

Turbulence of Spin Supercurrent ?

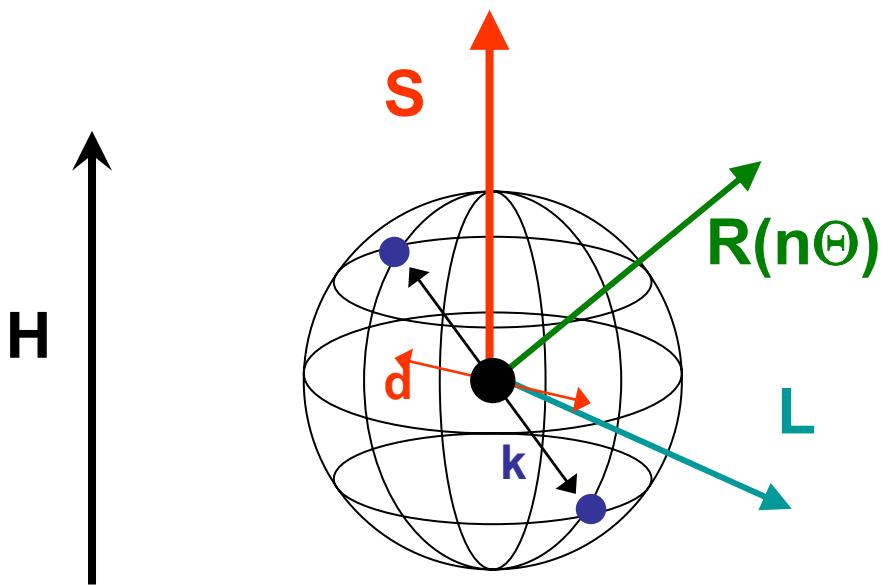
Plus Black hall horizon?

Yuriy M. Bunkov

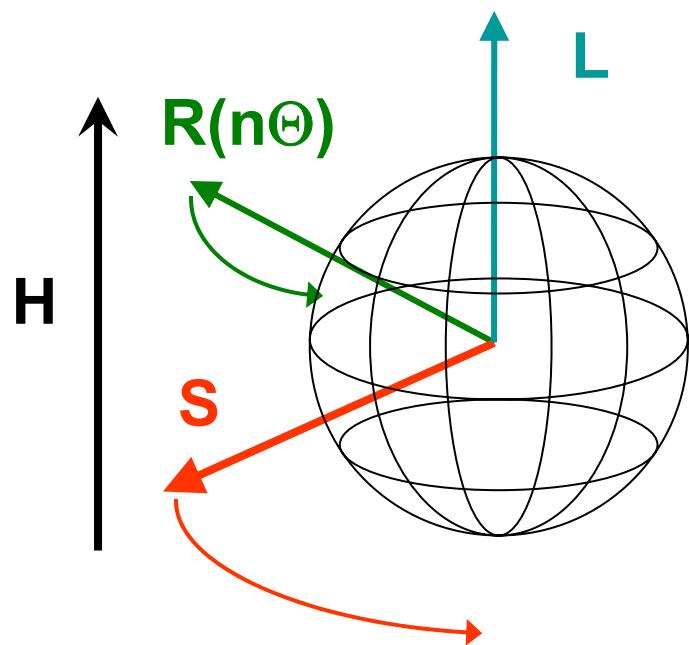
CRTBT - CNRS, Grenoble, France



Order parameter $^3\text{He-B}$



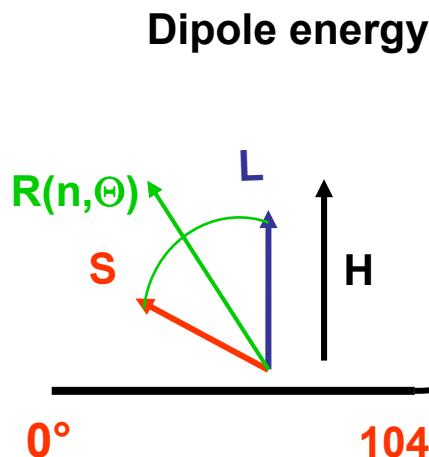
NMR



Coherent, Magnetically Excited States

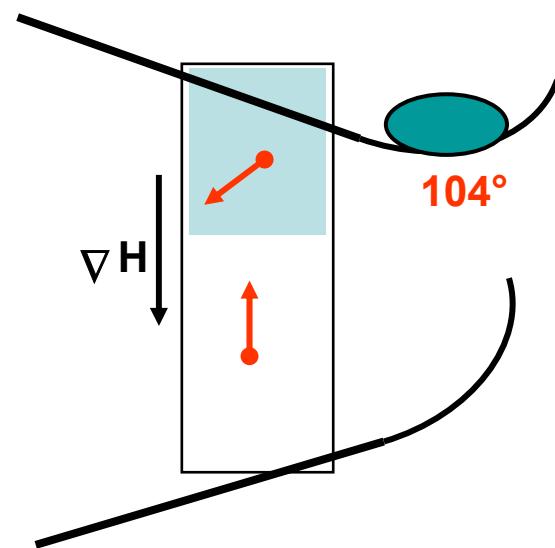
1. Domain with Homogeneous Precession of Magnetization (HPD) 1984

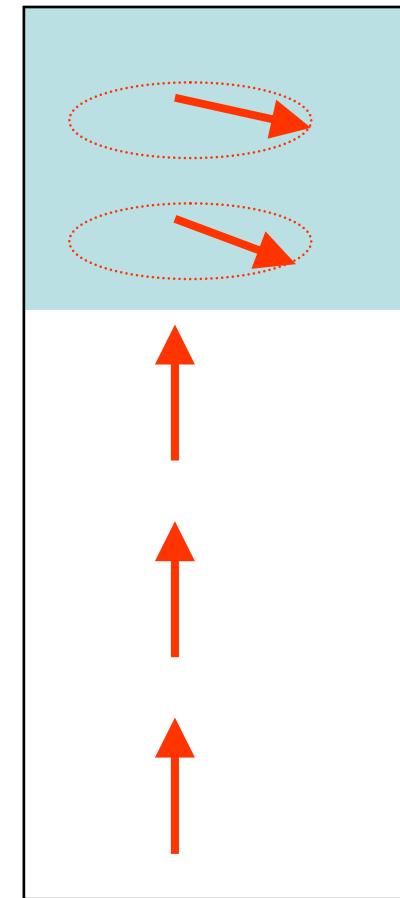
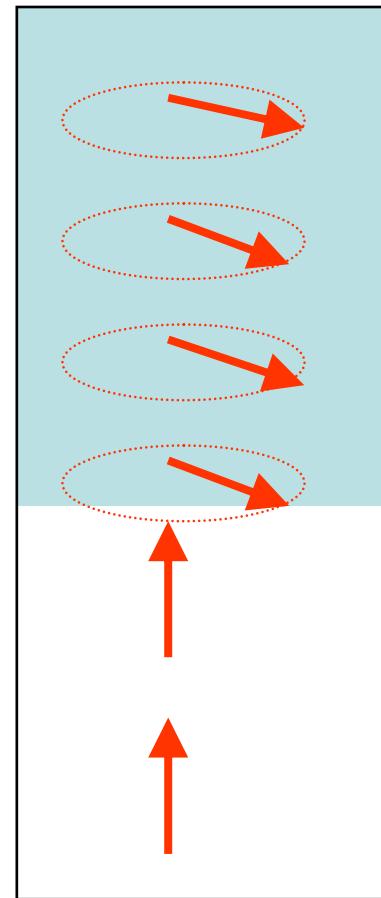
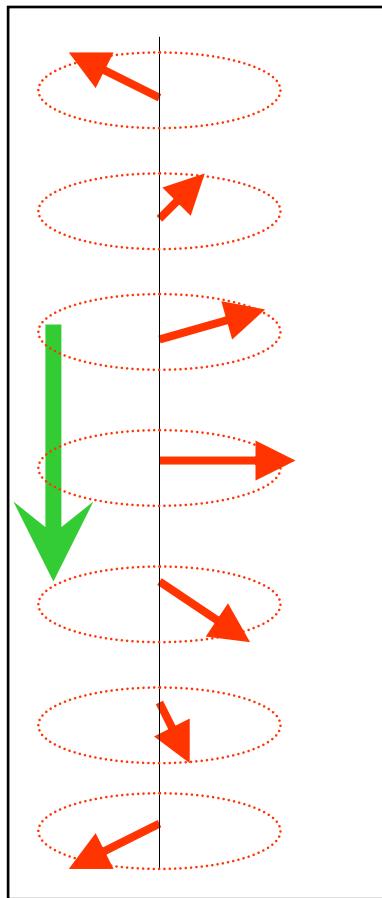
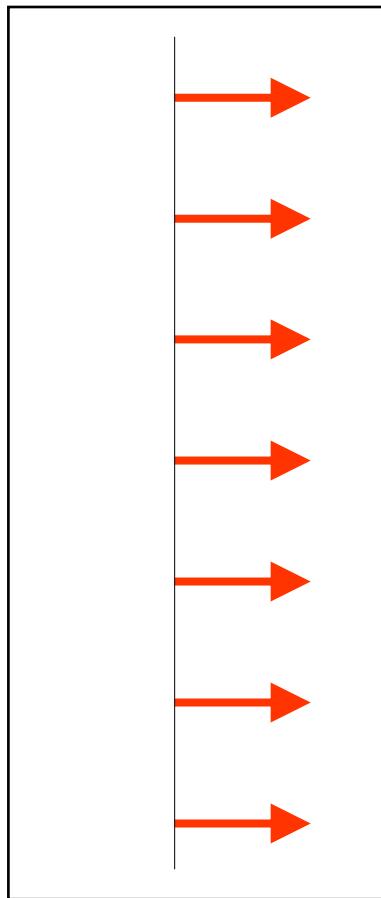
A.S.Borovik-Romanov, Yu.M.Bunkov, V.V.Dmitriev, Yu.M.Mukharskiy,
JETP Letters v.40, p.1033, (1984). Sov.Phys.JETPh, v.61, p.1199, (1985).
I.A.Fomin, JETP Letters v.40, p.1036, (1984).



Brinkman – Smith mode

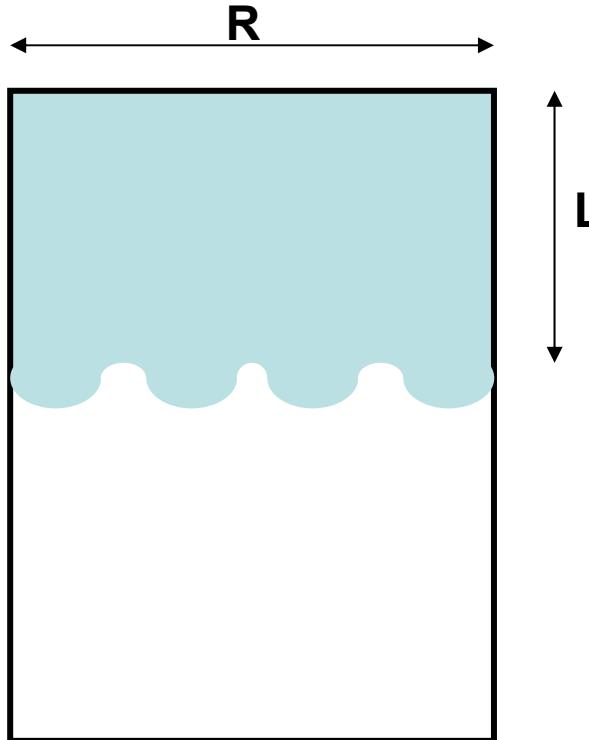
Dipole + magnetic gradient energy





$$\vec{J}_P = F_\alpha(\beta) \nabla \alpha + F_\beta(\beta) \nabla \beta$$

$$\lambda_F = \left(\frac{c_{\parallel}^2}{\gamma H \nabla H} \right)^{1/3}$$



$$\Omega_s^2 = \sqrt{2} \nabla H H^{-1} k c_1 c_2 \tanh\left(\frac{kLc_2}{\sqrt{2}c_1}\right) \quad (76)$$

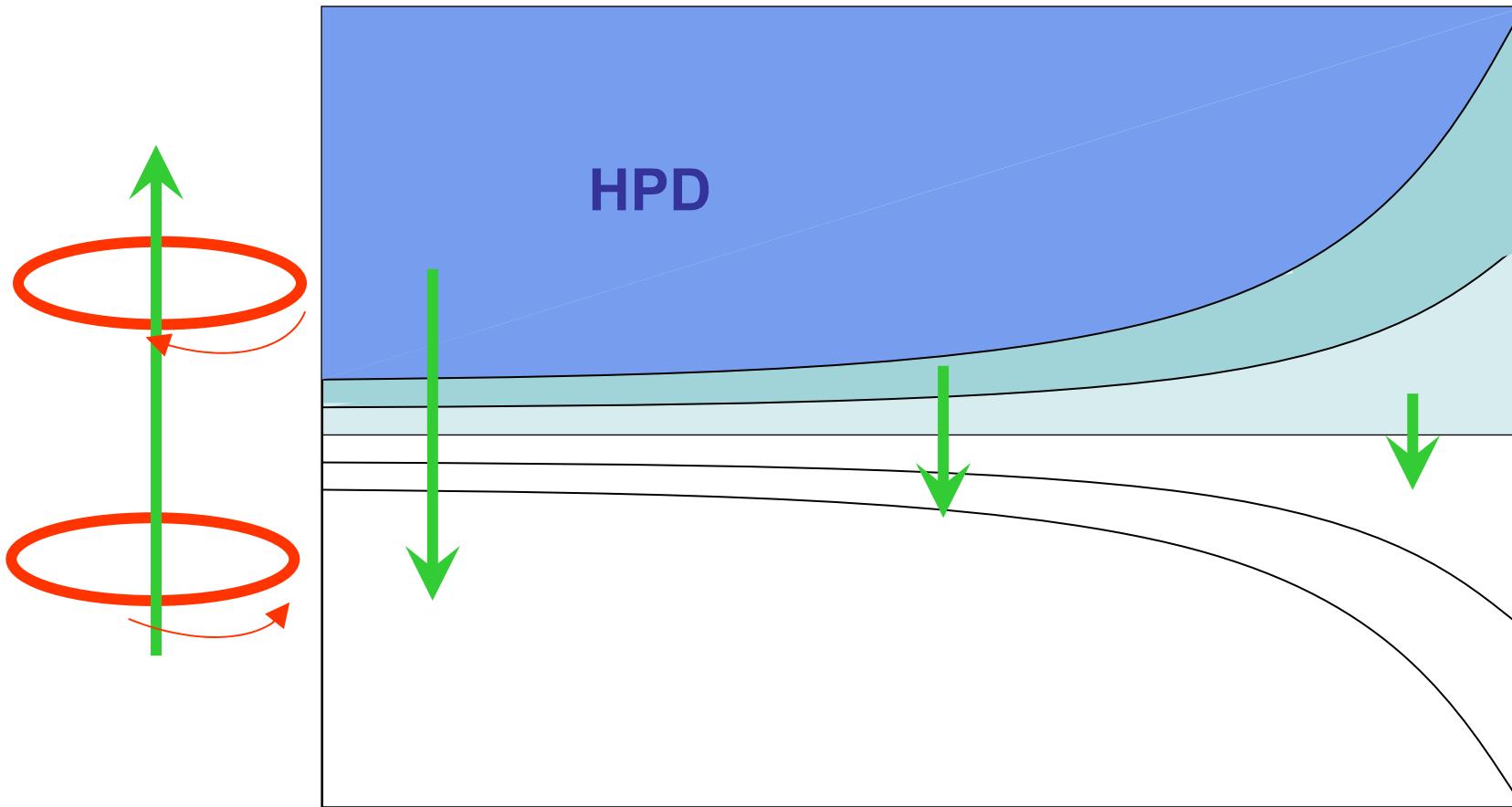
where $k = Q/R$, R is the radius of the cell, Q is the first non zero root of the equation $J(x) = 0$ (here J is the Bessel function J_0 for axial symmetry waves and J_1 for plain waves) and $c_2^2 = (5c_{\parallel}^2 + 3c_{\perp}^2)/4$. For $L \leq R$ the value of $\tanh()$ is close to unity and we can make the approximation: $4c_1^2 = 5c_{\perp}^2 - c_{\parallel}^2$.

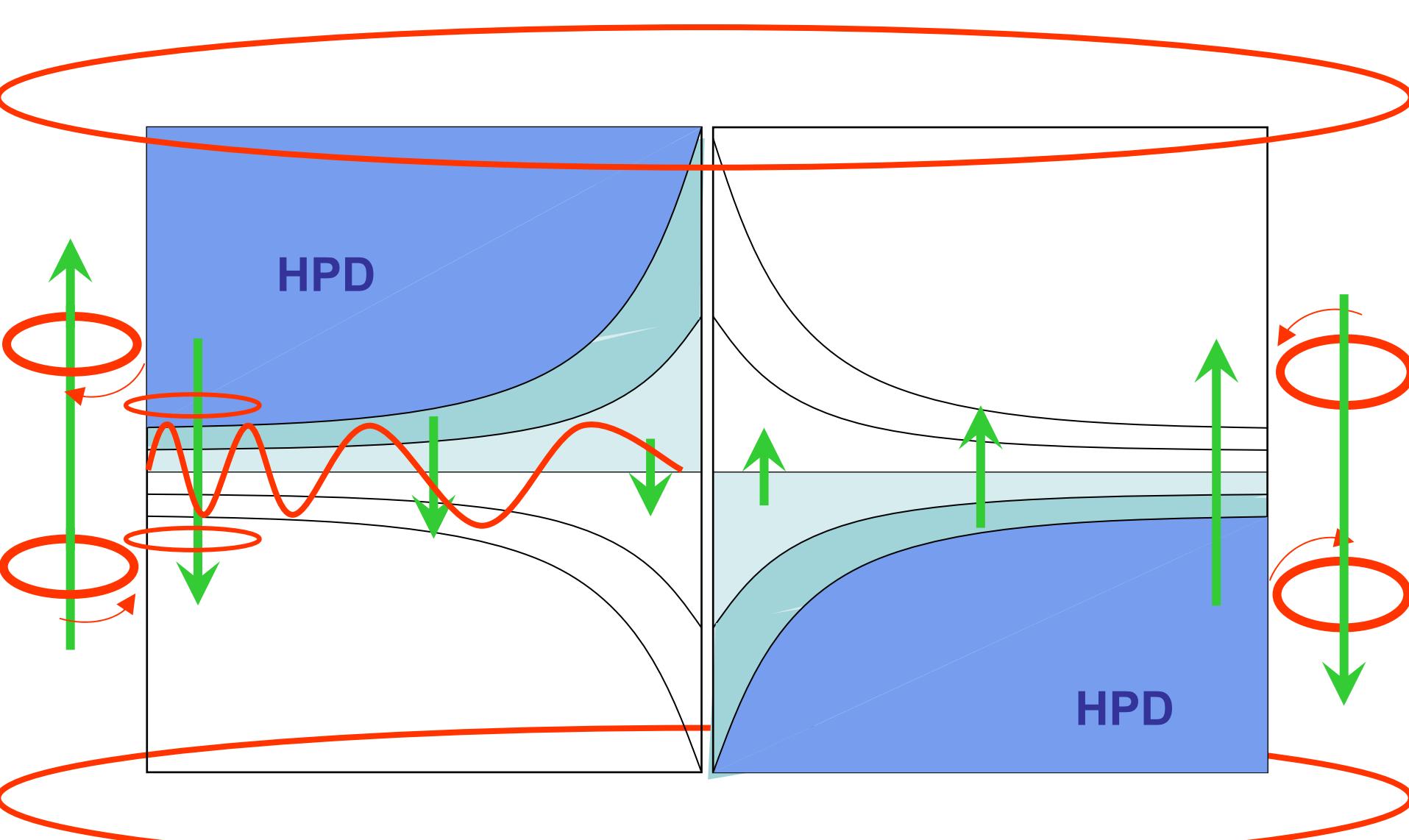
$$\Omega_s^2 \approx A c_1 c_2 \nabla H (HR)^{-1} \quad (77)$$

with $A = 2.6$ for plain waves and $A = 5.3$ for axial symmetry waves.

Present for Grigoriy

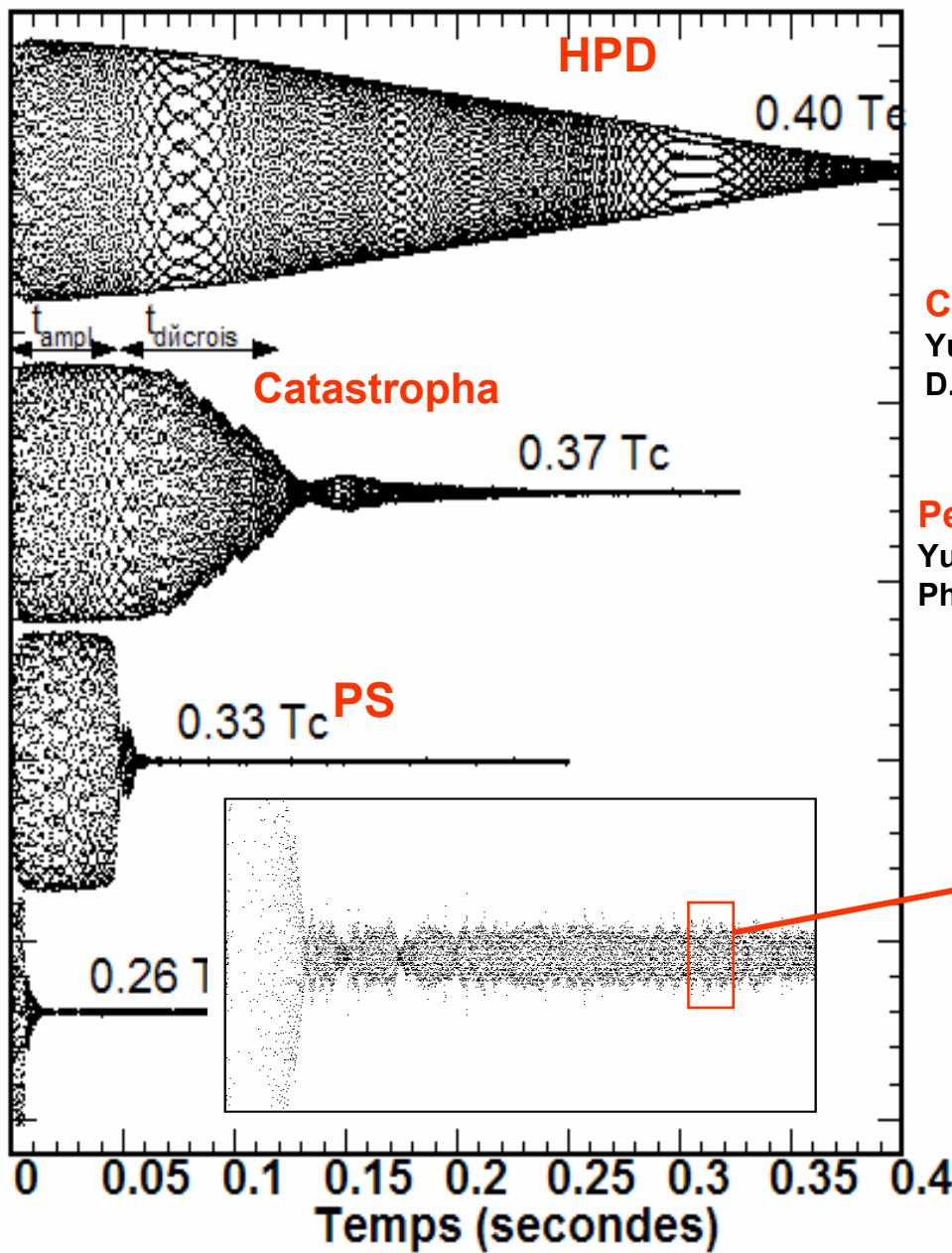
Black hole horizon





Grenoble, 1999

Signal d'induction du HPD

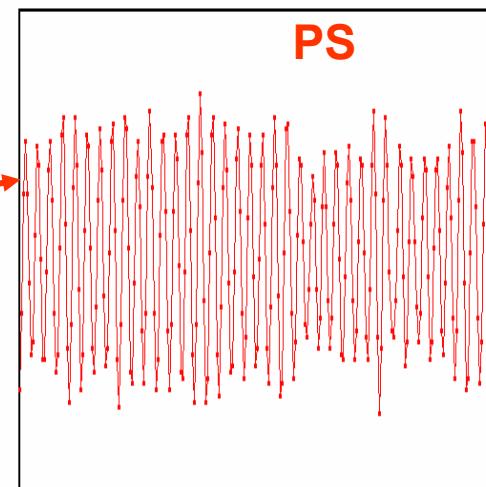


Catastrophic relaxation

Yu.M.Bunkov, V.V.Dmitriev, Yu.M.Mukharskiy, J.Nyeki,
D.A.Sergatskov, Europhysics Letters, v.8, p.645, (1989).

Persistent signal

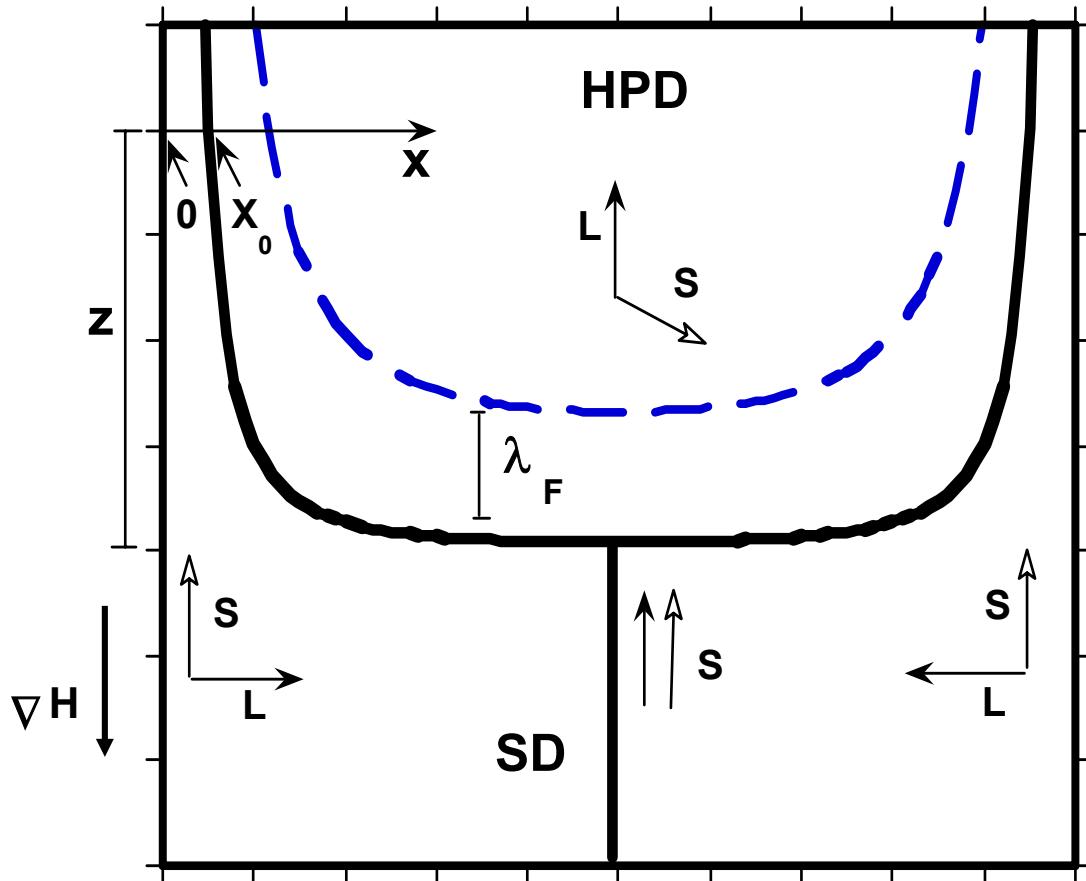
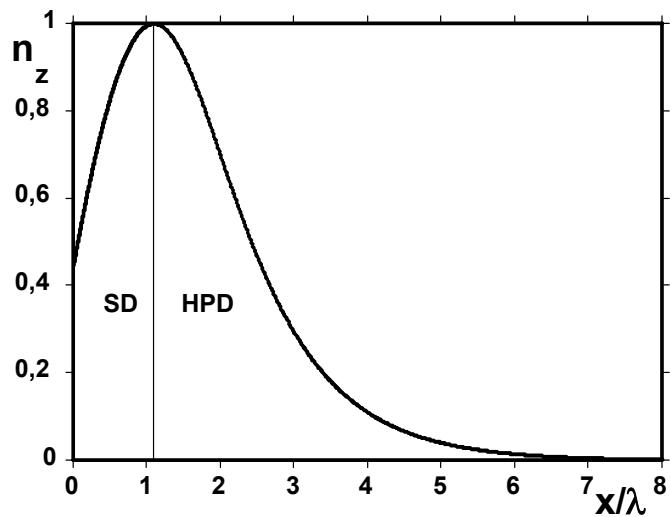
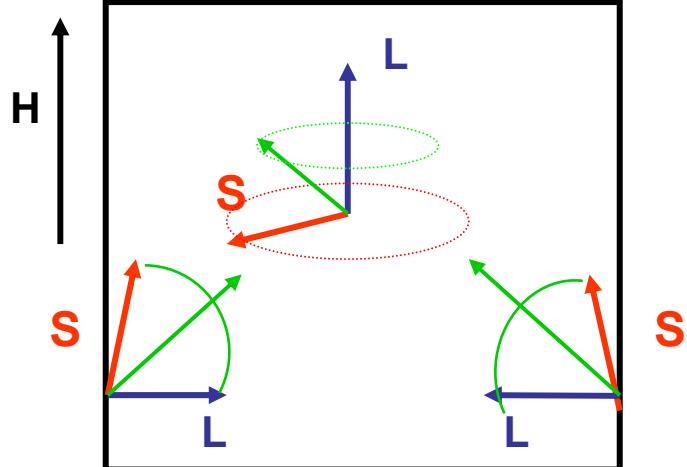
Yu.M.Bunkov, S.N.Fisher, A.M.Guenault, G.R.Pickett,
Phys, Rev, Letters, v.69, p3092, (1992).



Nonwetting. conditions for coherent quantum precession

Yu.M.Bunkov, O.D.Timofeevskaya, G.E.Volovik ` Phys. Rev. Lett., v. 73. p. 1817, (1994)

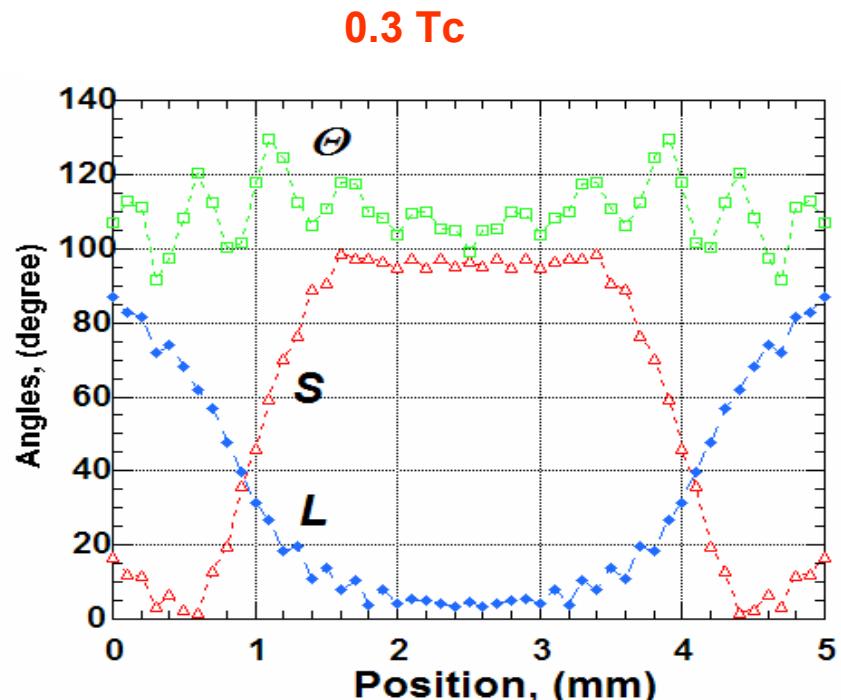
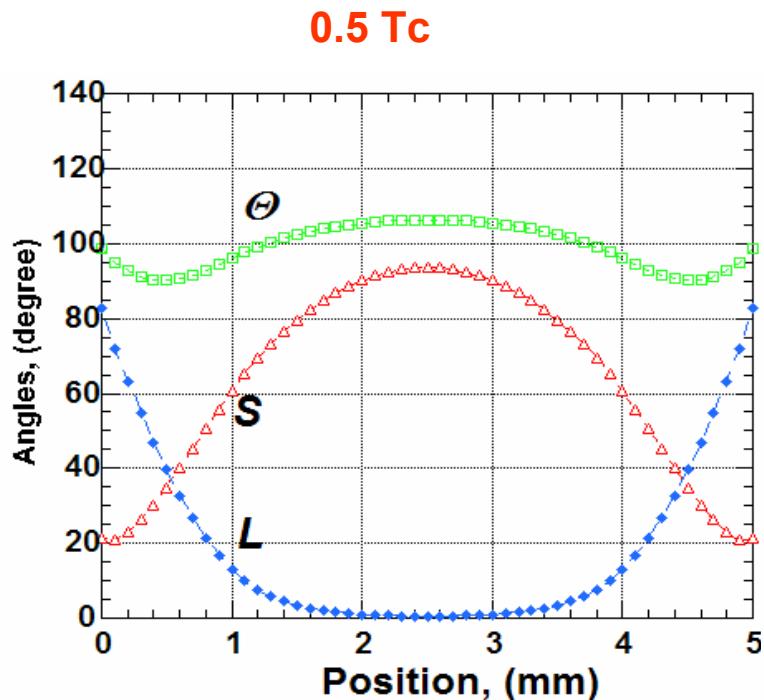
+ surface energy



$$\lambda_F = \left(\frac{c_{\parallel}^2}{\gamma H \nabla H} \right)^{1/3}$$

Surface Instability of Coherent Precession

Yu.M. Bunkov, V.L. Golo, O.D. Timofeevskaya, Czechoslovak Journal of Phys. V. 46, S1, p. 213 (1996).



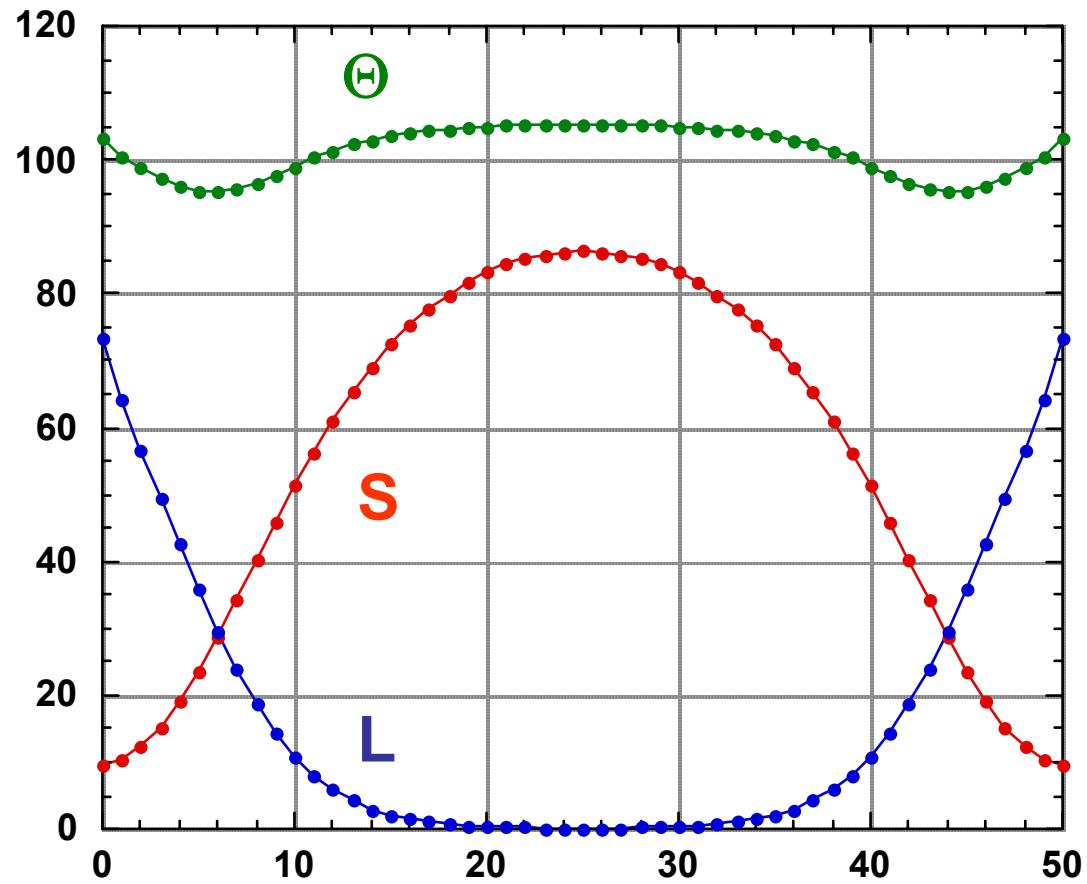
Leggett – Takagi equations with explicit orbital part

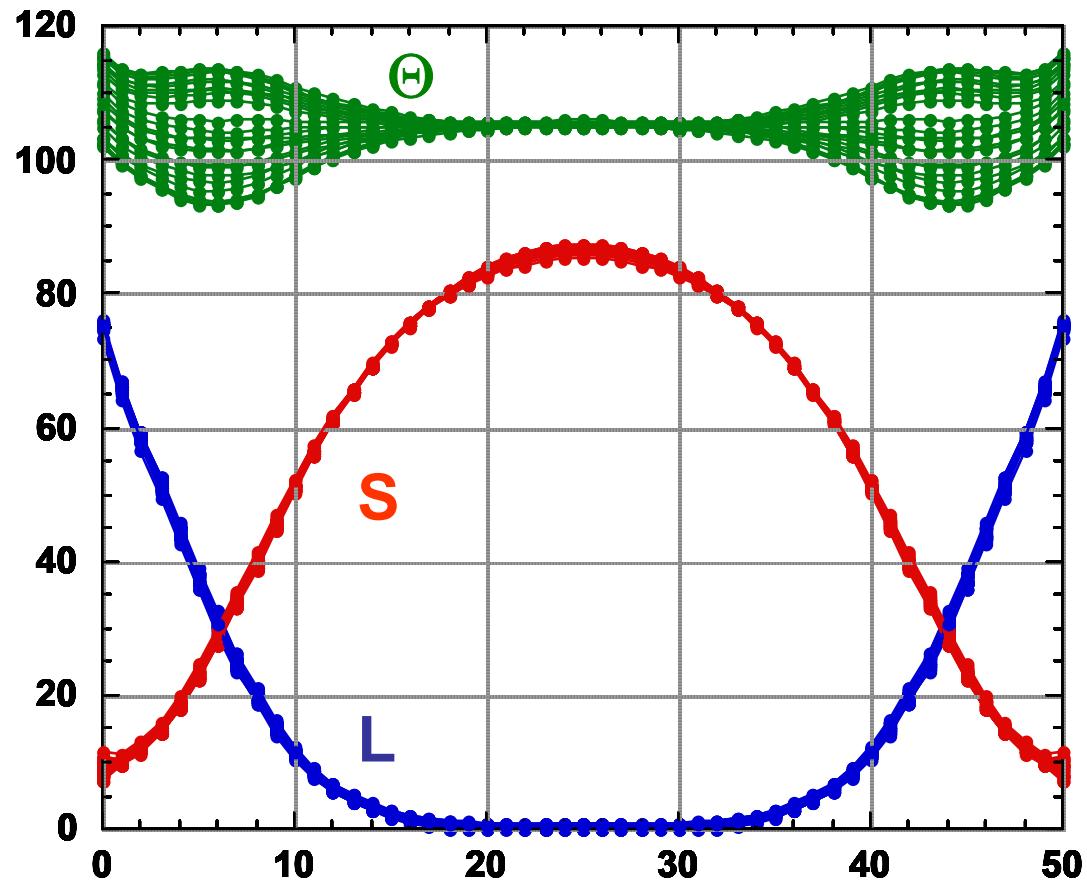
$$\frac{d\vec{S}}{dt} = \gamma[\vec{S} \times \vec{H}] + \vec{R}_d,$$

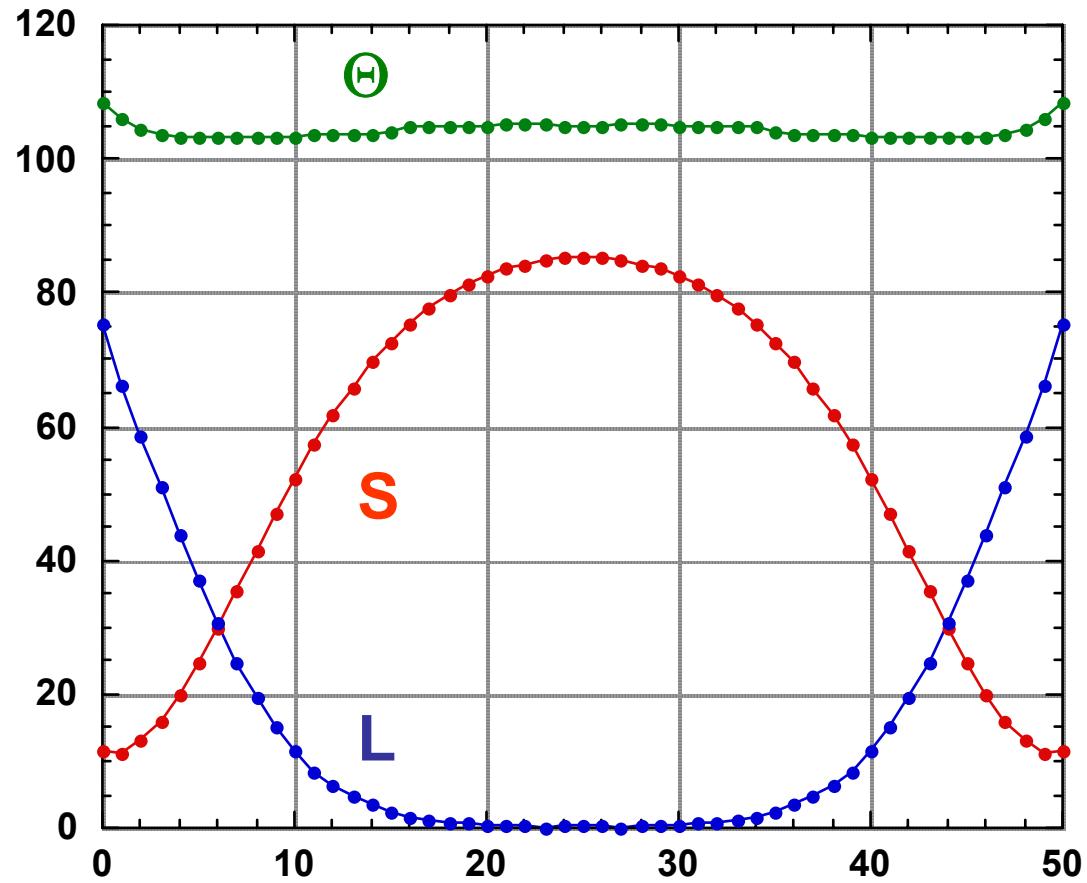
$$\frac{d\vec{A}_j}{dt} = \vec{A}_j \times \left[\vec{H} - \left(\vec{S} + \frac{1-\lambda}{\lambda} \frac{\chi}{\chi_0} \vec{Y} \right) \right]$$

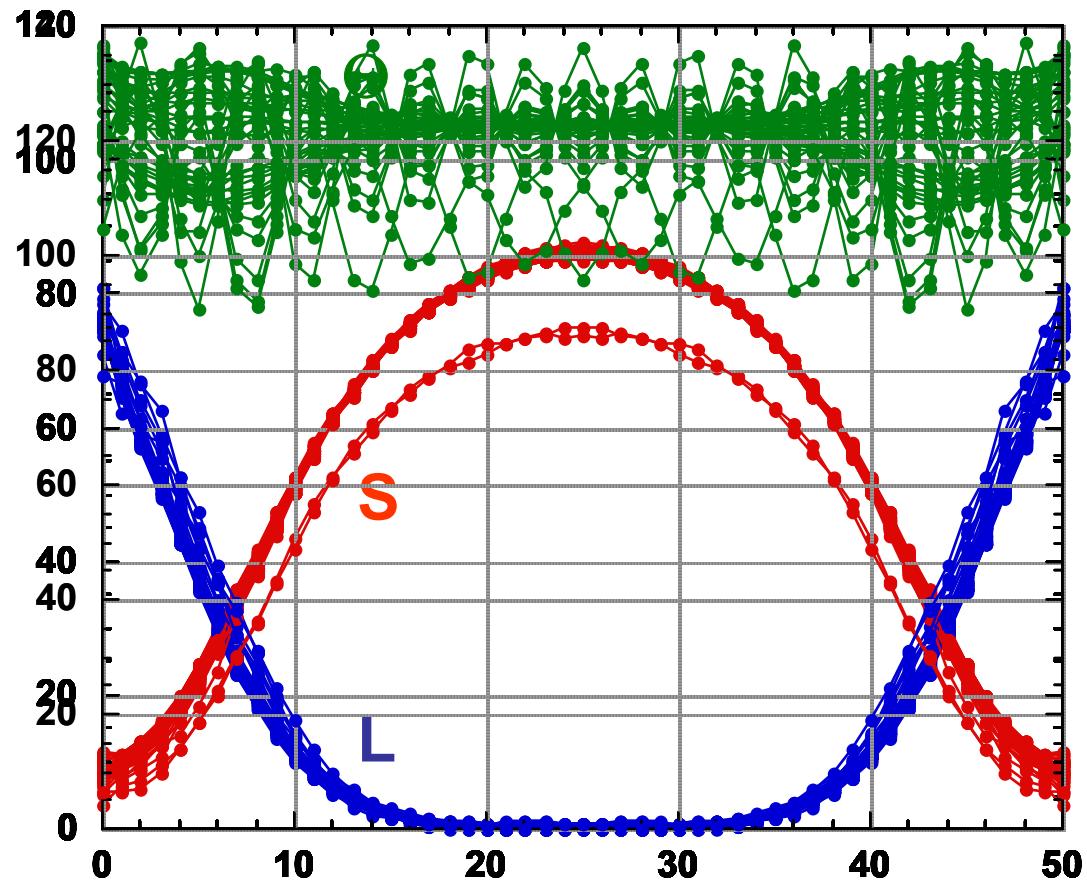
$$\frac{d\vec{Y}}{dt} = \vec{Y} \times \left[\vec{H} + \left(\frac{\chi}{\chi_0} - 1 \right) \right] + \vec{R}_d - \frac{1}{\tau} \vec{Y},$$

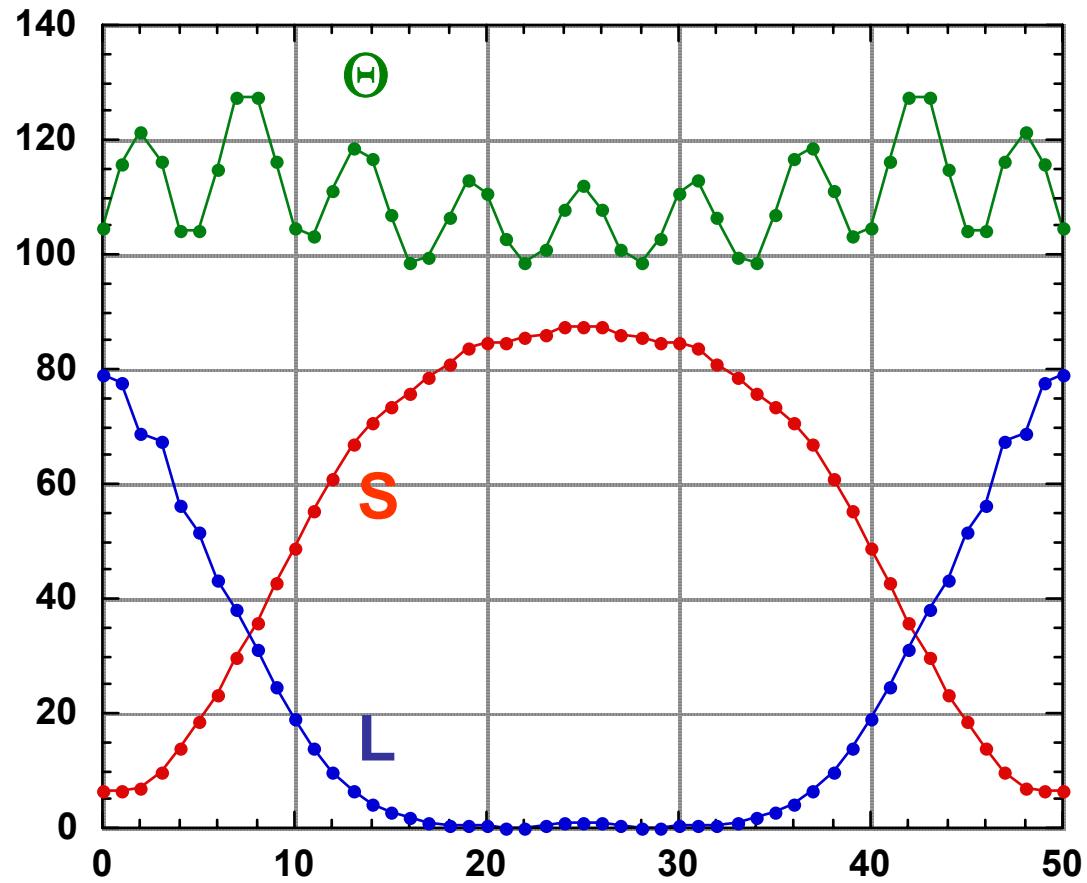
$$\frac{d\vec{L}}{dt} = -\vec{R}_d,$$

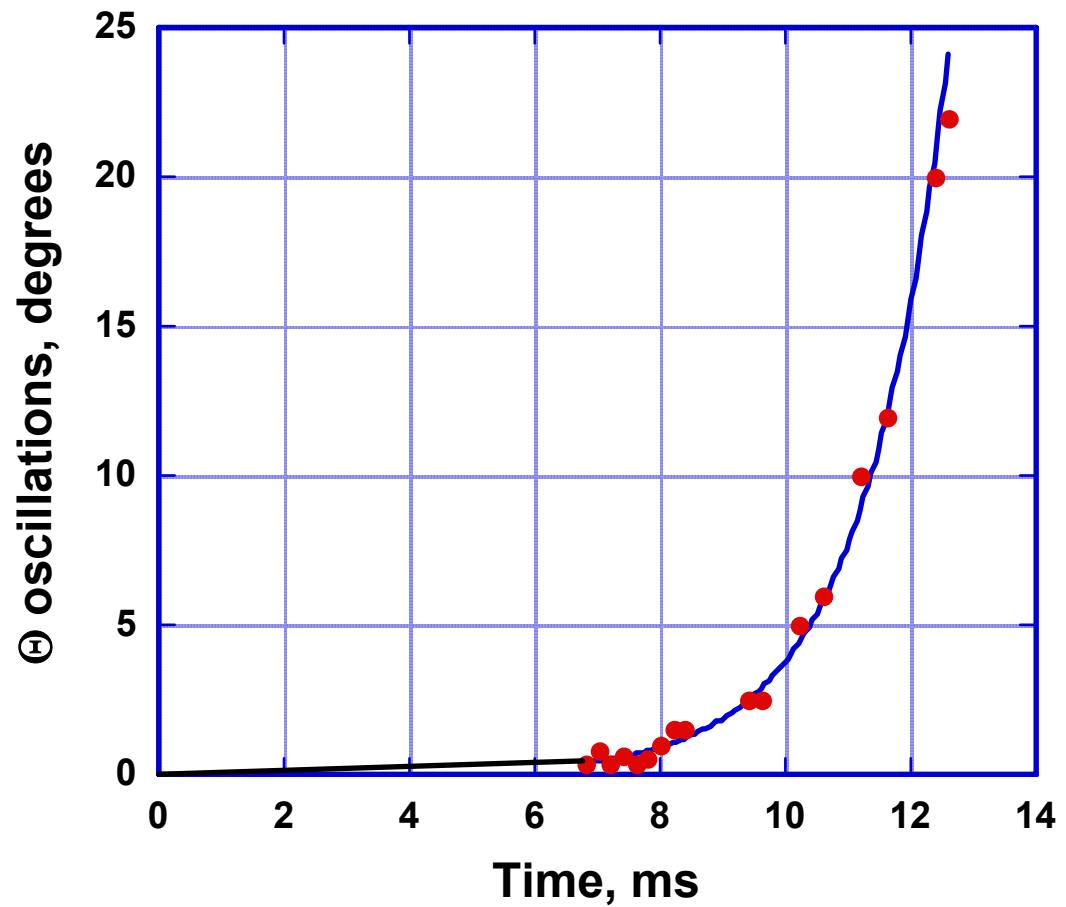






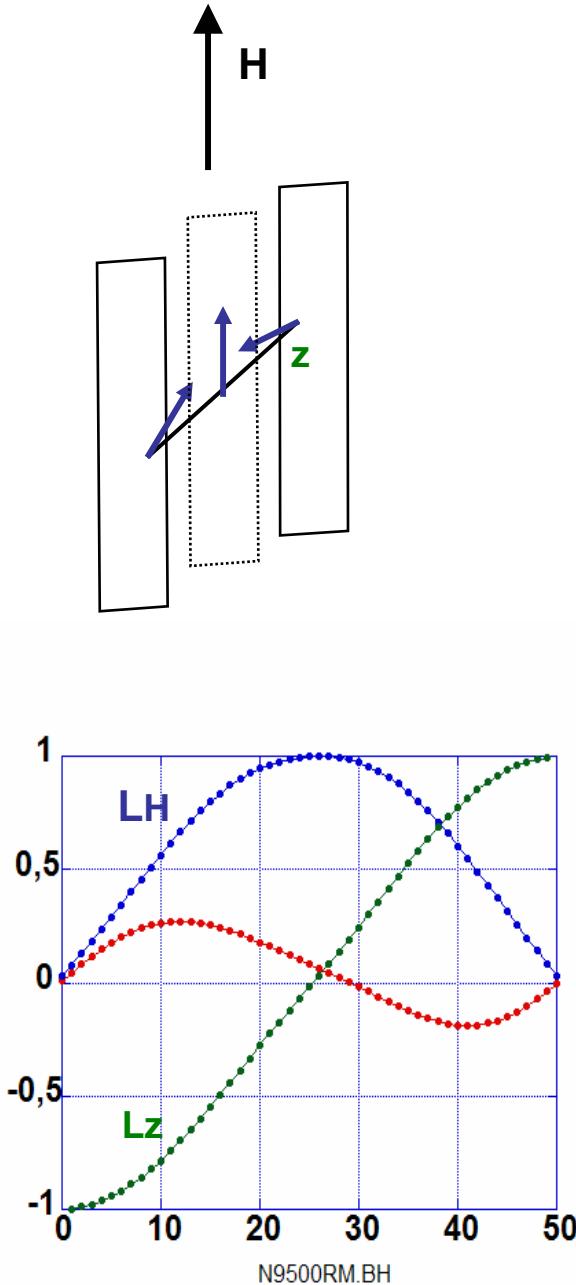




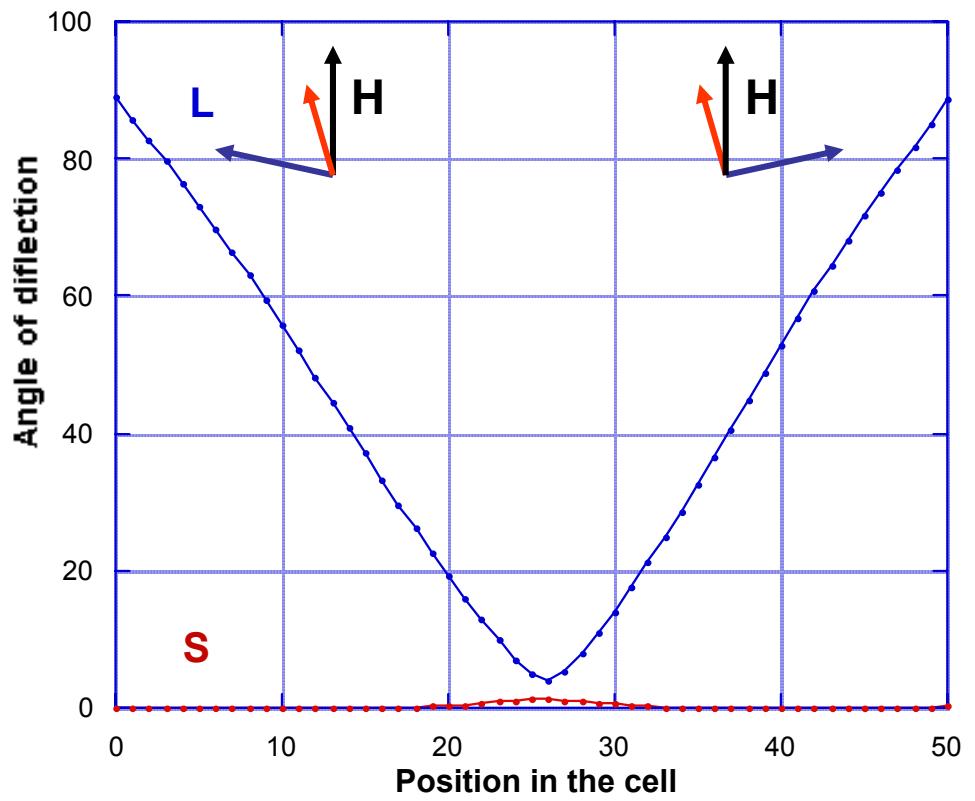


**Can it be the development of
spin turbulence?**

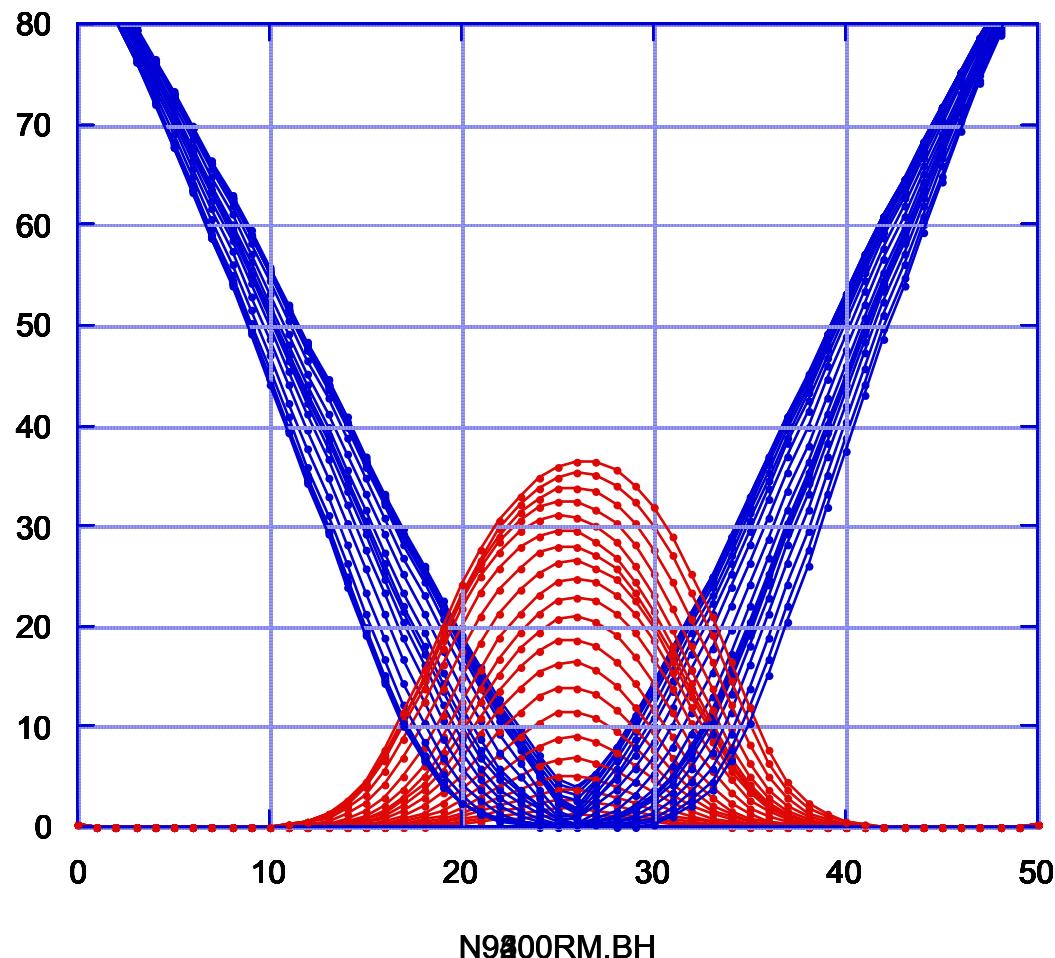
NMR in L potential well



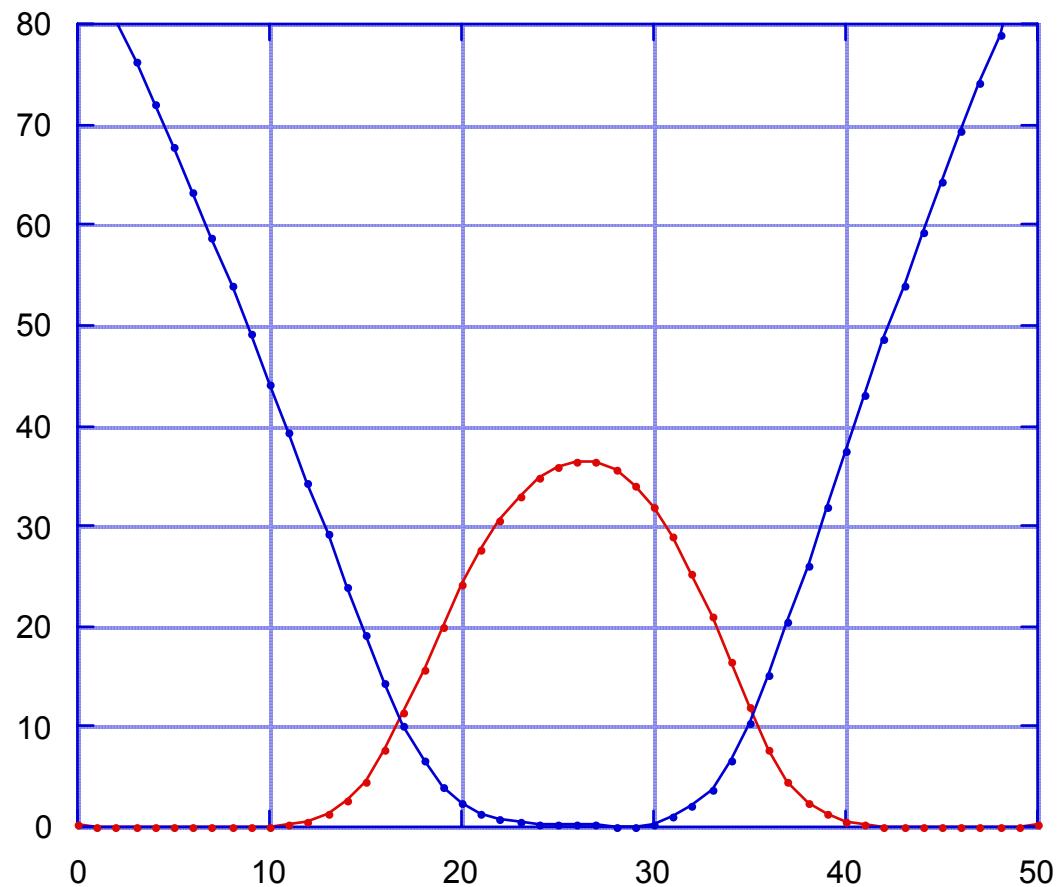
Calculations of a spatial deflection of spin and orbit on basis of Poisson brackets and Takagi relaxation



Grenoble, 2004



Grenoble, 2004



Oscillations Θ

