Exotic rotations and high-spin isomers in Nd nuclei

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Collaboration

- France : CSNSM Orsay, IPN Lyon, IPHC Strasbourg
- Italy: Padova University
- Finland : University of Jyväskylä
- Japan : Fukuoka & Osaka Universities

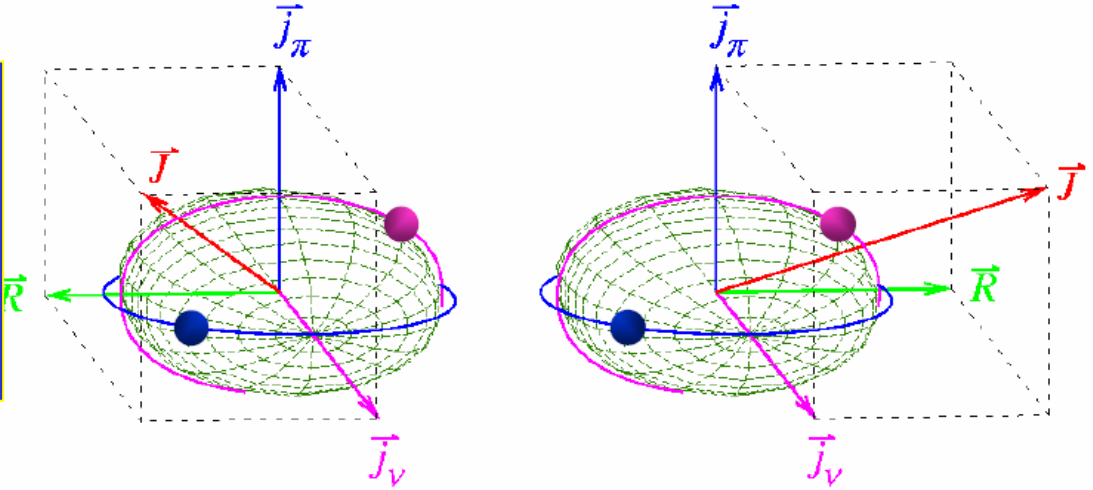
Triaxiality at high spins

Chiral Geometry in Nuclei

Mutually orthogonal coupling of three angular momenta in odd-odd nuclei

Chiral mode

- vibration (^{134}Pr)
- multiple (^{133}Ce)



Wobbling mode

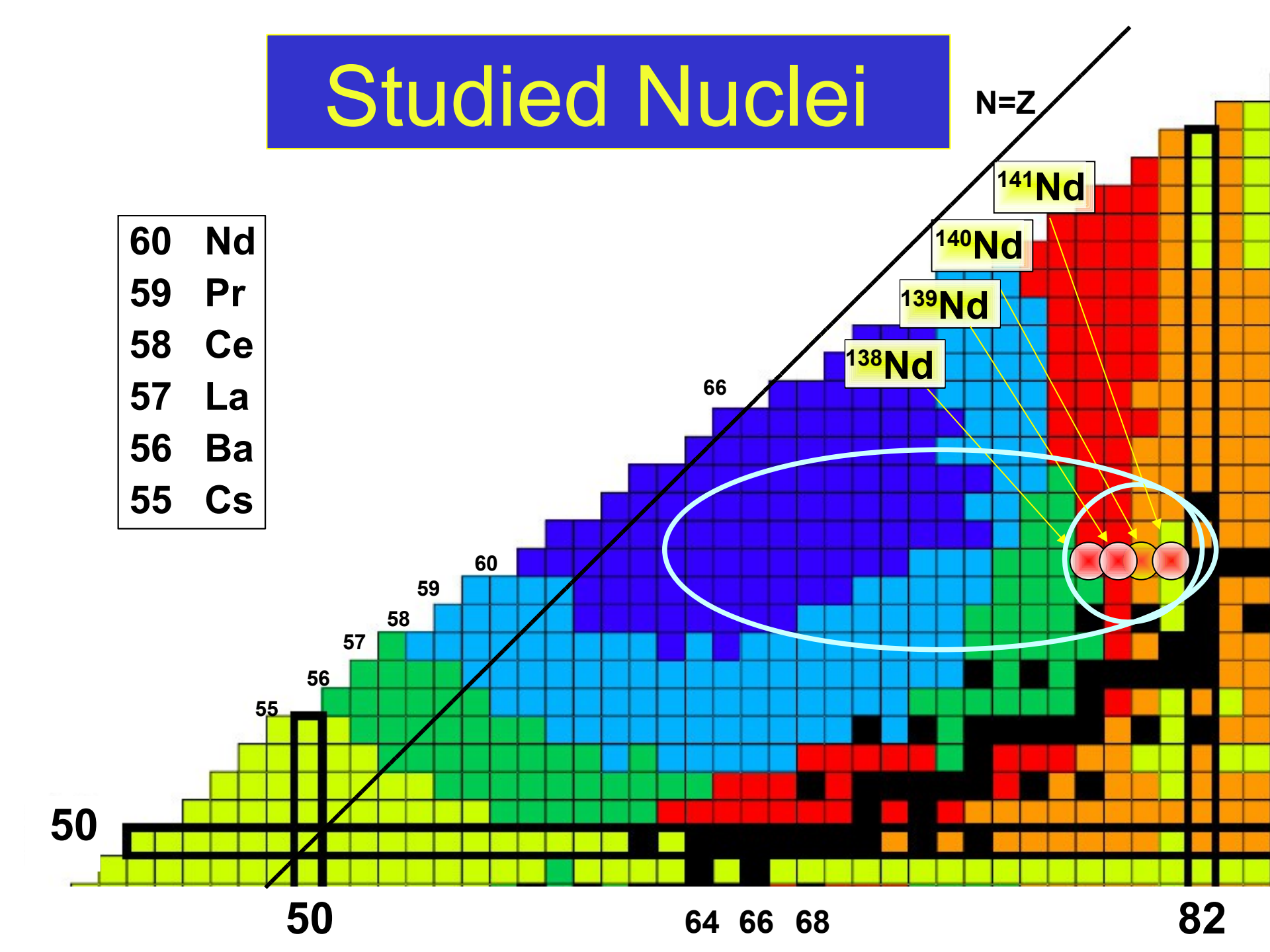
- longitudinal (^{161}Lu)
- transverse (^{135}Pr)

$$E(I, n_{\text{wobb}}) = \frac{I(I+1)}{2\mathcal{J}_x} + \hbar\omega_{\text{wobb}}\left(n_{\text{wobb}} + \frac{1}{2}\right)$$

$$\hbar\omega_{\text{wobb}} = \hbar\omega_{\text{rot}}\sqrt{\frac{(\mathcal{J}_x - \mathcal{J}_y)(\mathcal{J}_x - \mathcal{J}_z)}{\mathcal{J}_y\mathcal{J}_z}}$$

$$\hbar\omega_{\text{rot}} = \frac{I}{\mathcal{J}_x}$$

Studied Nuclei



CNS calculations for ^{138}Nd : high spins !

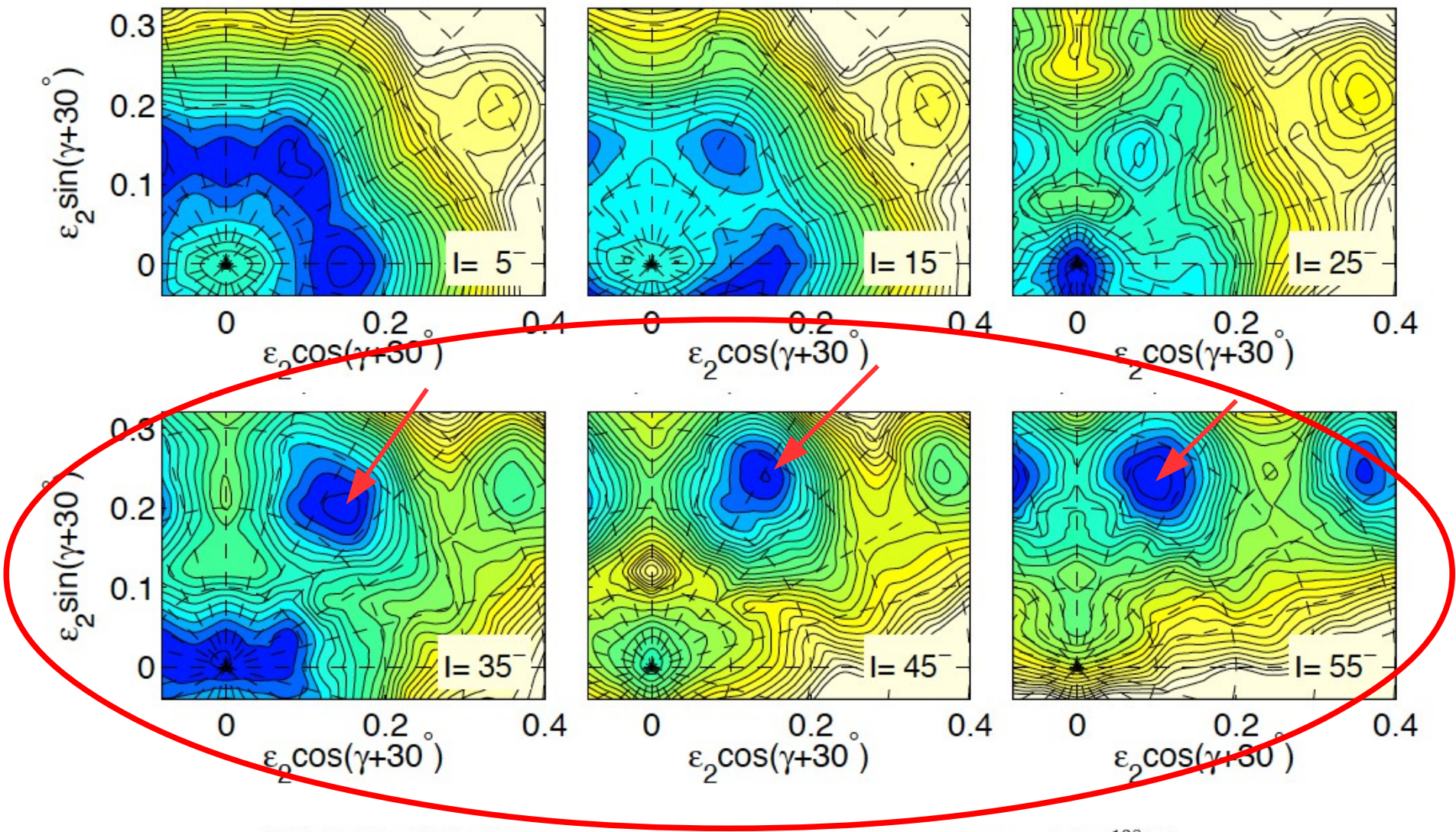
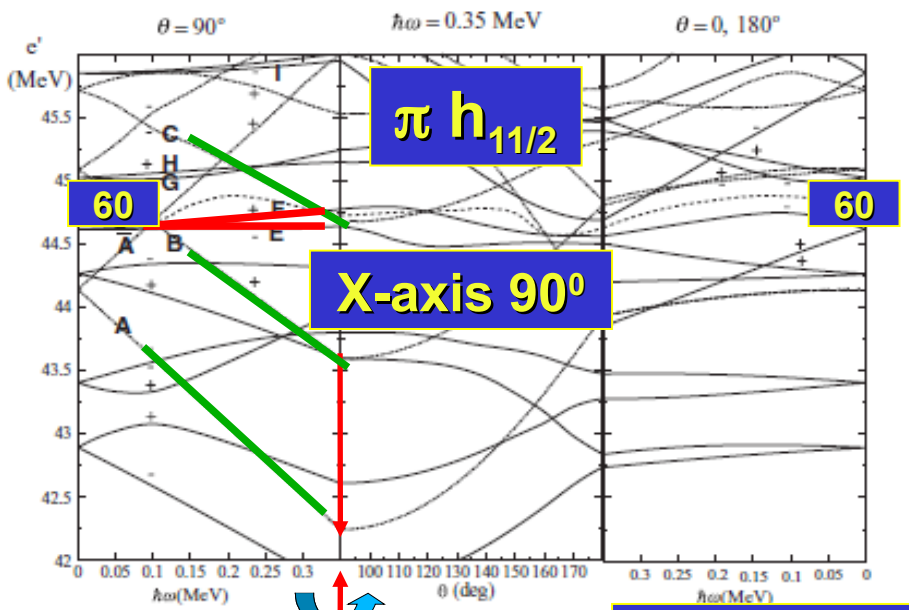
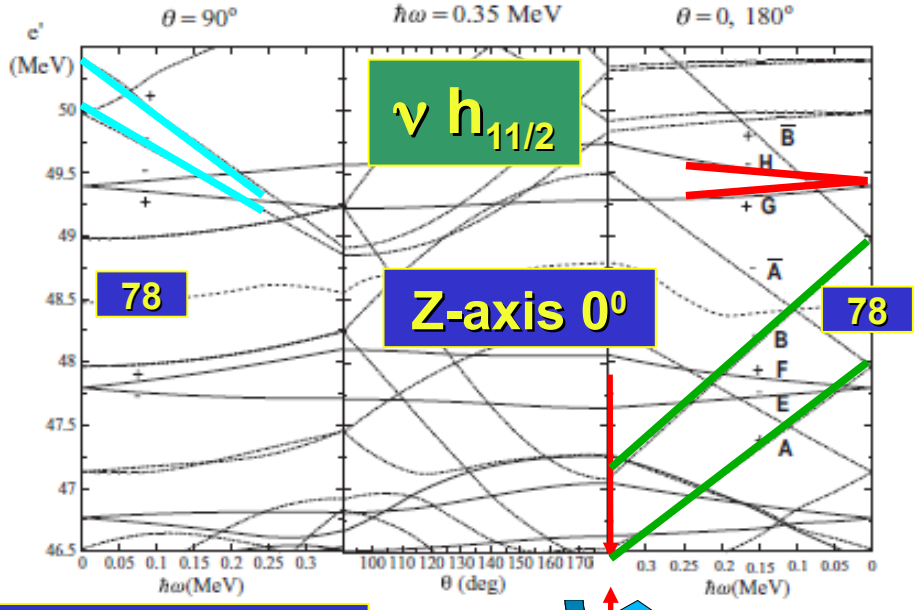


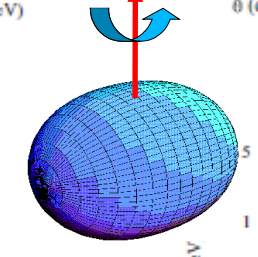
FIG. 3: The PES of the configuration $\pi_p = -, \alpha_p = 1, \pi_n = +, \alpha_n = 0$ for ^{138}Nd.

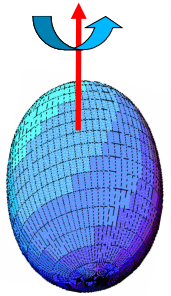
I. Ragnarsson

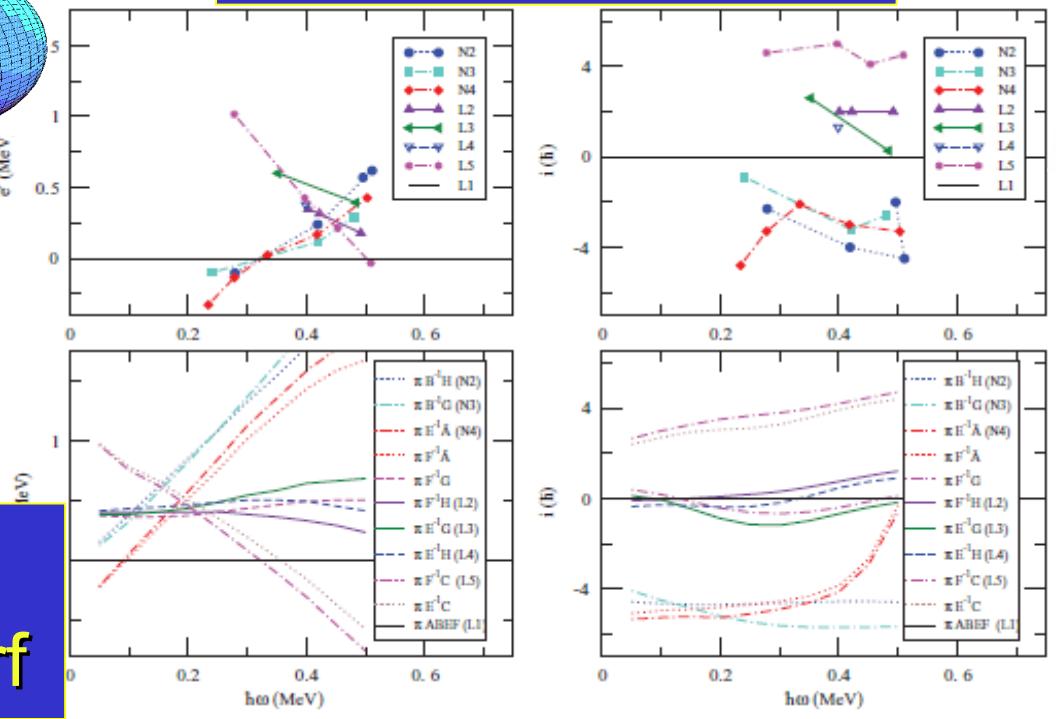


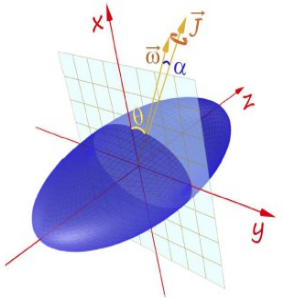


E2 bands in ^{138}Nd







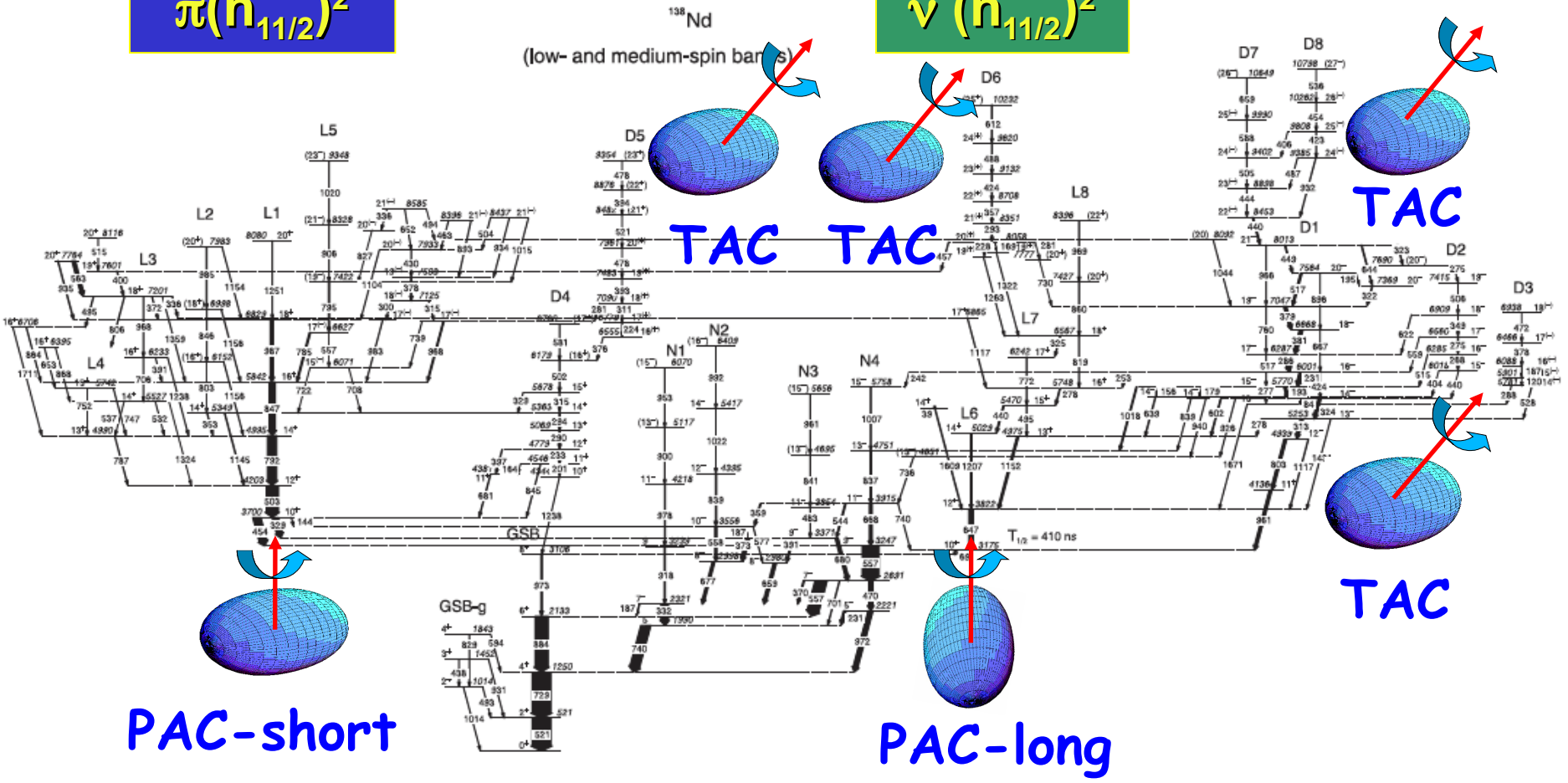


TAC, CSM
S. Frauendorf

^{138}Nd – 21 bands at medium spins !

$\pi(h_{11/2})^2$

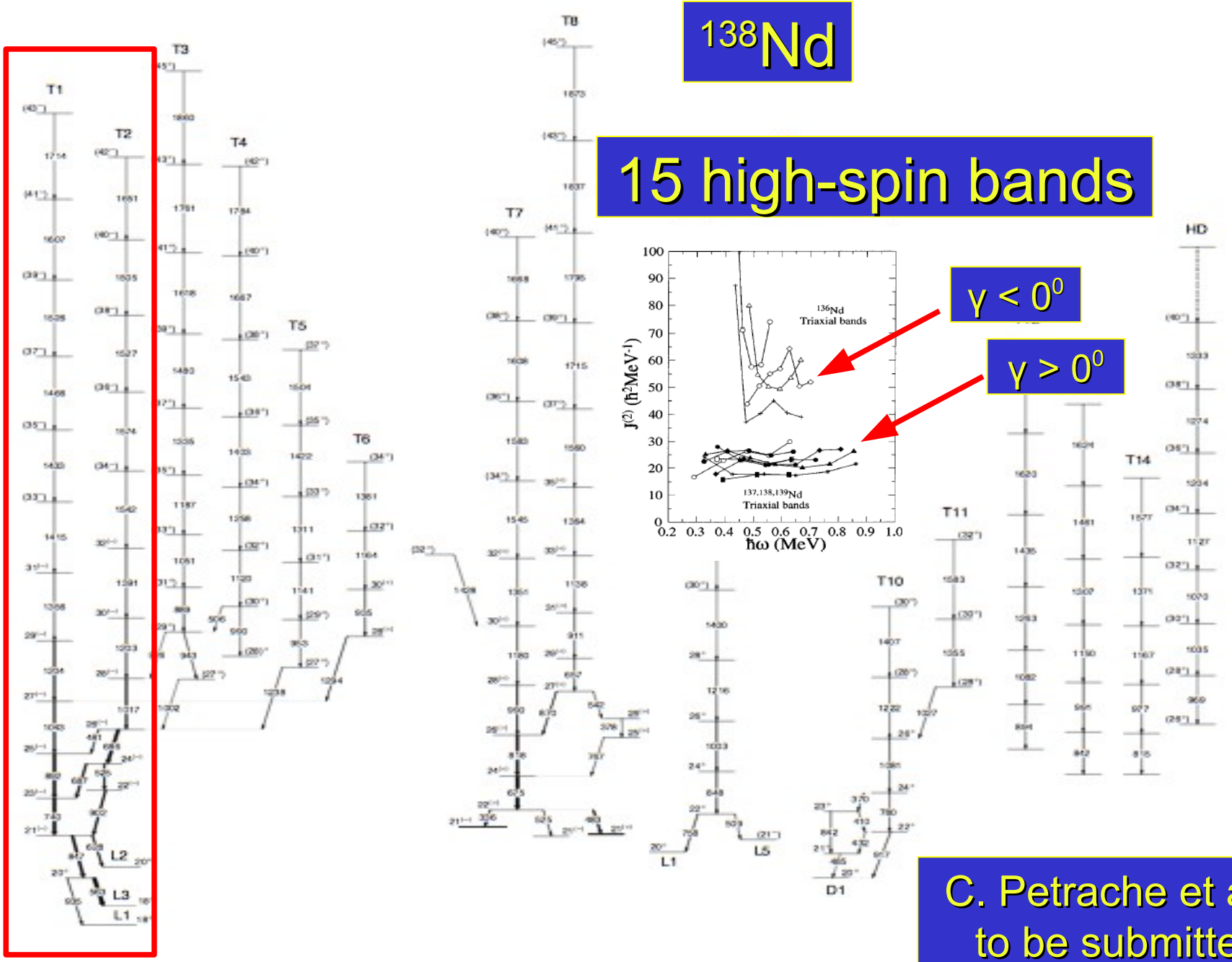
$\nu\ (h_{11/2})^2$



C. Petrache et al., PR C86, 044321 (2012)

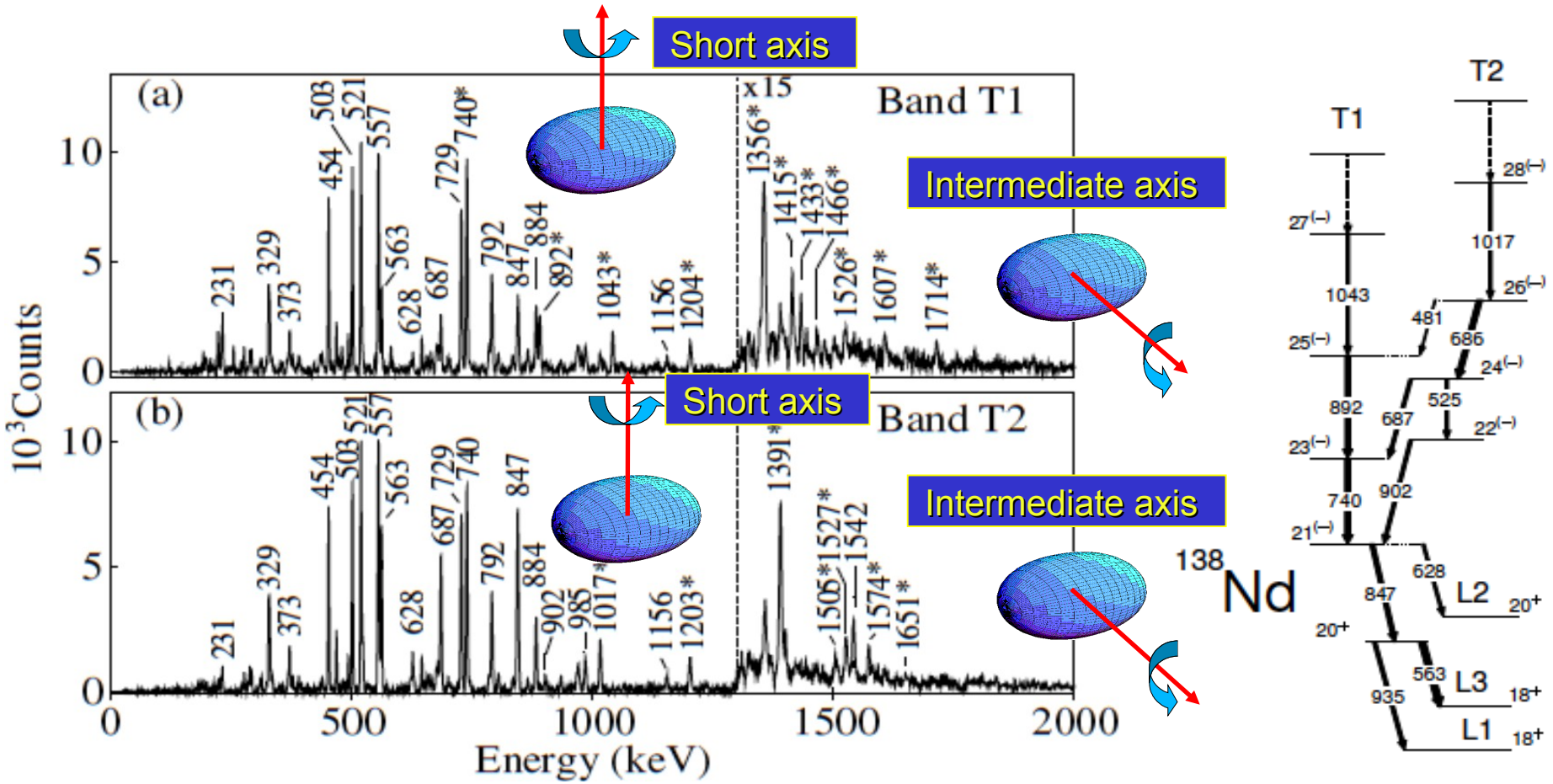
^{138}Nd

15 high-spin bands



C. Petrache et al.,
to be submitted

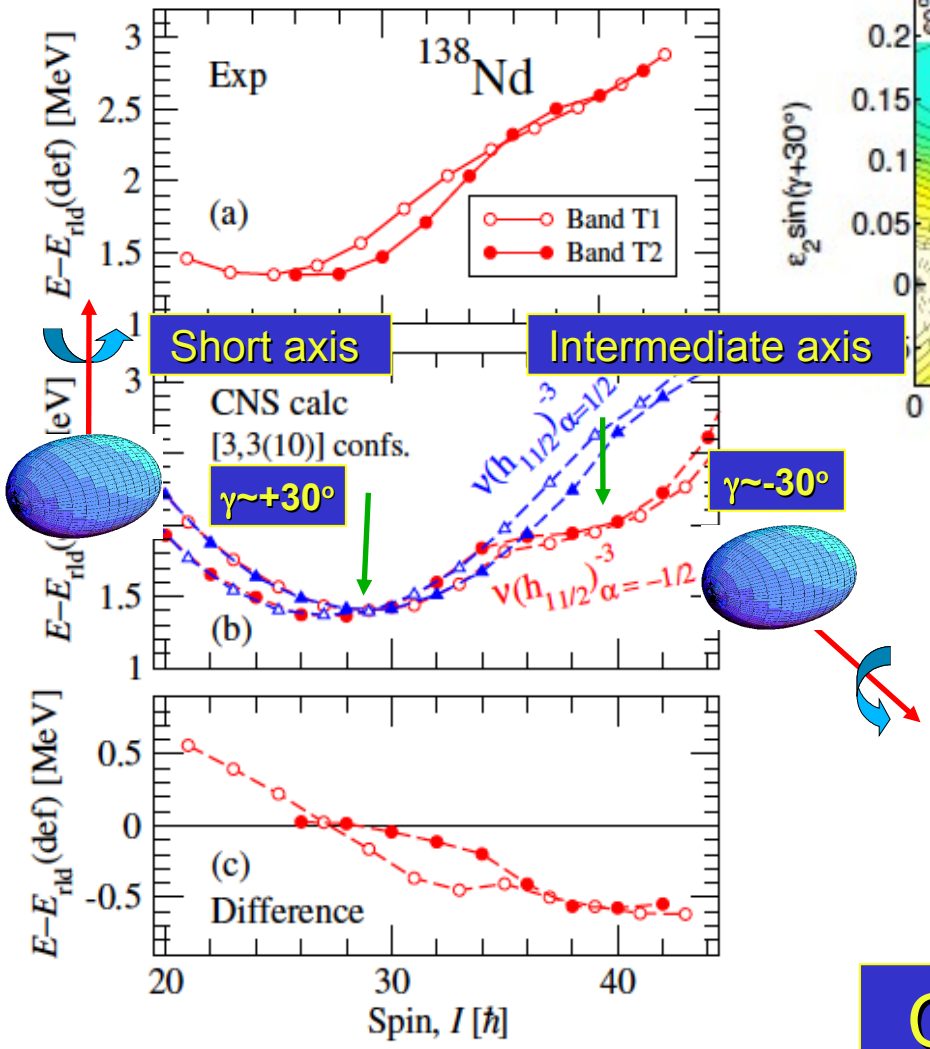
Switch of rotation from short to intermediate axis at high spin in ^{138}Nd

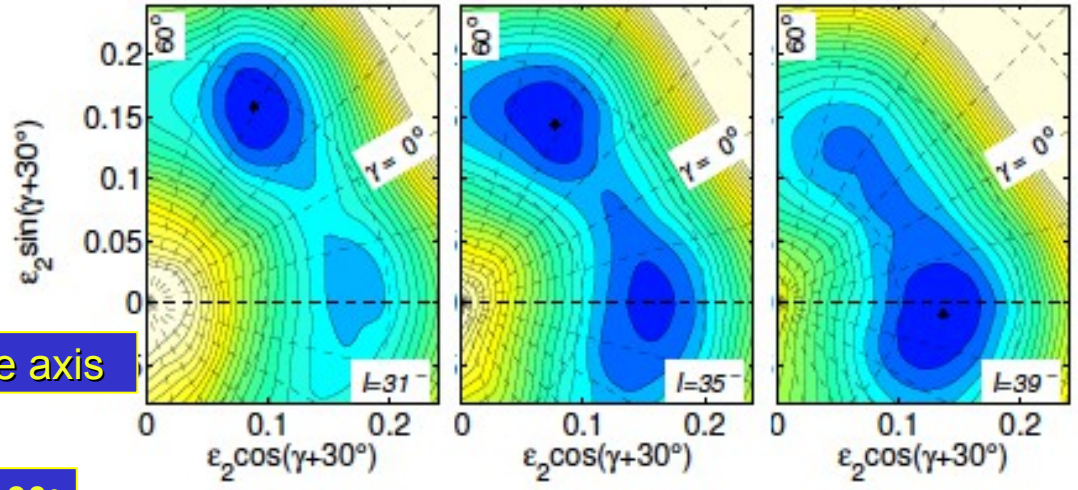


C. Petrache et al., PRC(R) 2013

Existence of triaxial shapes with γ > 0° and γ < 0°

CNS calculations for ^{138}Nd – I. Ragnarsson





Calculated potential energy surfaces in the (ε_2,γ)-plane, illustrating the shape change around I = 35 for the [3,3(10)] configuration assigned to the T1 band. The contour line separation is 0.25 MeV.

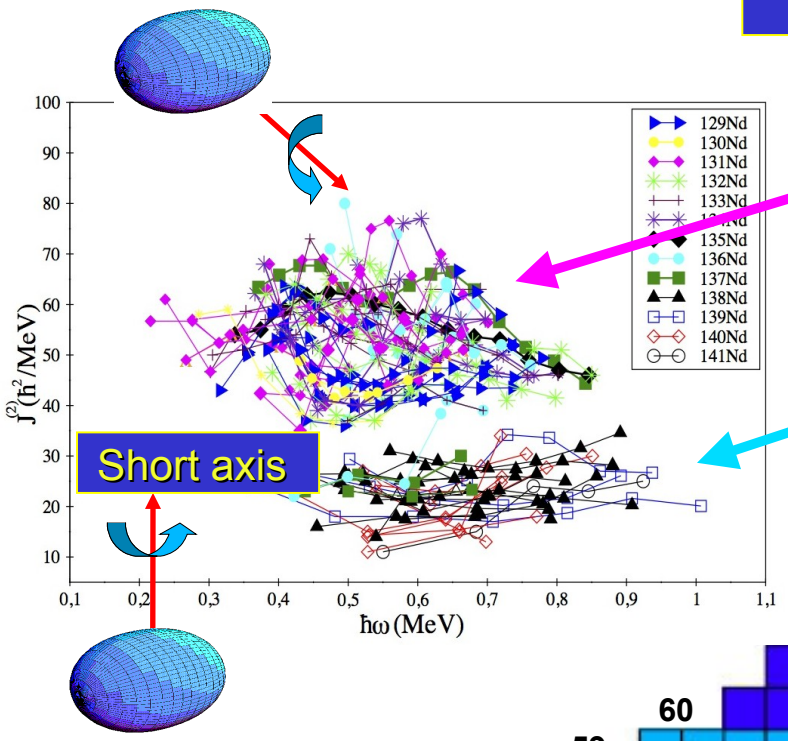
C. P. et al., PRC(R) 2013

The existence of stable triaxial shape at high spins in Lanthanides with N < 82 is supported by more than 70 bands

Nucleus	Number of triaxial bands		
		Quadrupole bands	**Dipole bands**
^{138}Nd	36	28	8
^{139}Nd	8	3	5
^{140}Nd	23	12	11
^{141}Nd	7	4	3

Nd Nuclei

Intermediate axis



Short axis

^{133}Nd-^{136}Nd

^{138}Nd-^{141}Nd

66

60

59

58

57

56

55

50

50

64 66 68

82

Collaborateurs

CSNSN Orsay – C.M. Petrache, R. Leguillon, T. Zerrouki, A. Astier, T. Konstantinopoulos

LTH Lund – I. Ragnarsson

Notre Dame University – S. Frauendorf

Fukuoka University – M. Matsuzaki

University of Jyväskylä – P. Greenlees et al.

University of Padova – S. Lunardi et al.