz W'(z), W_{ex} = A \int dV [(\theta'_z)^2 + \sin^2 \theta (\varphi'_z)^2]$
 RVM (Gus' PRL'06): $\frac{1}{M_s^2} W_{ex} = \frac{1}{2} \gamma \frac{L^2}{R^2} \int_0^L dz \left(\frac{\partial \vec{X}}{\partial z} \right)^2 = \frac{1}{2} \gamma \int_0^L dz \left(\frac{\partial \vec{S}}{\partial z} \right)^2, \vec{z} = \frac{z}{L}$
 $\gamma_{VM} = \left(\frac{L_e}{L} \right)^2 \ln \frac{1}{\epsilon}, \gamma_{MA} = \left(\frac{L_e}{L} \right)^2 \left(\ln \frac{1}{\epsilon} + \frac{5}{4} \right)$ - yzaron V. coze.
 $W_{ex} = \frac{1}{2} \gamma \pi M_s^2 R^2 L \int d\vec{z} \left(\frac{\partial \vec{S}}{\partial \vec{z}} \right)^2, W_{ex} = \frac{1}{2} \gamma \pi M_s^2 R^2 L \left(\frac{\partial \vec{S}}{\partial \vec{z}} \right)^2$

Abendua - Dictionnaire
 - 6 RM Cora. Gus' PRA'02, $W_{ex}(\text{plane}) = -\frac{1}{2} \int d^2z \mu \tilde{S}^2(z)$, $W_{ex}(\text{plane}) = -\frac{1}{2} \int d^2z \mu \tilde{S}^2(z)$
 26 stage pour normaliser à 1 VA, à ne RVN
 $W_{ex}/M_s^2 V = -(\ell_e/R)^2 \tilde{S}^2$, $W_{ex} = M_s^2 V (\ell_e/R)^2 \tilde{S}^2$
 $W_{ex}(\text{plane}) = -\pi M_s^2 R^2 (\ell_e/R)^2 \int d^2z \tilde{S}^2(z)$, $W = L \int d^2z W'$

Arcazhena - Mercredi
 $R^2 W_{ex}(\text{plane}) = -\pi M_s^2 (\ell_e/R)^2 \tilde{S}^2(z)$, $\frac{1}{R^2} W_{ex}' = \frac{1}{2} \mu \left(\frac{\partial \tilde{S}}{\partial z} \right)^2 - \frac{1}{2} \mu \tilde{S}^2$
 2go $\mu = \pi M_s^2 (\ell_e/R)^2 [\ln \frac{1}{2} + \frac{5}{4}]$, $\mu = 2\pi M_s^2 (\ell_e/R)^2$
 $W_m = \frac{1}{2} \int d^2z \int d^2z' \chi(zz') \tilde{S}(z) \tilde{S}(z') = L \int d^2z W'_m(z)$, $W'_m(z) = \frac{1}{2L} \int d^2z' \chi(zz') \tilde{S}(z) \tilde{S}(z')$
 Beq. Thiele give $\tilde{S}$ b'ogues $\frac{1}{R^2} W'(s)$, $W' = W'_m + W'_{ex}$
 $\frac{1}{R^2} W'_m = \frac{1}{2} \frac{1}{LR^2} \int d^2z' \chi(zz') \tilde{S}(z) \tilde{S}(z')$, $\chi(zz') = 8\pi^2 M_s^2 R^2 L^2 \int dk e^{-k|\ell_e z - \ell_e z'|} F^2(k)$

14/12 Pafona e fuesom nag High-tm PRL paper. N. yexara b' Kueb, c coscu 1750\$
 u 70€. Organ fuesy 1494€ = 1600€ (nepemca) - 70€ (organm) - 36€ (fuesy fuy)
 C Ant. f. u. Dnc u Rala ka ymum b' "Wok" - zurriola. Hamca Gabriela (Romania)
 E-mail to S. Gogorova.

15/12 Gpr. e-mails. yD Thiele $\partial_{\alpha\beta} \tilde{X}_{\beta} = -\frac{\delta W'}{\delta X_{\alpha}}$, $\partial_{\alpha\beta} (\tilde{S})_{\beta} = -\frac{1}{R^2} \frac{\delta W'}{\delta S_{\alpha}}$
 $\tilde{S} = \tilde{X}(z)/R$, $W' = \int d^2z \tilde{S}^2$, $W[\tilde{S}(z)] = \int d^2z W'[\tilde{S}(z)]$, $\tilde{g} \times \tilde{S} = -\frac{1}{R^2} \frac{\delta W'}{\delta \tilde{S}}$
 $W[\tilde{S}(z)] = \int d^2z [W'_m(\tilde{S}) + W'_{ex}(\tilde{S}, \partial \tilde{S}/\partial z)] = \int d^2z W'[\tilde{S}(z), \partial \tilde{S}/\partial z]$, $\tilde{g}_{\alpha\beta} = \int d^2z \tilde{S}^2(\dots)$
 $\frac{\delta W'}{\delta \tilde{S}} = \frac{\partial W'}{\partial \tilde{S}} + \frac{\partial}{\partial z} \frac{\partial W'}{\partial (\partial \tilde{S}/\partial z)}$, $\frac{W'}{R^2} = \frac{1}{2} \mu \left(\frac{\partial \tilde{S}}{\partial z} \right)^2 - \frac{1}{2} \mu \tilde{S}^2(z) + \frac{1}{2} \frac{1}{LR^2} \int d^2z' \chi(zz') \tilde{S}^2(z)$
 2go z.z' b' eq. L. $W[\tilde{S}(z)] = \frac{LR^2}{2} \int d^2z \left[\mu \left(\frac{\partial \tilde{S}}{\partial z} \right)^2 - \mu \tilde{S}^2(z) \right] + \frac{1}{2} \int d^2z \int d^2z' \chi(zz') \tilde{S}(z) \tilde{S}(z')$

Lowmo nag. yD uz $\tilde{L} = \frac{1}{2} \int d^2z (\tilde{g} \times \tilde{S}) \cdot \tilde{S} = \int d^2z W' = \tilde{L}_{kin} - W[\tilde{S}(z)]$
 $\tilde{L} = \int d^2z \left[\frac{1}{2} (\tilde{g} \times \tilde{S}) \cdot \tilde{S} R^2 - W' \right] \Rightarrow \tilde{S} \neq f(z)$ choqure k $\tilde{L} = \frac{1}{2} (\tilde{G} \times \tilde{X}) \cdot \tilde{X} - W(\tilde{X})$
 No b' Gled-PRL b'ogues $\tilde{L}$ nes nera. Octabum Thiele eq. $\tilde{G} = \tilde{g}L$
 Tacosor TM $W_n = \frac{\mu}{2} q_n^2 + \frac{1}{2} V_{nn}$, $V_{nn} = \int d^2z \int d^2z' \chi(zz') u_n u_n - \mu$, $W' = \int d^2z \tilde{S}^2$
 $W_{ex} = \frac{\mu}{2} q_n^2 = \pi M_s^2 (\ell_e/L)^2 [\ln \frac{1}{2} + 5/4]$, $\pi^2 n^2 = \frac{1}{2} 8\pi^2 M_s^2 (\ell_e/L)^2 \pi^2 [\ln \frac{1}{2} + \frac{5}{4}] \cdot n^2$

17 $\frac{W_{ex}}{W_m} = \frac{\pi (\ell_e/L)^2 [\ln \frac{1}{2} + \frac{5}{4}] \cdot n^2}{2\pi M_s^2 \frac{1}{2}}$, $\int d^2z \int d^2z' e^{-\beta k |z - z'|} \cos q_n z \cdot \cos q_n z' = f_n(\beta k)$
 $V_{nn} = \int d^2z \int d^2z' \chi(zz') \left(\frac{2}{1 + \delta_{no}} \right) \cos q_n z \cdot \cos q_n z' = \frac{2}{(1 + \delta_n)} (8\pi^2 M_s^2 L^2 R) \int d^2k e^{-\beta k |z - z'|} F^2(k)$
 18 $\cos q_n z \cdot \cos q_n z' d^2z d^2z' = \frac{2}{(1 + \delta_{no})} \frac{8\pi^2 M_s^2 L^2 R}{R^2 L} \int d^2k f_n(\beta k) F^2(k)$, $E_n = 1 + \delta_n$

19 $f_n(k) \cdot \frac{2}{E_n} = \frac{2k}{k^2 + q_n^2} \left[\frac{E_n}{2} + \frac{k}{k^2 + q_n^2} \{ (-1)^n e^{-k} - 1 \} \right] \left(\frac{E_n}{2} \right)^{-1} = \frac{2k}{k^2 + q_n^2} \left[1 + \frac{2}{E_n} \frac{k}{k^2 + q_n^2} \{ (-1)^n e^{-k} - 1 \} \right]$
 $V_{nn} = 8\pi^2 M_s^2 \beta^2 \int d^2k f_n(\beta k) F^2(k) = |\beta k \rightarrow k| = 8\pi^2 M_s^2 \beta^2 \int_0^\infty dx f_n(x) F^2(x/\beta) = 2f_n(k)$
 $W_n^{mag} = \frac{1}{2} V_{nn} = \frac{1}{2} 8\pi^2 M_s^2 \beta^2 \int_0^\infty dx f_n(x) F^2(x/\beta) = 2W_m \int_0^\infty dx f_n(x) F^2(x/\beta)$
 $f_n^{(u)} = \frac{1}{k} \left[1 + \frac{(-1)^n}{k} (1 - e^{-k}) \right]$, $\int dx \frac{1}{x} \left[1 - \frac{1}{x} (1 - e^{-x}) \right] F^2(x/\beta) = \int_0^\infty \frac{dk}{k} \left[1 - \frac{1}{\beta k} (1 - e^{-\beta k}) \right] F^2(k)$
 $W_n^{(u)} = 2W_m \int_0^\infty \frac{dk}{k} f(\beta k) F^2(k)$, $f(k) = 1 - \frac{1}{k} (1 - e^{-k})$ - b'epmo. $f_0(\beta k) = \frac{1}{\beta k} f(\beta k)$
 $W_n^{(u)} = 2W_m \beta \int d^2k f_n(\beta k) F^2(k)$ - uenoung.

Berkov v proboger  contact under contact. $\vec{\mu} \sim \hat{z} \times \vec{S}$ & many papers. $\langle \vec{m} \rangle$ - average $\langle \vec{m} \rangle$ - average $\langle \vec{m} \rangle = \vec{\mu}$

DAAD - Vertex-Berkov

TVA b mu. w $\vec{S}$ v proboger. (15/III 2005): $m_x(\vec{S}) = \frac{C}{g} [-y - y \frac{\vec{S} \cdot \vec{S}}{g^2} + S_y(1-x^2) + S_x y]$

$\langle m_x \rangle_r = \frac{1}{\pi r^2} \int_0^{2\pi} d\varphi \int_0^r dr m_x(\vec{S}, \vec{r})$. $y \vec{S} \cdot \vec{S} = \sin \varphi (S_x \cos \varphi + S_y \sin \varphi) r^2$

$\langle m_x \rangle_r = \frac{1}{\pi r^2} \int_0^{2\pi} d\varphi \int_0^r dr \frac{C}{g} [-\frac{1}{g^2} S_y \sin^2 \varphi r^2 + S_y(1-r^2 \cos^2 \varphi)] = \frac{1}{\pi r^2} \int_0^{2\pi} d\varphi \frac{C}{g} \times$

$\times [-S_y \pi + S_y 2\pi - S_y \pi r^2] = \frac{C}{r^2} \int_0^{2\pi} d\varphi (1-r^2) S_y = \frac{C S_y}{r^2} (r - \frac{1}{3} r^3) = \frac{C S_y}{r} (1 - \frac{1}{3} r^2)$

$\langle m_x \rangle_r = C S_y \frac{1}{r} (1 - \frac{1}{3} r^2)$, $\langle m_y \rangle_r = -C S_x \frac{1}{r} (1 - \frac{1}{3} r^2)$. When $r=1(R)$ becomes $\frac{2}{3}$.

$\langle \vec{m} \rangle_r = -C \frac{1}{r} (1 - \frac{1}{3} r^2) \hat{z} \times \vec{S}$ - bne v. core. $r \gg R_c$, r - radius of contact.

Larumbata Sabina $\vec{\mu} \sim \hat{z} \times \vec{S}$ Case (iii) Berkov na ocuobe paterob Buchi. Ph. 15. Domingo. Igandea

$W(\vec{x}_1, \vec{x}_2) = \frac{1}{2} \kappa_1 (x_1^2 + x_2^2) + \frac{1}{2} \kappa_2 (y_1^2 + y_2^2) + \mu_1 x_1 x_2 + \mu_2 y_1 y_2$, $\vec{x}_i$ - coordinates of vertices j - vertex. $P_1 P_2 = +1$, 19/II 2005.

Oscroga $\omega_x^2 = \frac{1}{G^2} (x_1 + \mu_1)(x_2 + \mu_2) - (i, i)$, $\omega_z^2 = \frac{1}{G^2} (x_1 - \mu_1)(x_2 - \mu_2) - (0, 0)$ mode $\vec{x} = \frac{1}{2} (\vec{x}_1 + \vec{x}_2)$, $\vec{z} = \vec{x}_1 - \vec{x}_2$. ω_x : $x_1 = x_2, y_1 = y_2$ v ω_z : $x_1 = -x_2, y_1 = -y_2$.

Coon. ω_x, ω_z zabucur or znakov μ_1, μ_2 , kyga byoguer C_1, C_2 . $W_{int} = \mu_1 x_1 x_2 + \mu_2 y_1 y_2$. Dne (i, i) mode $W_{int} = \mu_1 x_1^2 + \mu_2 y_1^2 = x_1^2 (\mu_1 + \mu_2 \frac{x_1 + \mu_1}{x_2 + \mu_2})$

$$\frac{\partial m_z}{\partial z} = \frac{1}{2} \left(\frac{\partial m_z}{\partial x} - i \frac{\partial m_z}{\partial y} \right) = \frac{\partial}{\partial z} \left(\frac{1-f\bar{f}}{1+f\bar{f}} \right) = \frac{-\frac{\partial f}{\partial z} \bar{f} (1+f\bar{f}) - (1-f\bar{f}) \frac{\partial \bar{f}}{\partial z}}{(1+f\bar{f})^2}$$

$$\frac{\partial f}{\partial z} = i \frac{c}{2} \left[1 - \frac{1}{1+|f|^2} 2\bar{f}z \right] \approx i \frac{c}{2} [1 - 2\bar{f}z]$$

$$\frac{\partial f}{\partial z} = i \frac{c}{2} [1 - 2\bar{f}z] \approx i \frac{c}{2} [1 - 2\bar{f}z]$$

$$\frac{\partial f}{\partial z} = i \frac{c}{2} [1 - 2\bar{f}z] \approx i \frac{c}{2} [1 - 2\bar{f}z]$$

$$m_x \frac{\partial m_z}{\partial y} - m_y \frac{\partial m_z}{\partial x} = \text{Re} (m_x - i m_y) \left(\frac{\partial m_z}{\partial x} - i \frac{\partial m_z}{\partial y} \right) = \text{Re} \frac{2\bar{f}}{1+f\bar{f}} \cdot 2 \frac{\partial m_z}{\partial z}$$

$$\text{Re} \left(\bar{f} \frac{\partial m_z}{\partial z} \right) = \frac{(-2)4}{(1+f\bar{f})^3} \text{Re} \left(\bar{f} 2 \frac{\partial f}{\partial z} \right)$$

$$\bar{f} 2 \frac{\partial f}{\partial z} = \frac{1}{c^2} \left[(1+2|f|^2 g^2) \bar{z} - \bar{f} (1+2g^2) - \bar{f} z^2 + 2\bar{f}^2 z \right] + i \frac{c}{2} [\bar{z} - \bar{f} - \bar{f} z^2] =$$

$$= -i \frac{c}{c^3} \left[(1+2|f|^2 g^2) \bar{z}^2 - \bar{f} \bar{z} - \bar{f} z^3 - \bar{f} (1+2g^2) \bar{z} + \bar{f}^2 (1+2g^2) + |f|^2 (1+2g^2) \bar{z}^2 - \right.$$

$$\left. - \bar{f} z^3 + |f|^2 \bar{z}^2 + \bar{f} z^4 + 2\bar{f}^2 g^2 \right] = -i \frac{c}{c^3} \left[\bar{f}^2 (1+4g^2) - \bar{f} \bar{z} 2(1+g^2) + \right.$$

$$\left. + \bar{z}^2 (1+2|f|^2 + 4g^2|f|^2) - 2\bar{f} \bar{z}^3 + \bar{f} z^4 \right], \text{Re} \bar{f}^2 = \text{Re} |f|^2 e^{i2\varphi_s} = |f|^2 \cos 2\varphi_s$$

$$\text{Re} \bar{f} \bar{z} = \text{Re} |f| g e^{-i(\varphi + \varphi_s)} = |f| g \cos(\varphi + \varphi_s), \text{Re} \bar{z}^2 = g^2 \cos 2\varphi$$

$$\text{Re} \bar{f} \bar{z}^3 = \text{Re} |f| g^3 e^{-3i\varphi} e^{-i\varphi_s} = |f| g^3 \cos(3\varphi + \varphi_s), \text{Re} \bar{f} z^4 = |f|^2 g^4 \cos(4\varphi - 2\varphi_s)$$

$$m_x \frac{\partial m_z}{\partial y} - m_y \frac{\partial m_z}{\partial x} = \frac{-8}{(1+f\bar{f})^3} \text{Re} (-i) \frac{c}{c^3} [\dots] = \frac{8}{(1+f\bar{f})^3 c^3} \text{Im} [\dots] =$$

$$= \frac{8}{(1+f\bar{f})^3 c^3} \left[-(1+g^2) |f|^2 \sin 2\varphi_s + 2(1+g^2) |f| g \sin(\varphi + \varphi_s) + (1+2|f|^2 + 4g^2|f|^2) g^2 (-1) \sin 2\varphi \right.$$

$$\left. + 2|f| g^3 \sin(3\varphi + \varphi_s) + |f|^2 g^4 (-1) \sin(4\varphi - 2\varphi_s) \right] - \text{Gegenwartig nicht } S_d!!$$

$$\frac{\partial m_y}{\partial x} - \frac{\partial m_x}{\partial y} = -i \left[\frac{\partial}{\partial z} (m_x + i m_y) - \frac{\partial}{\partial \bar{z}} (m_x - i m_y) \right] = -2i \left[\frac{\partial}{\partial z} \frac{f}{1+f\bar{f}} - \frac{\partial}{\partial \bar{z}} \frac{\bar{f}}{1+f\bar{f}} \right] =$$

$$= -2i \left[\frac{\frac{\partial f}{\partial z} (1+f\bar{f}) - f \bar{f} \frac{\partial \bar{f}}{\partial z}}{(1+f\bar{f})^2} - \frac{\frac{\partial \bar{f}}{\partial \bar{z}} (1+f\bar{f}) - \bar{f} f \frac{\partial f}{\partial \bar{z}}}{(1+f\bar{f})^2} \right] = -2i \left[\frac{\frac{\partial f}{\partial z} - \frac{\partial \bar{f}}{\partial \bar{z}}}{(1+f\bar{f})^2} \right]$$

$$\frac{\partial f}{\partial z} \approx i \frac{c}{2} [1 - 2\bar{f}z], \quad \frac{\partial \bar{f}}{\partial \bar{z}} \approx -i \frac{c}{2} [\bar{z} - (\bar{f} + \bar{f} z^2)], \quad \frac{\partial \bar{f}}{\partial z} = -i \frac{c}{2} [\bar{z} - 2\bar{f}z]$$

$$\frac{\partial m_y}{\partial x} - \frac{\partial m_x}{\partial y} = \frac{-2i}{(1+f\bar{f})^2} \left[(1-2\bar{f}z) + (1-2\bar{f}z) \right] i \frac{c}{2} = \frac{c}{(1+f\bar{f})^2} \left[1 - \bar{f}z - \bar{f}z \right]$$

Barbog: yzer $W_D = D(\vec{m} \cdot \text{rot} \vec{m})$ - zuna gaer muer muer no S_d b $W(\vec{s})$ of shifted vortex.

$W_D(\vec{s}) = a_x s_x + a_y s_y + O(s^2)$. T.e. DMI b muer.

in-plane field muer aneuler equil. core position, u b muer u muer muer re b muer re muer vortex-TM. $W_D \sim p \mathcal{C}$

$$m_x \frac{\partial m_z}{\partial y} - m_y \frac{\partial m_z}{\partial x} = i \left[m_+ \frac{\partial m_z}{\partial z} - m_- \frac{\partial m_z}{\partial \bar{z}} \right] = -2 \text{Im} \left(m_+ \frac{\partial m_z}{\partial z} \right), \quad m_+ = m_x + i m_y$$

$$\left(\frac{\partial m_y}{\partial x} - \frac{\partial m_x}{\partial y} \right) m_z = -i m_z \left[\frac{\partial m_+}{\partial z} - \frac{\partial m_-}{\partial \bar{z}} \right] = 2 m_z \text{Im} \left(\frac{\partial m_+}{\partial z} \right)$$

$$\text{rot} \vec{m} = i \left[m_+ \frac{\partial m_z}{\partial z} - m_- \frac{\partial m_z}{\partial \bar{z}} \right] - i m_z \left[\frac{\partial m_+}{\partial z} - \frac{\partial m_-}{\partial \bar{z}} \right] = -2 \text{Im} \left(m_+ \frac{\partial m_z}{\partial z} \right) + 2 m_z \text{Im} \left(\frac{\partial m_+}{\partial z} \right)$$

$$\text{Im} \left(m_+ \frac{\partial m_z}{\partial z} \right) = \text{Im} \left(\frac{2f}{1+f\bar{f}} \cdot \frac{1}{2} \frac{\partial f}{\partial z} \right) = \frac{(-4)f\bar{f}}{(1+f\bar{f})^3} \text{Im} \left(\frac{\partial f}{\partial z} \right), \quad \text{Im} \left(\frac{\partial m_+}{\partial z} \right) \Rightarrow$$

$$\frac{\partial m_+}{\partial z} = 2 \frac{\partial}{\partial z} \frac{f}{1+f\bar{f}} = 2 \frac{1}{(1+f\bar{f})^2} \left[\frac{\partial f}{\partial z} (1+f\bar{f}) - f \bar{f} \frac{\partial \bar{f}}{\partial z} \right] = 2 \frac{1}{(1+f\bar{f})^2} \frac{\partial f}{\partial z} \frac{c}{2}$$