Többszörös kiralitás kimutatása a ^{104}Rh atommagban

Krakó Attila

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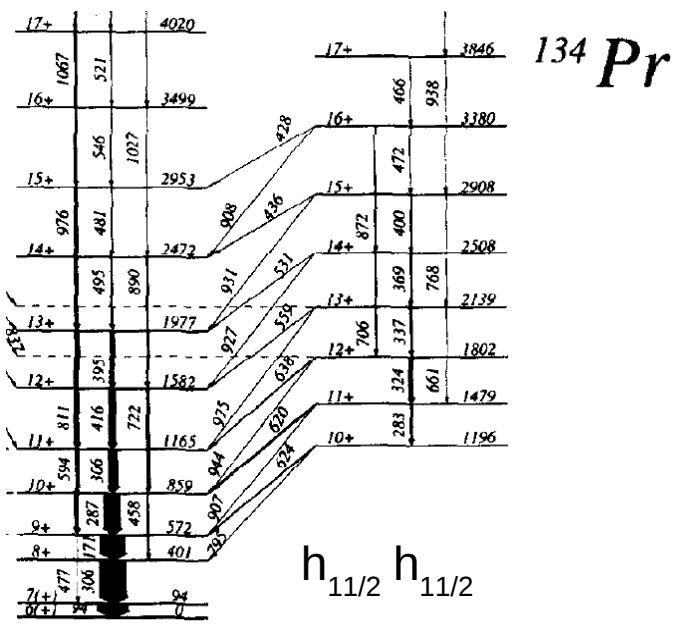
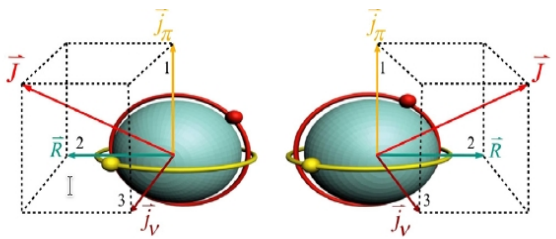
Kiralitás az atommagban



C. M. Petrache et al., Nucl. Phys. A597, 106 (1996).



ELSEVIER
Nuclear Physics A 617 (1997) 131–147
NUCLEAR PHYSICS A

Tilted rotation of triaxial nuclei

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Received 14 November 1996

(a) Chiral objects

A kiralitás a háromtengelyűen deformált forgó atommagokban jelenik meg:

- ΔI=1 degenerált párok
- Ugyanolyan konfiguráció
- Ugyanolyan paritás
- Hasonló elektromágneses tulajdonságok

Többszörös királis sávpárok

Possible existence of multiple chiral doublets in ^{106}Rh

J. Meng,[1,2,3,*] J. Peng,[1] S. Q. Zhang,[1] and S.-G. Zhou[2,3]
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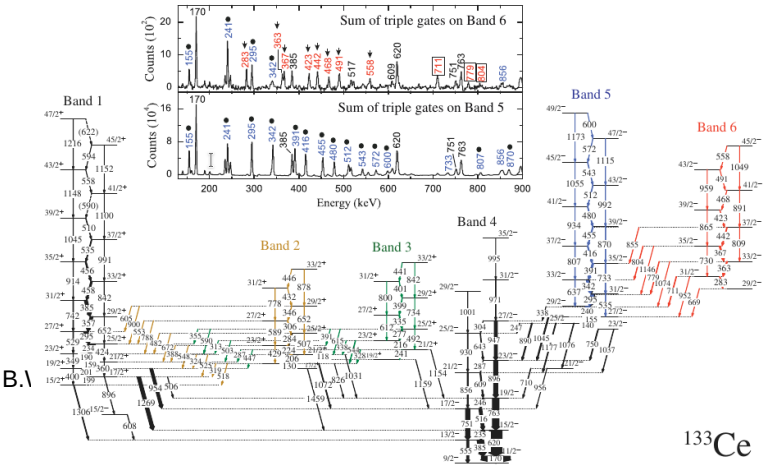
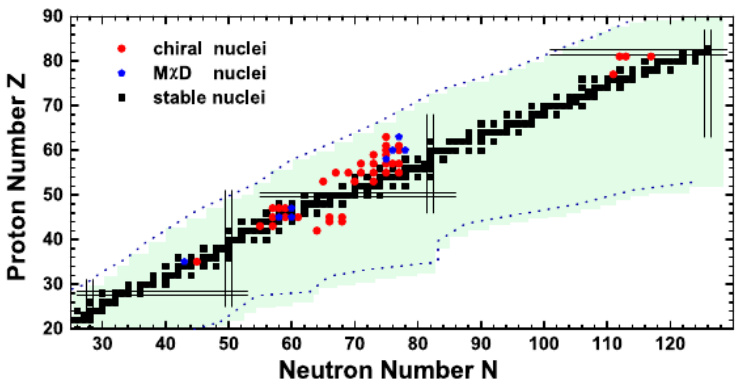
(Received 30 March 2005; published 15 March 2006)

Adiabatic and configuration-fixed constrained triaxial relativistic mean field (RMF) approaches are developed for the first time. A new phenomenon, the existence of multiple chiral doublets (MχD), i.e., more than one pair of chiral doublet bands in one single nucleus, is suggested for ^{106}Rh based on the triaxial deformations and their corresponding proton and neutron configurations.



B.\

^{133}Ce



Evidence for Multiple Chiral Doublet Bands in ^{133}Ce

A. D. Ayangeakaa,[1] U. Garg,[1] M. D. Anthony,[1] S. Frauendorf,[1] J. T. Matta,[1] B. K. Nayak,[1,*] D. Patel,[1] Q. B. Chen (陈启博),[2] S. Q. Zhang (张双全),[2] P. W. Zhao (赵鹏巍),[2] B. Qi (亓斌),[3] J. Meng (孟杰),[2,4,5] R. V. F. Janssens,[6] M. P. Carpenter,[6] C. J. Chiara,[6,7] F. G. Kondev,[8] T. Lauritsen,[6] D. Seweryniak,[6] S. Zhu,[6] S. S. Ghugre,[9] and R. Palit[10,11]
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[3]*School of Space Science and Physics, Shandong University at Weihai, Weihai 264209, China*
[4]*School of Physics and Nuclear Energy Engineering, Beihang University, Beijing 100191, China*
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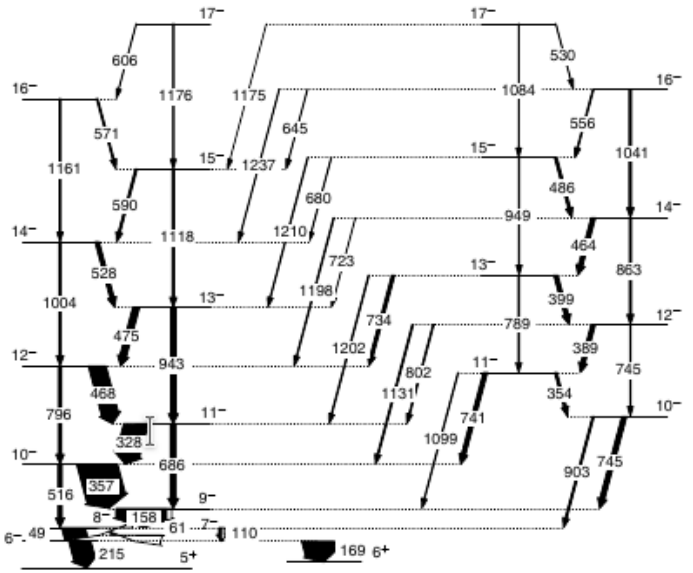
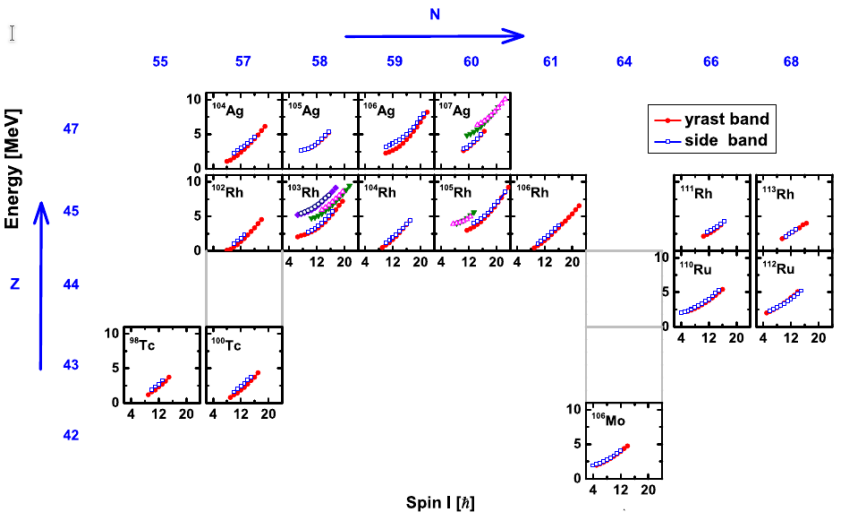
[8]*Nuclear Engineering Division, Argonne National Laboratory, Argonne, Illinois 60439, USA*
[9]*UGC-DAE Consortium for Science Research, Kolkata 700 098, India*
[10]*Tata Institute of Fundamental Research, Mumbai 400 005, India*
[11]*The Joint Institute for Nuclear Astrophysics, University of Notre Dame, Notre Dame, Indiana 46556, USA*
(Received 31 January 2013; published 24 April 2013)

Two distinct sets of chiral-partner bands have been identified in the nucleus ^{133}Ce. They constitute a multiple chiral doublet, a phenomenon predicted by relativistic mean field (RMF) calculations and observed experimentally here for the first time. The properties of these chiral bands are in good agreement with results of calculations based on a combination of the constrained triaxial RMF theory and the particle-rotor model.

Kiralitás az A~100 tömegszámtartományban



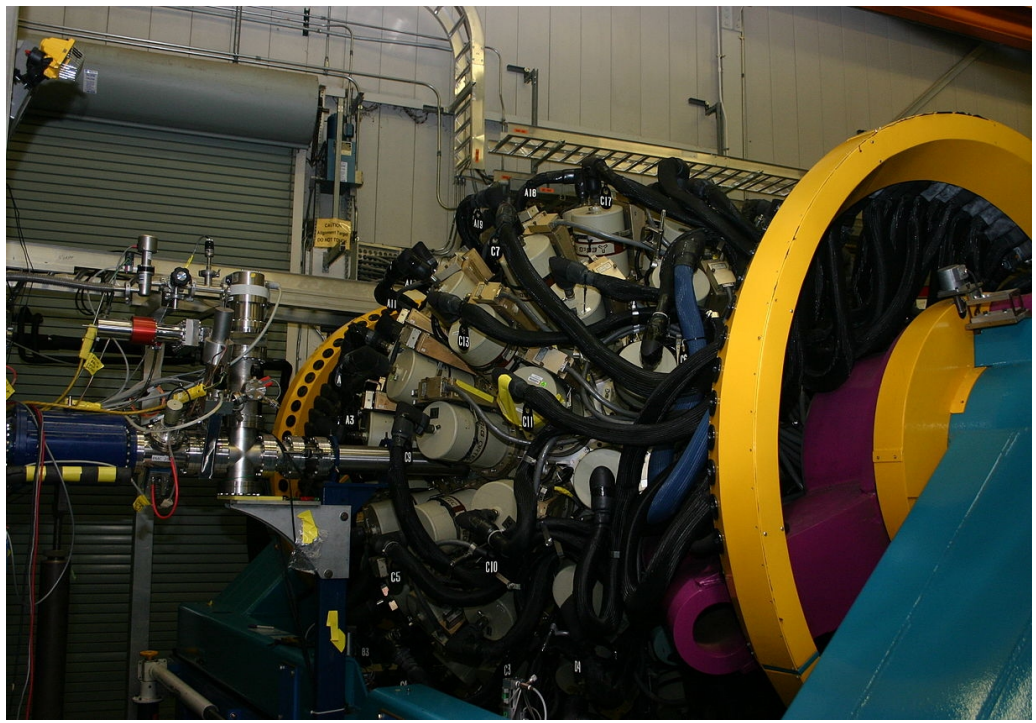
Vaman et al., Phys. Rev. Lett. 92 (2004)



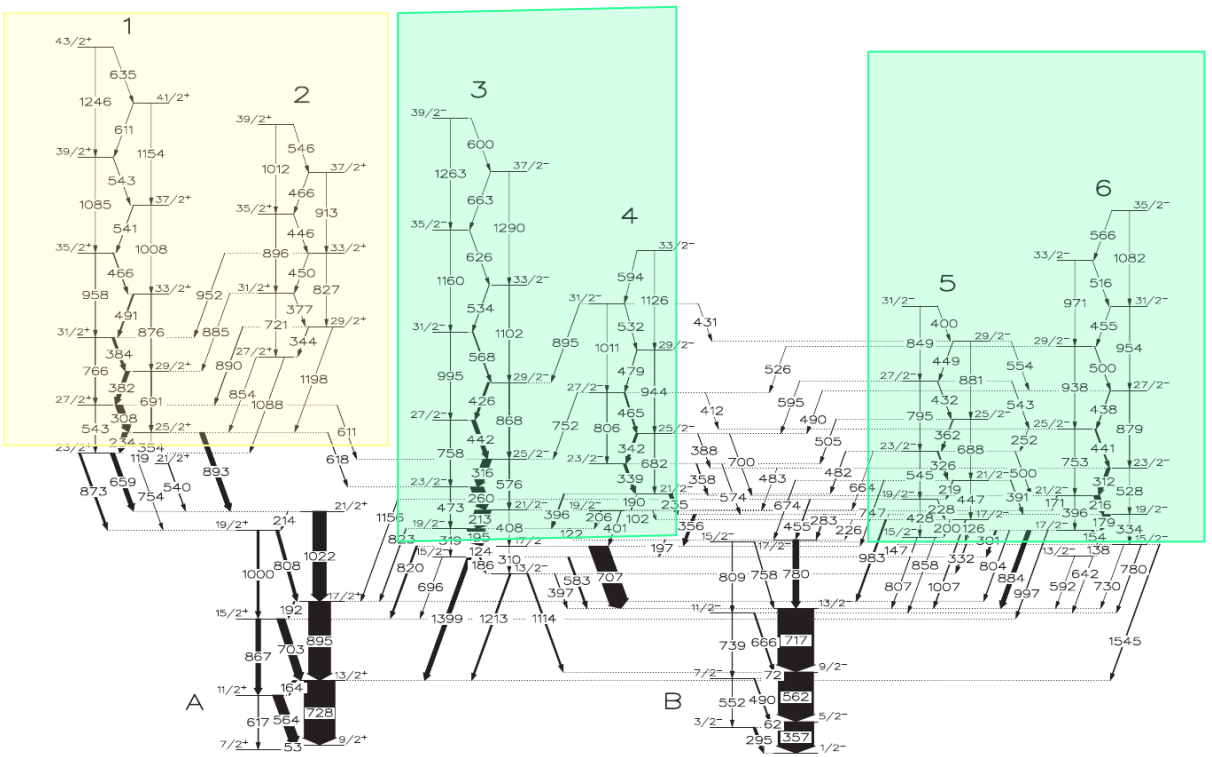
B.W. Xiong, Y.Y. Wang./Atomic Data and Nuclear Data Tables 125 (2019)

Kisérlet

- Nehéz-ion fúzió-evaporációs reakció: 40 MeV energiájú ^{11}B nyaláb ütközött ^{96}Zr céltárgyon
- Trigger: gggg-koincidencia, ~9 x 10^8 esemény
- GAMMASPHERE: több mint 100 HPGe detektor gömbszerű szimmetriában elrendezve



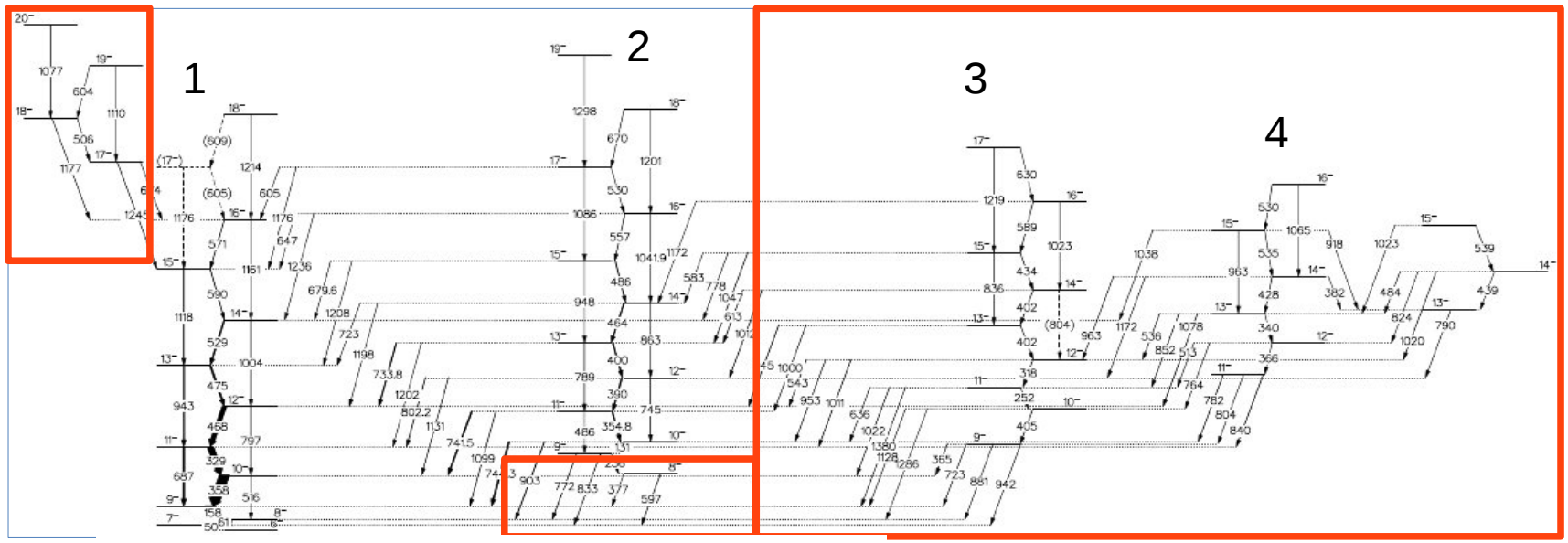
Többszörös kiralitás a ^{103}Rh atommagban

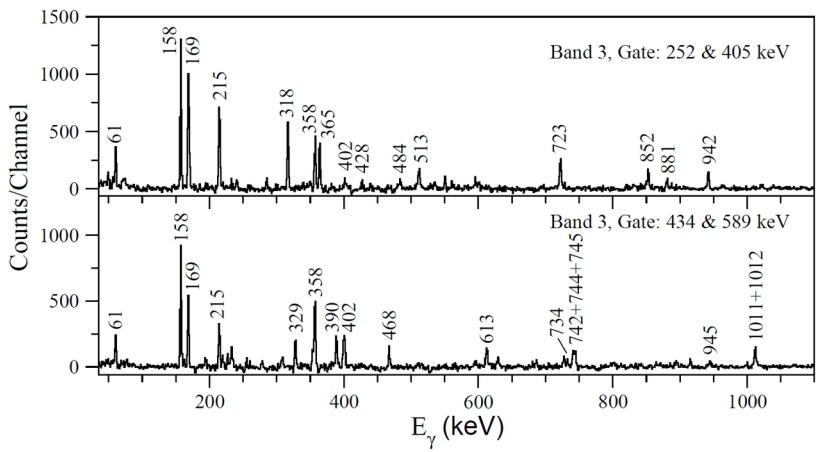


- A $\pi(1g_{9/2})^{-1} \otimes \nu\,(1h_{11/2})^{2}$ konfigurációhoz tartozó pozitív paritású királis sávpár
- A $\pi(1g_{9/2})^{-1} \otimes \nu\,(1h_{11/2})^{1}\,(1g_{7/2})^{1}$ konfigurációhoz két negatív paritású királis sávpár tartozik

I. Kuti et al., PRL 113, 032501 (2014)

A ^{104}Rh atommag negatív paritású nívósémája

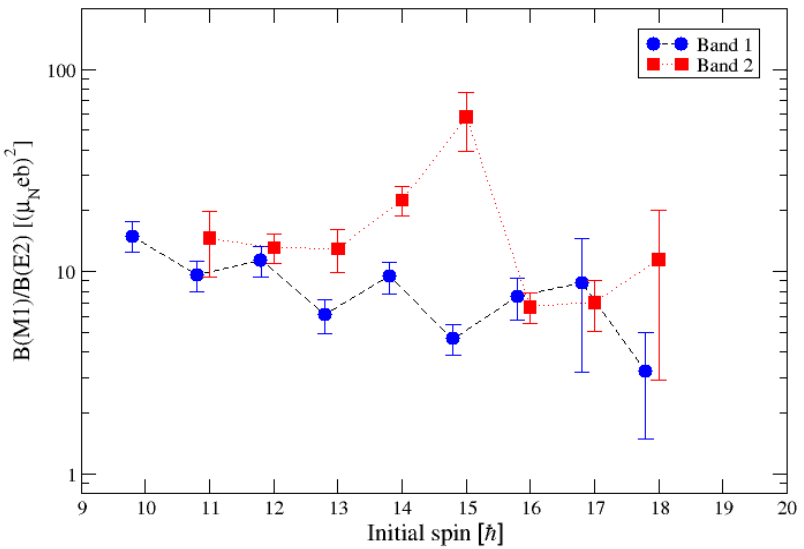




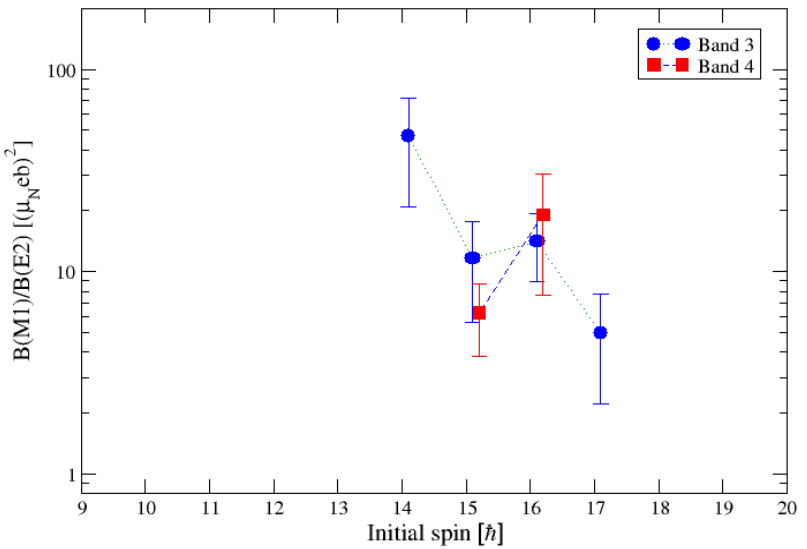
- A forgó állapotokat a γ-koincidenciák alapján határoztuk meg
- A spin-paritás értékeket DCO anilizís segítségével határoztuk meg

Kísérleti B(M1)/B(E2) arányok

B(M1)/B(E2) arányok a 1 és 2

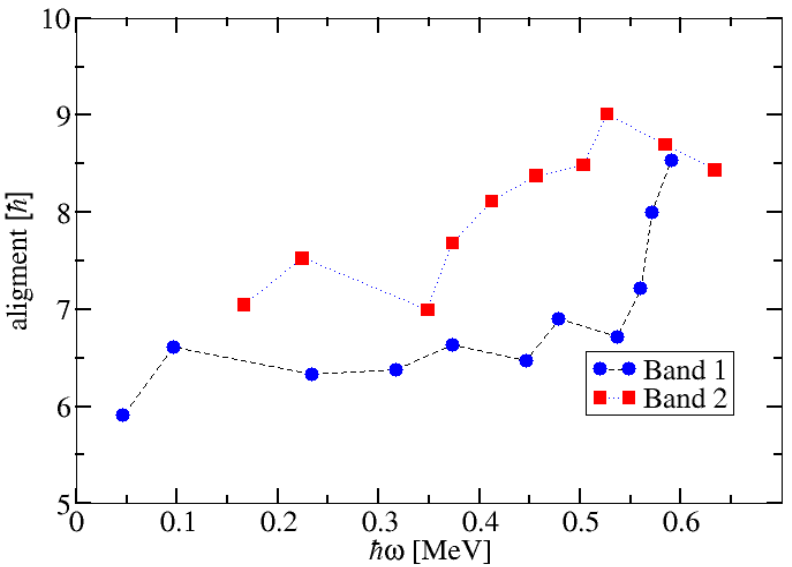


B(M1)/B(E2) arányok a 3 és 4

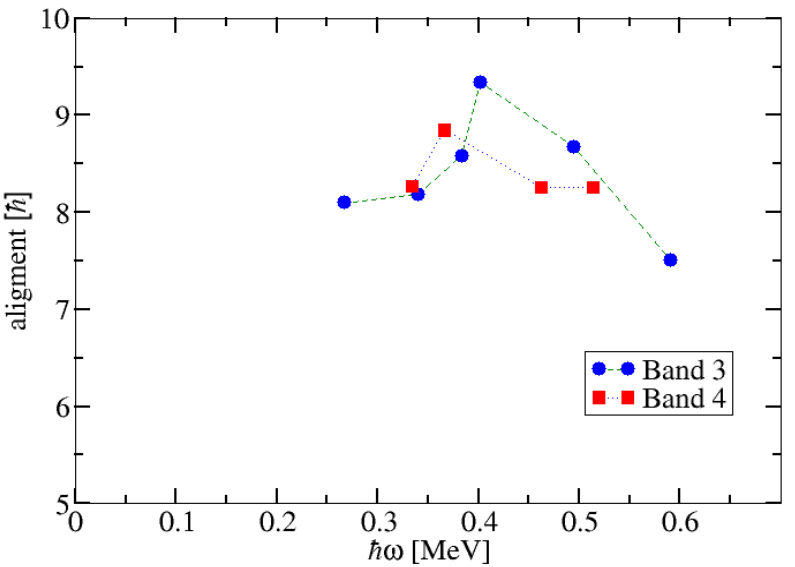


Kísérleti aligment értékek

Aligment értékek az 1-2 sávokra



Aligment értékek a 3-4 sávokra



Harris formula $\mathfrak{I} = \mathfrak{I}_0 + \mathfrak{I}_1\omega^2$, $\mathfrak{I}_0 = 8.9\ \hbar^2/\text{MeV}$, $\mathfrak{I}_1 = 15.7\ \hbar^4/\text{MeV}^3$
K=4 (K: a perdület szimmetriatengelyre vett vetülete a belső vonatkoztatási rendszerben)

Adiabatikus és konfiguráció rögzített relativisztikus átlagtér modell számítások

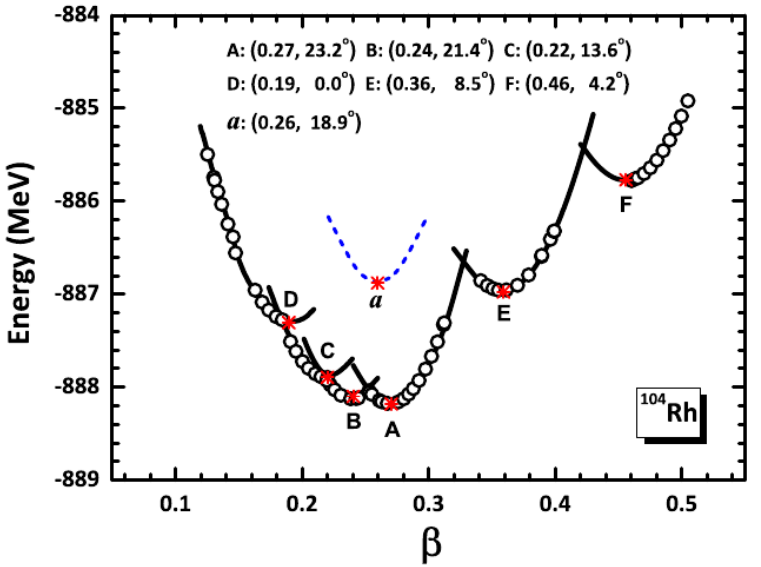
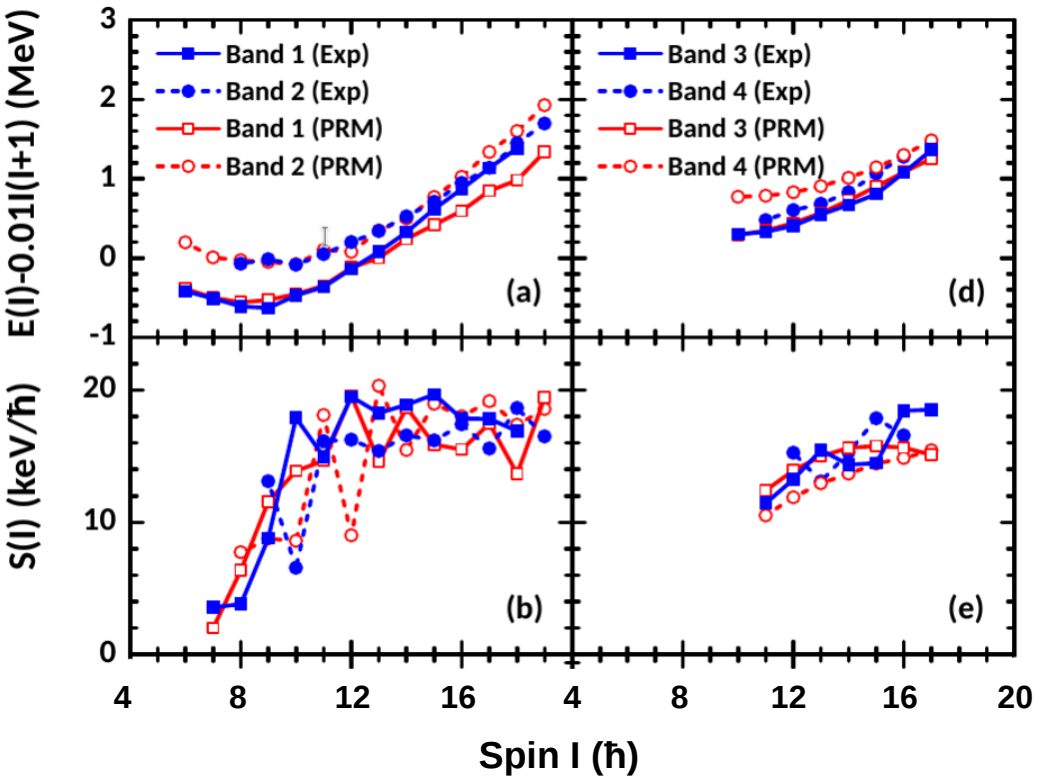


Table 1

The excitation energies E_x, deformation parameters β and γ, and their corresponding configurations (valence nucleon and unpaired nucleon) as well as the parities of minima for states A-F and a in the configuration-fixed constrained triaxial CDFT calculations.

State	E_x	(β, γ)	Unpaired configuration	π
A	0.00	$(0.27, 23.2°)$	$\pi(1g_{9/2})^{-1} \otimes \nu(1h_{11/2})^{1}$	−
B	0.08	$(0.24, 21.4°)$	$\pi(1g_{9/2})^{-1} \otimes \nu(1g_{7/2})^{-1}$	+
C	0.29	$(0.22, 13.6°)$	$\pi(2p_{1/2})^{1} \otimes \nu(1g_{7/2})^{-1}$	−
D	0.87	$(0.19, 0.0°)$	$\pi(1g_{9/2})^{1} \otimes \nu(1g_{7/2})^{-1}$	+
E	1.21	$(0.36, 8.5°)$	$\pi(1g_{7/2})^{1} \otimes \nu(1h_{11/2})^{1}$	−
F	2.41	$(0.46, 4.2°)$	$\pi(2p_{3/2})^{-1} \otimes \nu(1g_{9/2})^{-1}$	−
a	1.30	$(0.26, 18.9°)$	$\pi(1g_{9/2})^{-1} \otimes \nu(1g_{7/2})^{-2}(1h_{11/2})^{1}$	−

Részecske rotor modell számolások



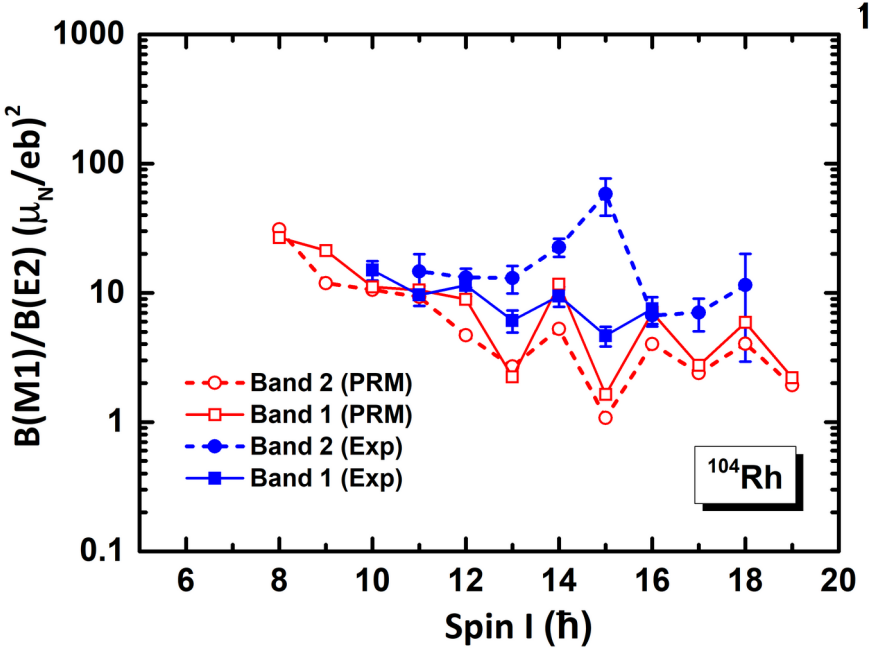
S(I)= [E(I) – E(I-1)]/2I
staggering paraméter

β=0.27, γ=23.2°
$\pi(1g_{9/2})^{-1} \otimes \nu\,(1h_{11/2})^{1}$
konfiguráció

β=0.26, γ=18.9°
$\pi(1g_{9/2})^{-1} \otimes \nu(1g_{7/2})^{-2}\,(1h_{11/2})^{1}$ konfiguráció

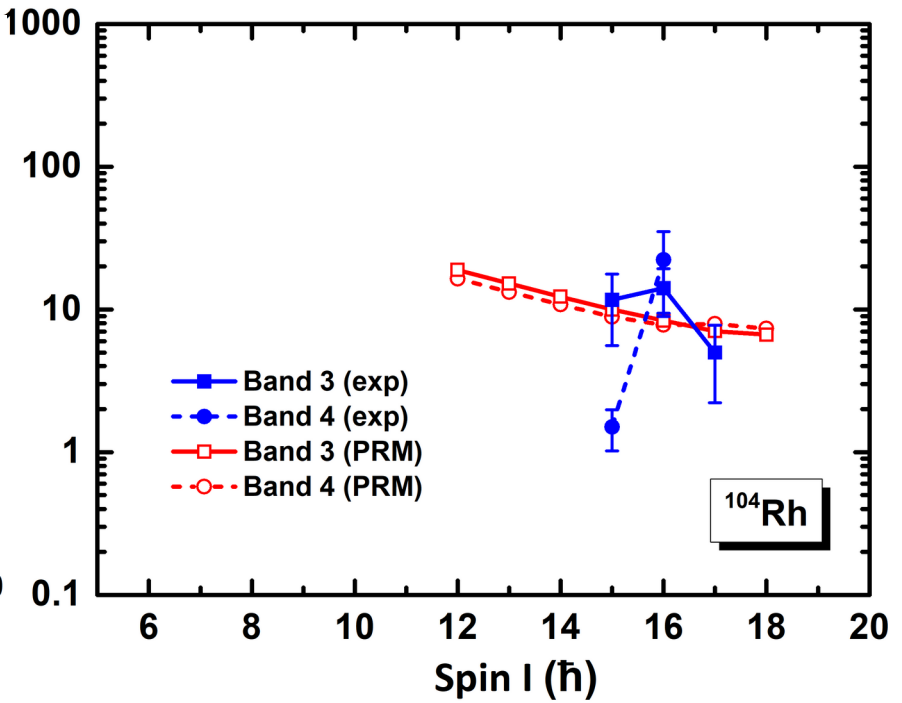
Elektromágneses tulajdonságok

B(M1)/B(E2) arányok az 1-2 sávokra



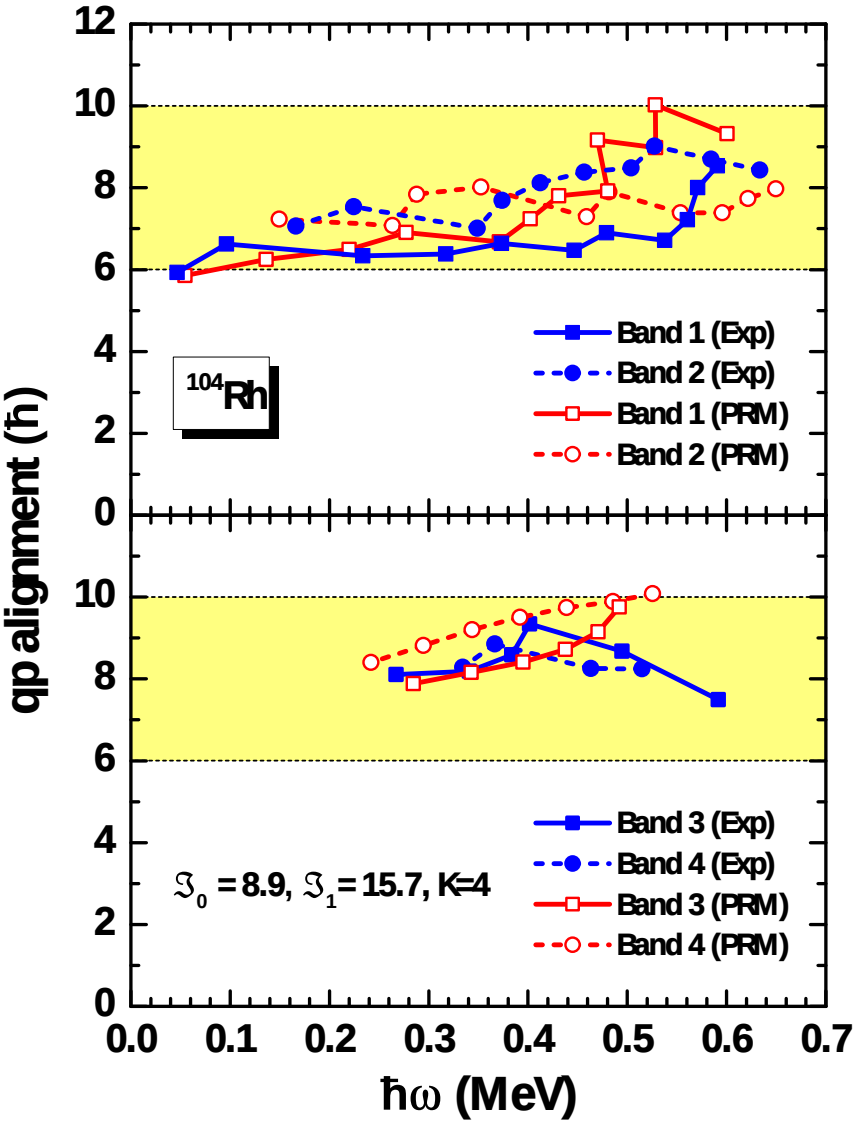
β=0.27, γ=23.2°

B(M1)/B(E2) arányok a 3-4 sávokra



β=0.26, γ=18.9°

Elméleti és kísérleti aligment értékek



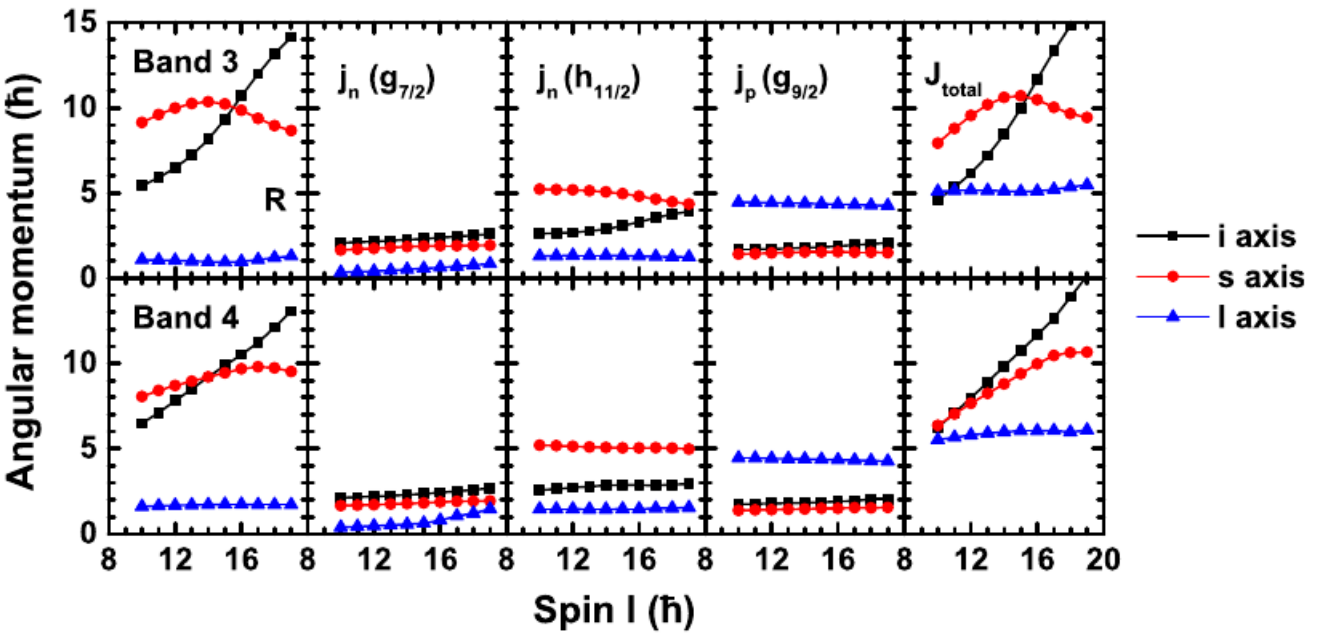
Az 1. és 2. sávok
$\pi(1g_{9/2})^{-1} \otimes \nu\,(1h_{11/2})^{1}$ konfigurációval rendelkeznek

β=0.27, γ=23.2°

A 3. és 4. sávok
$\pi(1g_{9/2})^{-1} \otimes \nu(1g_{7/2})^{-2}\,(1h_{11/2})^{1}$
konfigurációval rendelkeznek

β=0.26, γ=18.9°

Perdület komponensek



n-lyuk n-részecske p-lyuk

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Letter

Multiple chiral doublet bands in ^{104}Rh

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