Tracking Low-lying Nuclear Shape Evolution from the Dysprosium Valence Maximum to Gamma-soft Osmium Isotopes

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Outline

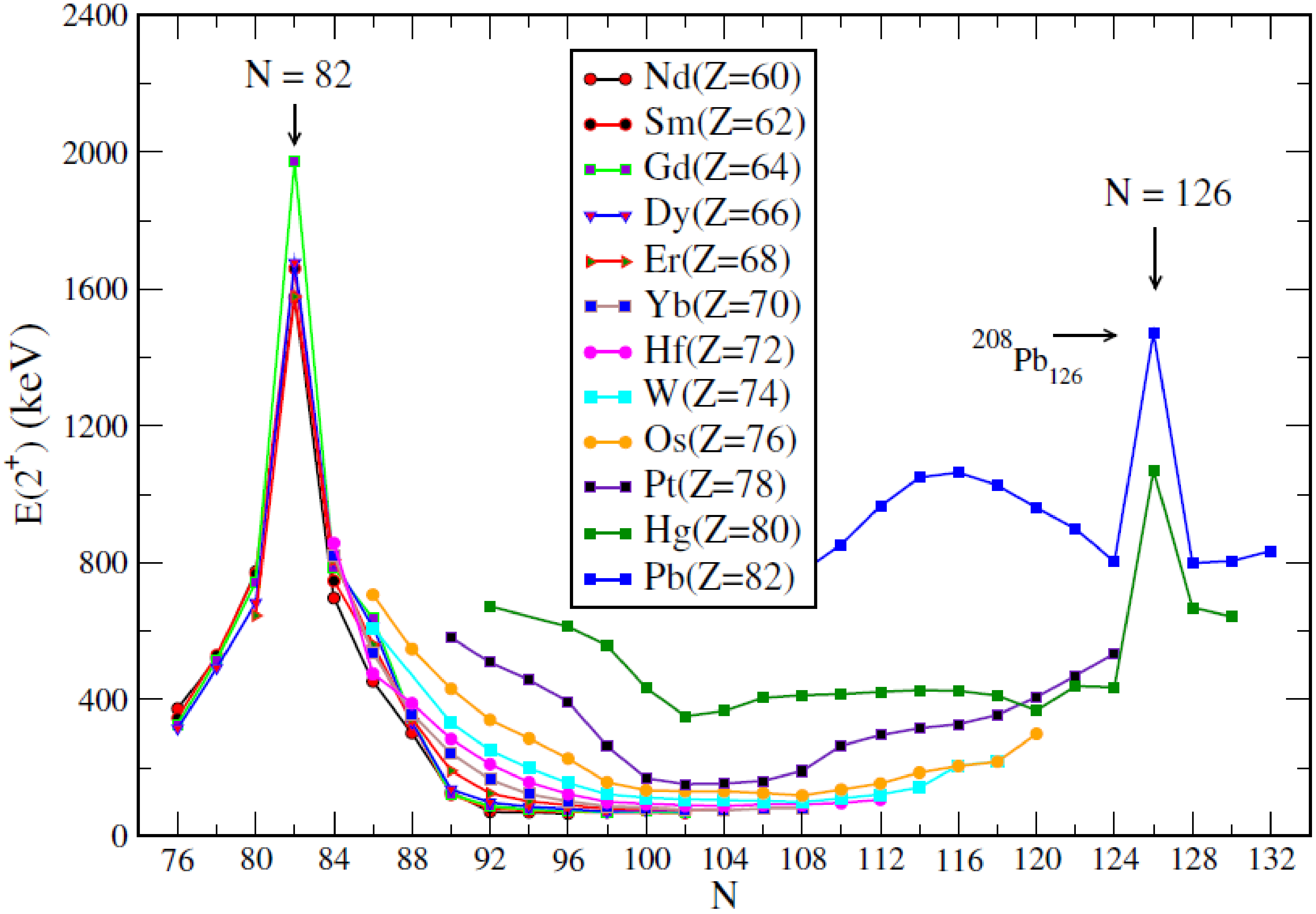
- Reminders:
  - What are the **simplest** signatures of (even-even) nuclear shape (evolution)
  - $E(2^+)$, $R(4^+/2^+)$, $B(E2{:}2^+ \rightarrow 0^+)$, $E(2^+_2) / E(2^+_1)$ etc.

- Energy systematics around the double-mid-shell ‘valence maximum’ $^{166\text{-}172}$Dy

- Physics around the N~116 ‘triaxial/gamma-soft’ minimum? ($^{188\text{-}192}$W; $^{192\text{-}6}$Os)

- $B(E2{:}2^+ \rightarrow 0^+)$ values in stable+2n ‘transitional’ nuclei $^{188}W_{114}$; $^{194}Os_{118}$

‘Easiest’ signature of nuclear ‘shape’ and deformation E(2^+);
Evidence for (SPHERICAL) SHELL STRUCTURE and QUADRUPOLE COLLECTIVITY (=deformation) due to configuration mixing of MANY possible 2^+ basis states.



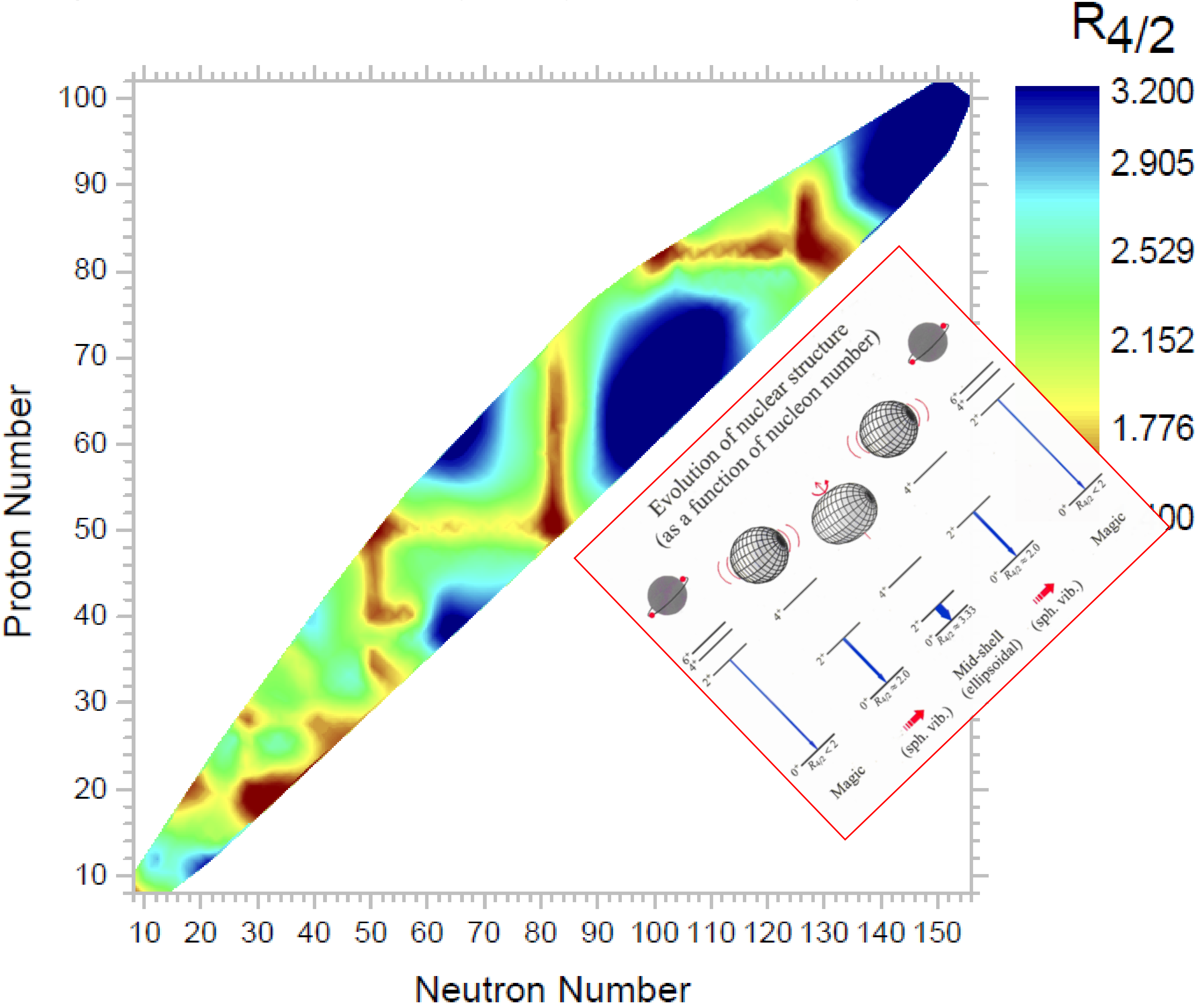
Low-energy Nuclear ‘Rotations’ and ‘Vibrations’

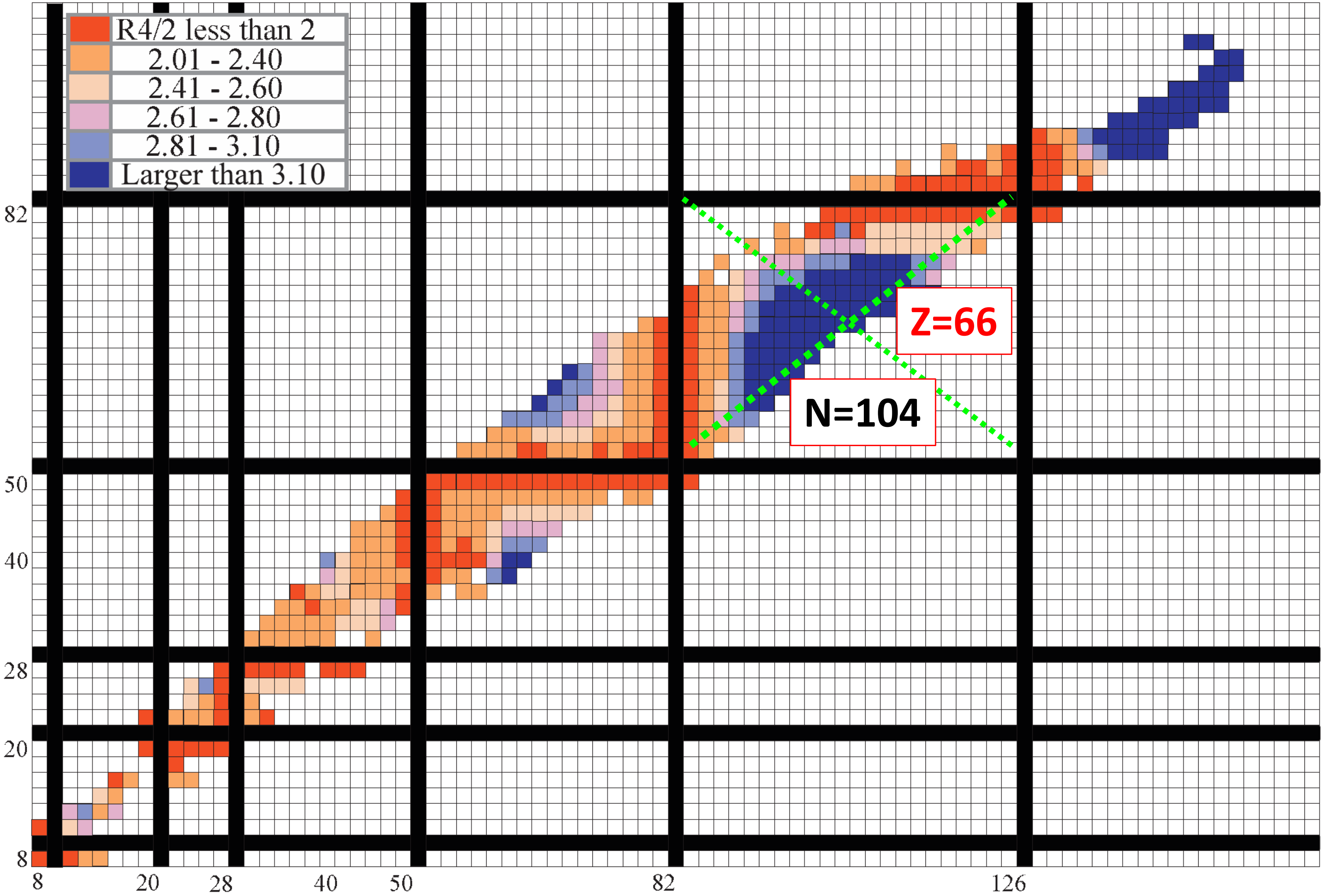
- What are the signatures (in even-even nuclei) ?
  - (**extreme**) theoretical / collective model energy limits

$$E_J = \frac{\hbar^2}{2\ell} J(J+1), \qquad \frac{E(4^+)}{E(2^+)} = \frac{4(5) = 20}{2(3) = 6} = 3.33$$

$$E_N = \hbar\omega N \qquad \frac{E(4^+)}{E(2^+)} = \frac{2}{1} = 2.00$$

‘Next easiest’ signature of nuclear qudrupole collectivity: R(4/2).

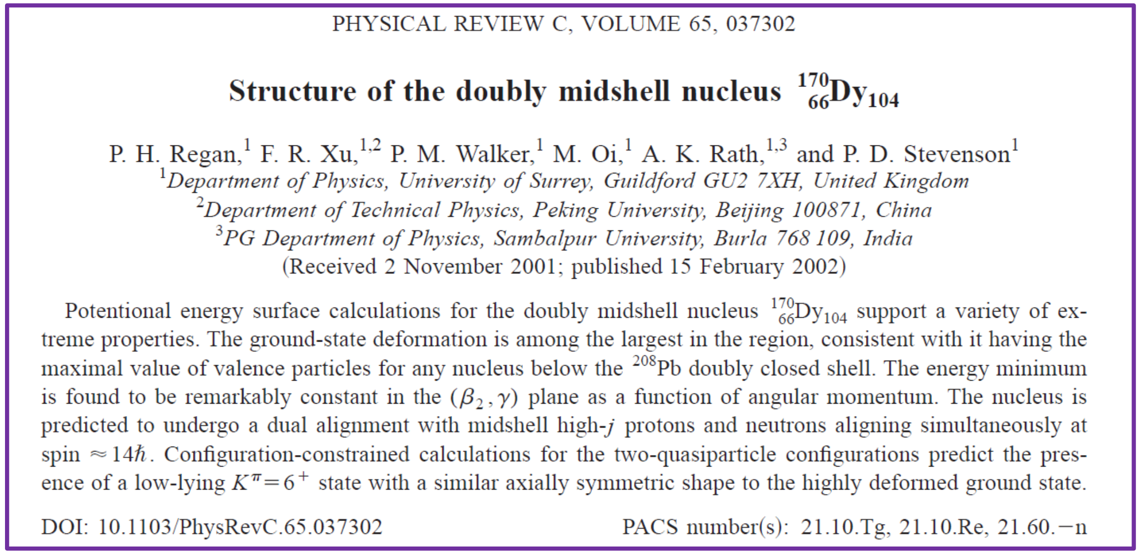




R(E(4^+) / E(2^+)) Systematics plot from Burcu Cakirli

^{170}Dy$_{104}$: is it special?

- $N_\pi.N_\nu$ max. nucleus (below ^{208}Pb anyway).
- Max (valence driven) collectivity?
- Should be one of the 'best cases' of an axially symmetric, 'stiff' quadrupole deformed nucleus.
- Signatures ? Energy spacing; B(E2); K-Hindrance ?



PHYSICAL REVIEW C, VOLUME 65, 037302

Structure of the doubly midshell nucleus $^{170}_{66}$Dy$_{104}$

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(Received 2 November 2001; published 15 February 2002)

Potentional energy surface calculations for the doubly midshell nucleus $^{170}_{66}$Dy$_{104}$ support a variety of extreme properties. The ground-state deformation is among the largest in the region, consistent with it having the maximal value of valence particles for any nucleus below the ^{208}Pb doubly closed shell. The energy minimum is found to be remarkably constant in the (β_2, γ) plane as a function of angular momentum. The nucleus is predicted to undergo a dual alignment with midshell high-j protons and neutrons aligning simultaneously at spin $\approx 14\hbar$. Configuration-constrained calculations for the two-quasiparticle configurations predict the presence of a low-lying $K^\pi = 6^+$ state with a similar axially symmetric shape to the highly deformed ground state.

DOI: 10.1103/PhysRevC.65.037302 PACS number(s): 21.10.Tg, 21.10.Re, 21.60.−n

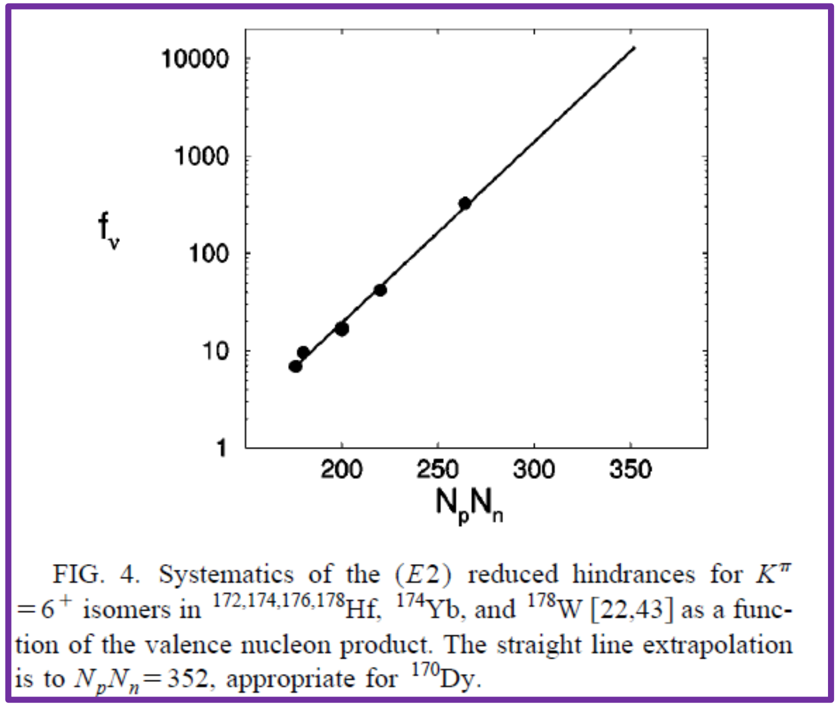
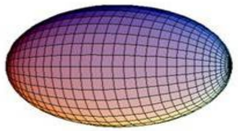
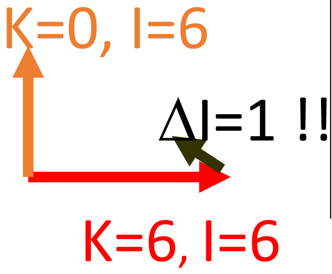
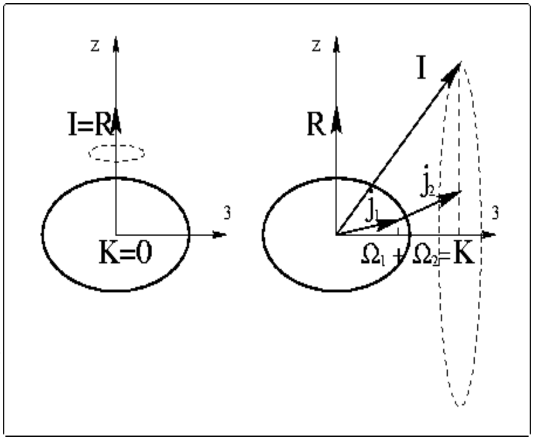


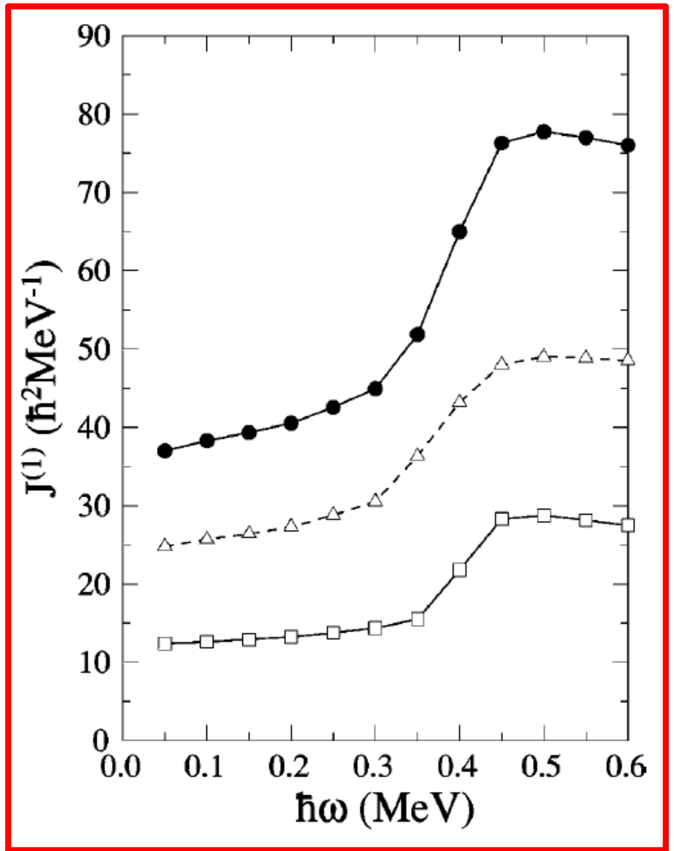
FIG. 4. Systematics of the $(E2)$ reduced hindrances for $K^\pi = 6^+$ isomers in ^{172,174,176,178}Hf, ^{174}Yb, and ^{178}W [22,43] as a function of the valence nucleon product. The straight line extrapolation is to $N_pN_n = 352$, appropriate for ^{170}Dy.

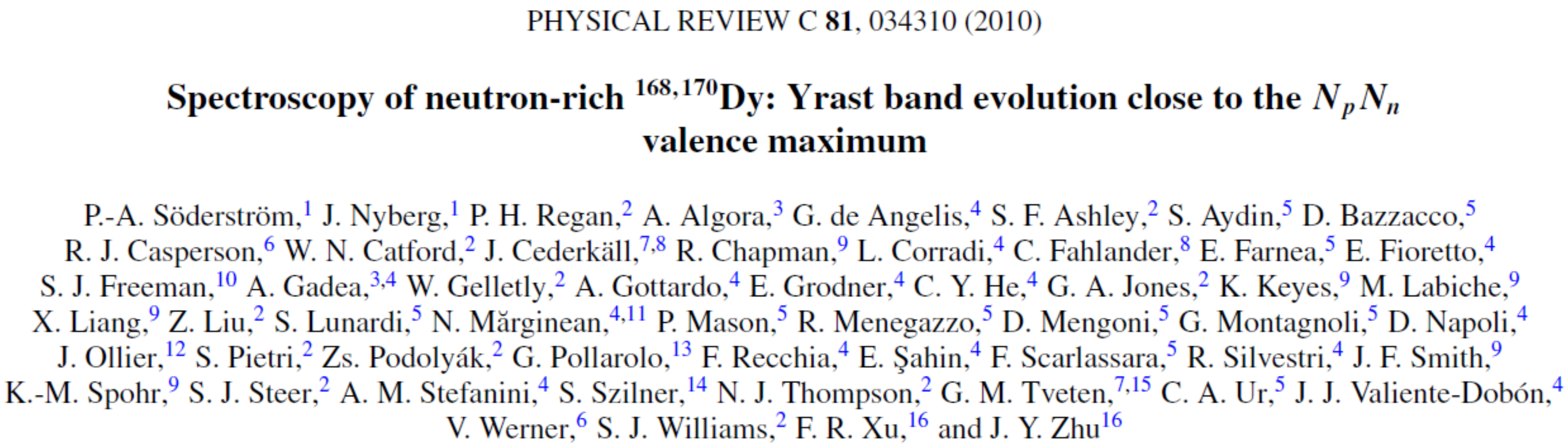
K-isomerism







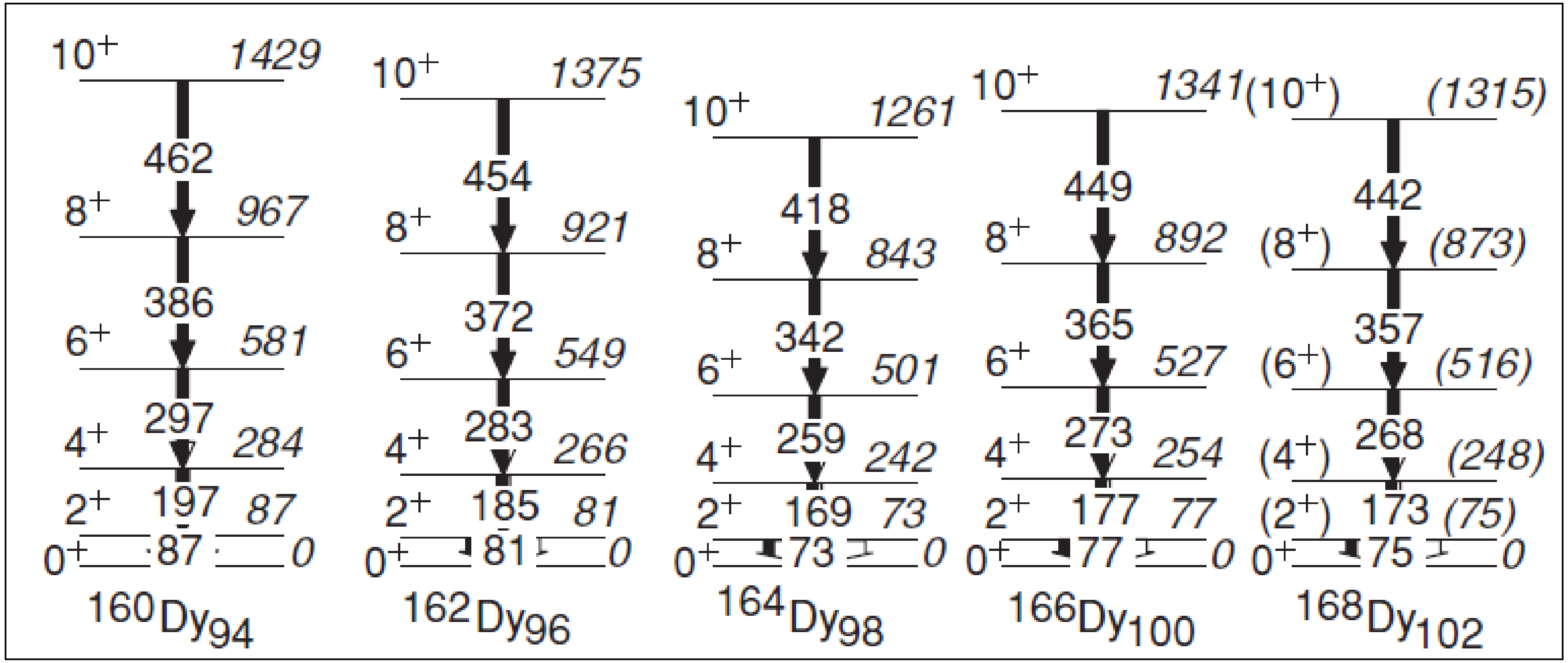




PHYSICAL REVIEW C **81**, 034310 (2010)

Spectroscopy of neutron-rich ^{168,170}Dy: Yrast band evolution close to the N_pN_n valence maximum

P.-A. Söderström,[1] J. Nyberg,[1] P. H. Regan,[2] A. Algora,[3] G. de Angelis,[4] S. F. Ashley,[2] S. Aydin,[5] D. Bazzacco,[5]
R. J. Casperson,[6] W. N. Catford,[2] J. Cederkäll,[7,8] R. Chapman,[9] L. Corradi,[4] C. Fahlander,[8] E. Farnea,[5] E. Fioretto,[4]
S. J. Freeman,[10] A. Gadea,[3,4] W. Gelletly,[2] A. Gottardo,[4] E. Grodner,[4] C. Y. He,[4] G. A. Jones,[2] K. Keyes,[9] M. Labiche,[9]
X. Liang,[9] Z. Liu,[2] S. Lunardi,[5] N. Mărginean,[4,11] P. Mason,[5] R. Menegazzo,[5] D. Mengoni,[5] G. Montagnoli,[5] D. Napoli,[4]
J. Ollier,[12] S. Pietri,[2] Zs. Podolyák,[2] G. Pollarolo,[13] F. Recchia,[4] E. Şahin,[4] F. Scarlassara,[5] R. Silvestri,[4] J. F. Smith,[9]
K.-M. Spohr,[9] S. J. Steer,[2] A. M. Stefanini,[4] S. Szilner,[14] N. J. Thompson,[2] G. M. Tveten,[7,15] C. A. Ur,[5] J. J. Valiente-Dobón,[4]
V. Werner,[6] S. J. Williams,[2] F. R. Xu,[16] and J. Y. Zhu[16]

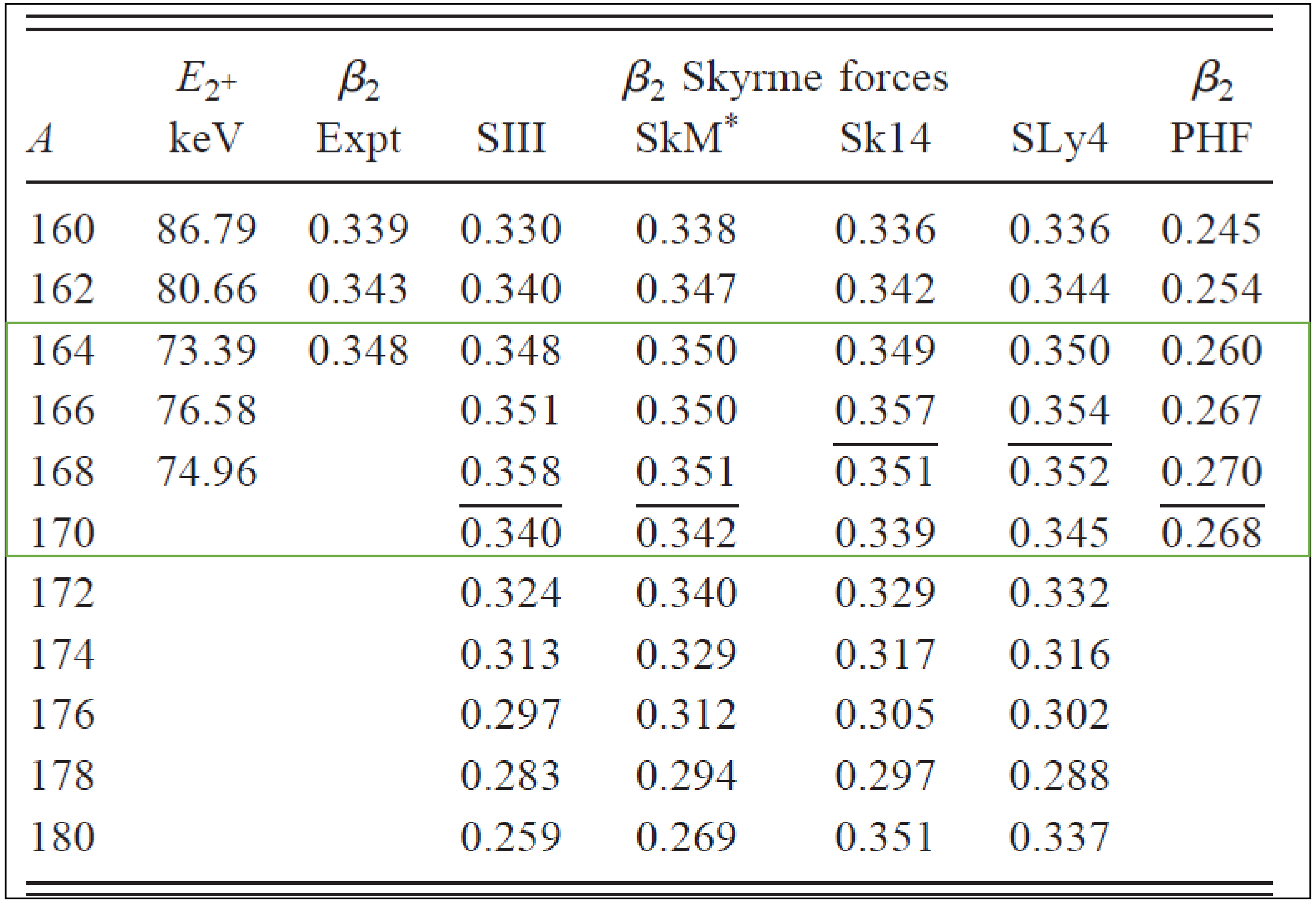


^{166,168}Dy yrast states populated with CLARA+PRISMA experiment, gated on binary BLFs (Kr isotopes) to select Dy partners following the ^{82}Se+^{170}Er DIC / binary transfer reaction.

PHYSICAL REVIEW C **68**, 044315 (2003)

Self-consistent description of dysprosium isotopes in the doubly midshell region

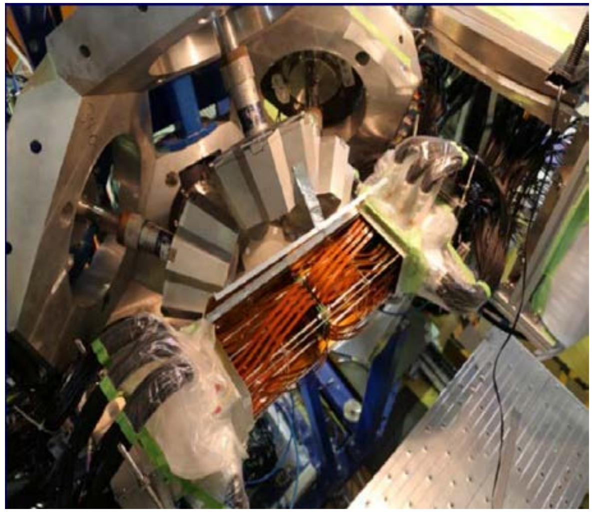
A. K. Rath,[1,2] P. D. Stevenson,[1] P. H. Regan,[1] F. R. Xu,[1,3] and P. M. Walker[1]



	E_{2^+}	β_2	β_2 Skyrme forces				β_2
A	keV	Expt	SIII	SkM*	Sk14	SLy4	PHF
160	86.79	0.339	0.330	0.338	0.336	0.336	0.245
162	80.66	0.343	0.340	0.347	0.342	0.344	0.254
164	73.39	0.348	0.348	0.350	0.349	0.350	0.260
166	76.58		0.351	0.350	0.357	0.354	0.267
168	74.96		0.358	0.351	0.351	0.352	0.270
170			0.340	0.342	0.339	0.345	0.268
172			0.324	0.340	0.329	0.332	
174			0.313	0.329	0.317	0.316	
176			0.297	0.312	0.305	0.302	
178			0.283	0.294	0.297	0.288	
180			0.259	0.269	0.351	0.337	

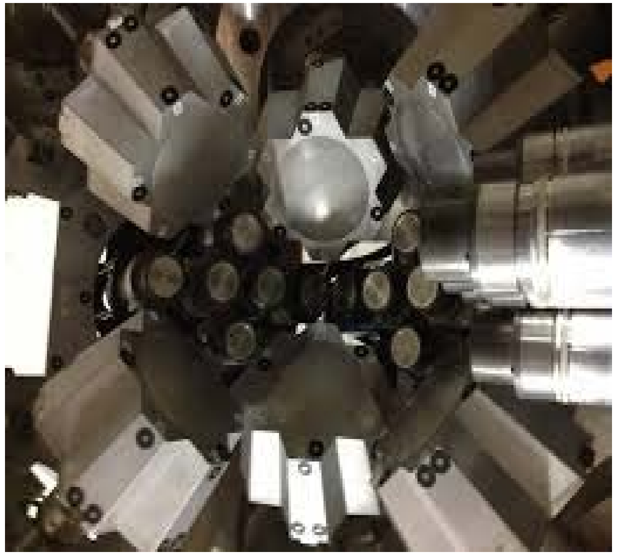
Skyrme Hartee-Foch and Projected Hartree Foch Mean-Field calculations
for Dy isotopes which predict maximum deformation at either N=100 or N=102.

WAS3ABI & EURICA



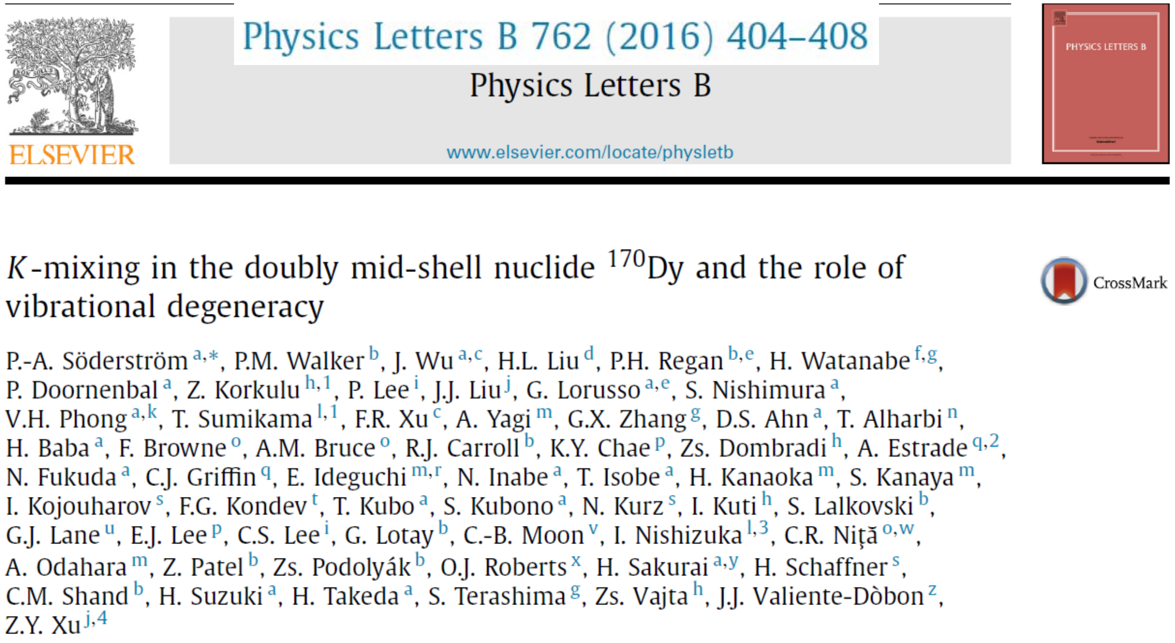
WAS3ABI: Wide-range Active Silicon-Strip Stopper Array for Beta and Ion detection

Double-sided Silicon Strip Detectors
60 x 1 mm strips in x direction
40 x 1 mm strips in y direction



EURICA: Euroball RIKEN Cluster Array for (ion correlated) gamma-ray measurements.

- 84 HPGe in 12 x 7 element CLUSTER dets.
- 18 LaBr3(Ce).


Physics Letters B 762 (2016) 404–408
Physics Letters B
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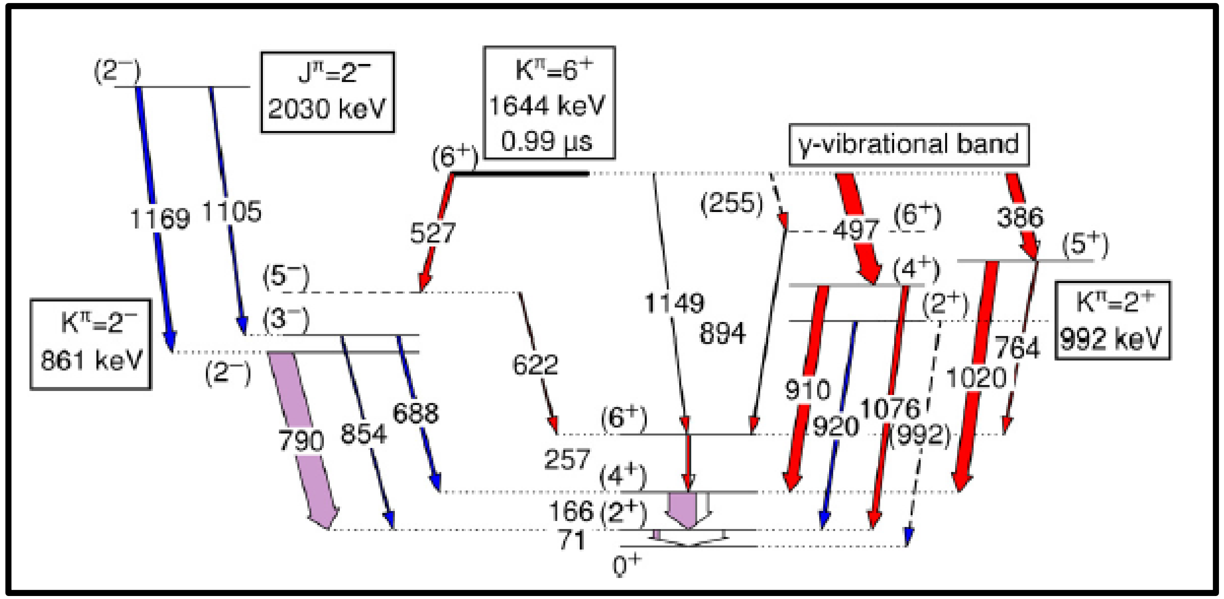
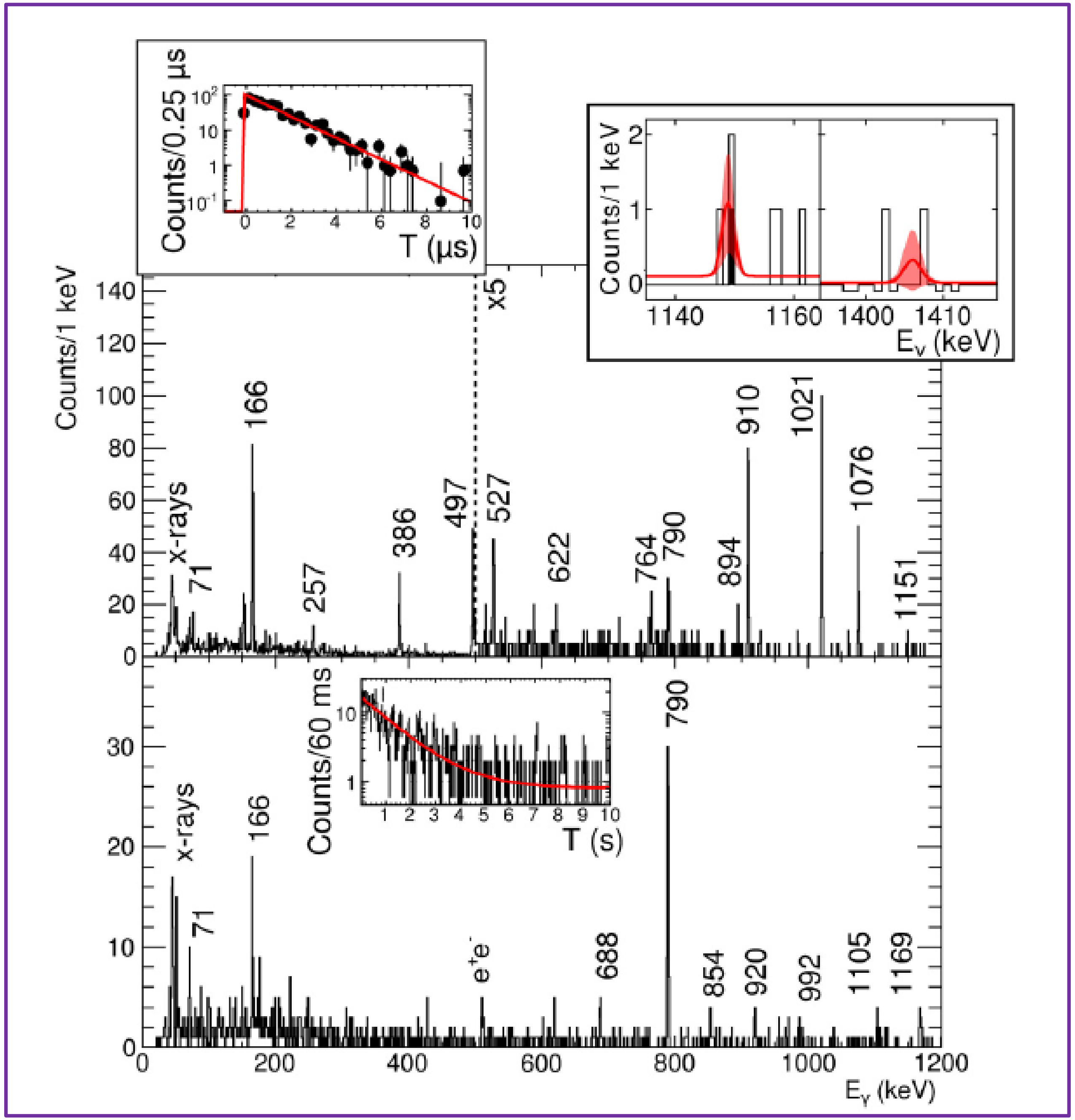
K-mixing in the doubly mid-shell nuclide ^{170}Dy and the role of vibrational degeneracy

P.-A. Söderström [a,*], P.M. Walker [b], J. Wu [a,c], H.L. Liu [d], P.H. Regan [b,e], H. Watanabe [f,g], P. Doornenbal [a], Z. Korkulu [h,1], P. Lee [i], J.J. Liu [j], G. Lorusso [a,e], S. Nishimura [a], V.H. Phong [a,k], T. Sumikama [l,1], F.R. Xu [c], A. Yagi [m], G.X. Zhang [g], D.S. Ahn [a], T. Alharbi [n], H. Baba [a], F. Browne [o], A.M. Bruce [o], R.J. Carroll [b], K.Y. Chae [p], Zs. Dombradi [h], A. Estrade [q,2], N. Fukuda [a], C.J. Griffin [q], E. Ideguchi [m,r], N. Inabe [a], T. Isobe [a], H. Kanaoka [m], S. Kanaya [m], I. Kojouharov [s], F.G. Kondev [t], T. Kubo [a], S. Kubono [a], N. Kurz [s], I. Kuti [h], S. Lalkovski [b], G.J. Lane [u], E.J. Lee [p], C.S. Lee [i], G. Lotay [b], C.-B. Moon [v], I. Nishizuka [l,3], C.R. Niţă [o,w], A. Odahara [m], Z. Patel [b], Zs. Podolyák [b], O.J. Roberts [x], H. Sakurai [a,y], H. Schaffner [s], C.M. Shand [b], H. Suzuki [a], H. Takeda [a], S. Terashima [g], Zs. Vajta [h], J.J. Valiente-Dòbon [z], Z.Y. Xu [j,4]

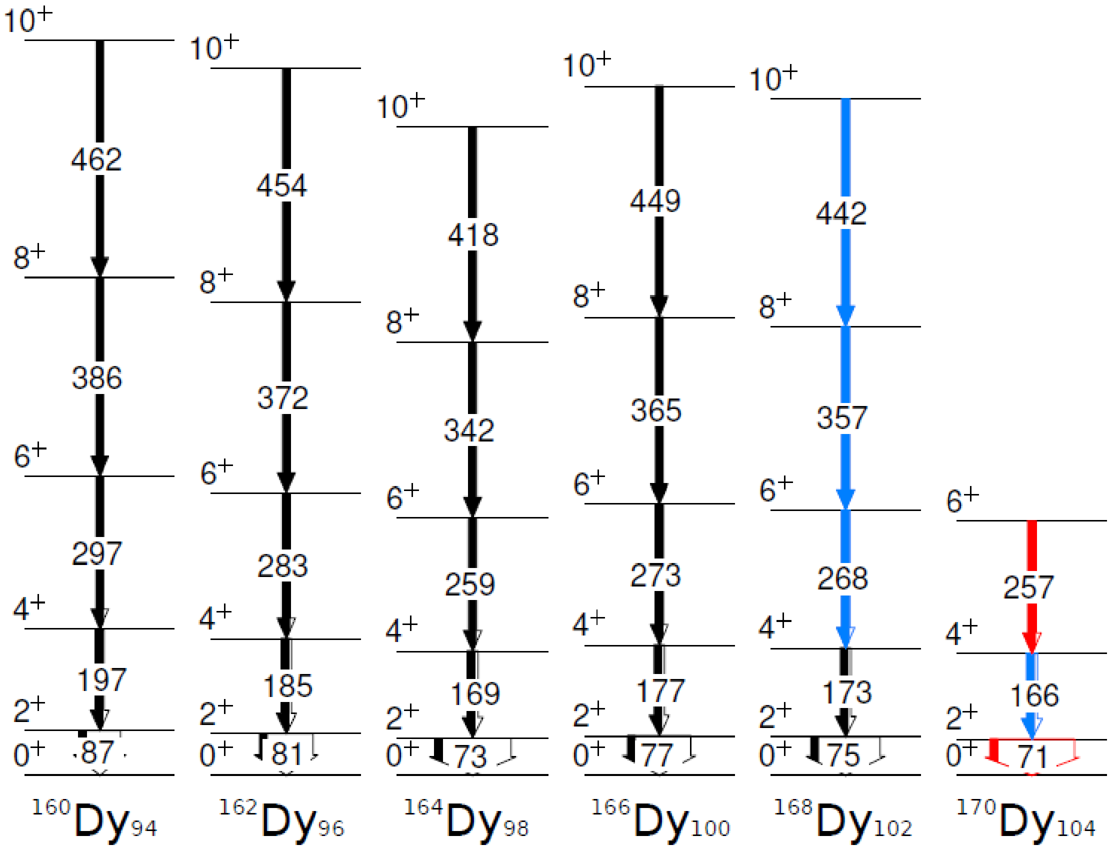


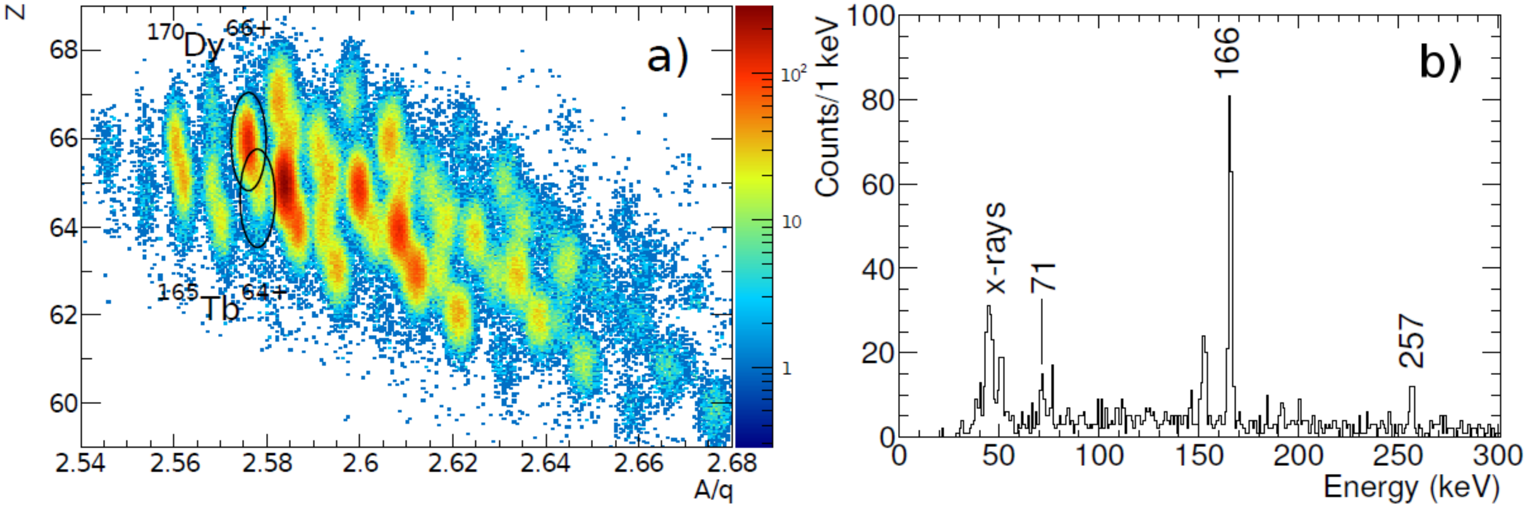


Nuclear Structure and Dynamics '15
AIP Conf. Proc. 1681, 030010-1–030010-5; doi: 10.1063/1.4932254

Heavy Rotation – Evolution of quadrupole collectivity centred at the neutron-rich doubly mid-shell nucleus ^{170}Dy

P.-A. Söderström[1,a)], P. H. Regan[2,3], P. M. Walker[2], H. Watanabe[4,5], P. Doornenbal[1], Z. Korkulu[6], P. Lee[7], H.L. Liu[8], J.J. Liu[9], G. Lorusso[1,3], S. Nishimura[1], T. Sumikama[10], V. H. Phong[1,11], J. Wu[1,12], F.R. Xu[12], A. Yagi[13], G.X. Zhang[5], T. Alharbi[14], H. Baba[1], F. Browne[15], A.M. Bruce[14], R. Carroll[2], K.Y. Chae[16], Zs. Dombradi[6], A. Estrade[17], N. Fukuda[1], C. Griffin[17], E. Ideguchi[13,18], N. Inabe[1], T. Isobe[1], H. Kanaoka[13], I. Kojouharov[19], F.G. Kondev[20], T. Kubo[1], S. Kubono[1], N. Kurz[19], I. Kuti[6], S. Lalkovski[2], G. J. Lane[21], C.S. Lee[7], E.J. Lee[16], G. Lotay[2], C.-B. Moon[22], I. Nishizuka[10], C.R. Nita[15,23], A. Odahara[13], Z. Patel[2], Zs. Podolyák[2], O.J. Roberts[24], H. Sakurai[1,25], H. Schaffner[19], C.M. Shand[2], H. Suzuki[1], H. Takeda[1], S. Terashima[5], Zs. Vajta[6], J.J. Valiente-Dòbon[26], Z.Y. Xu[9] and S. Yoshida[13]





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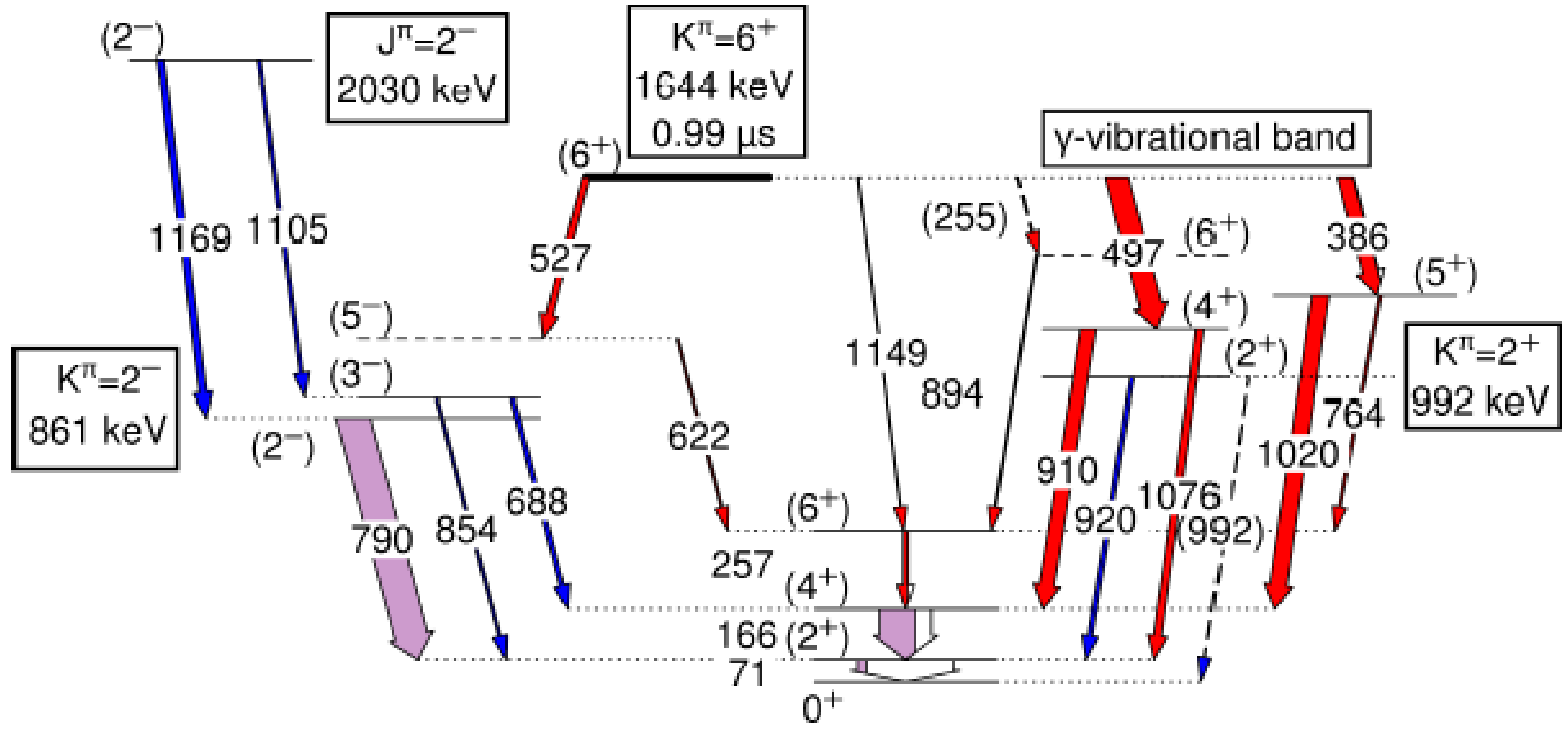
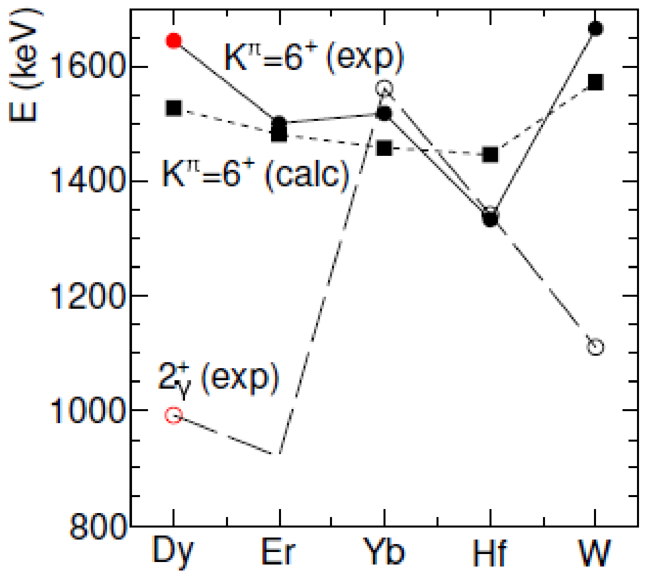
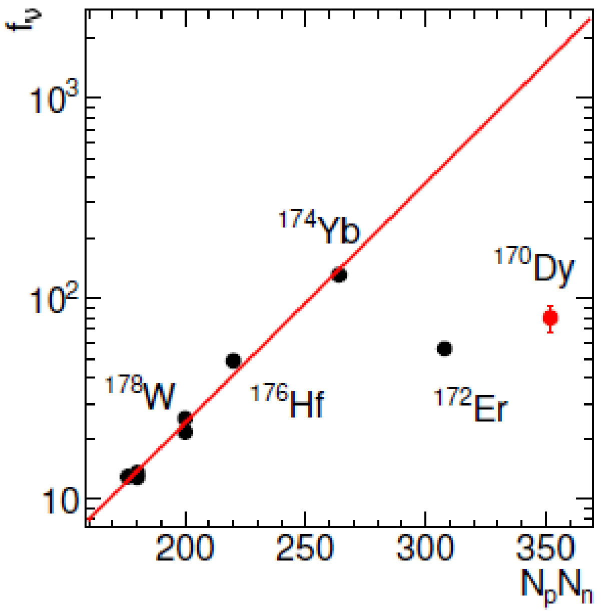
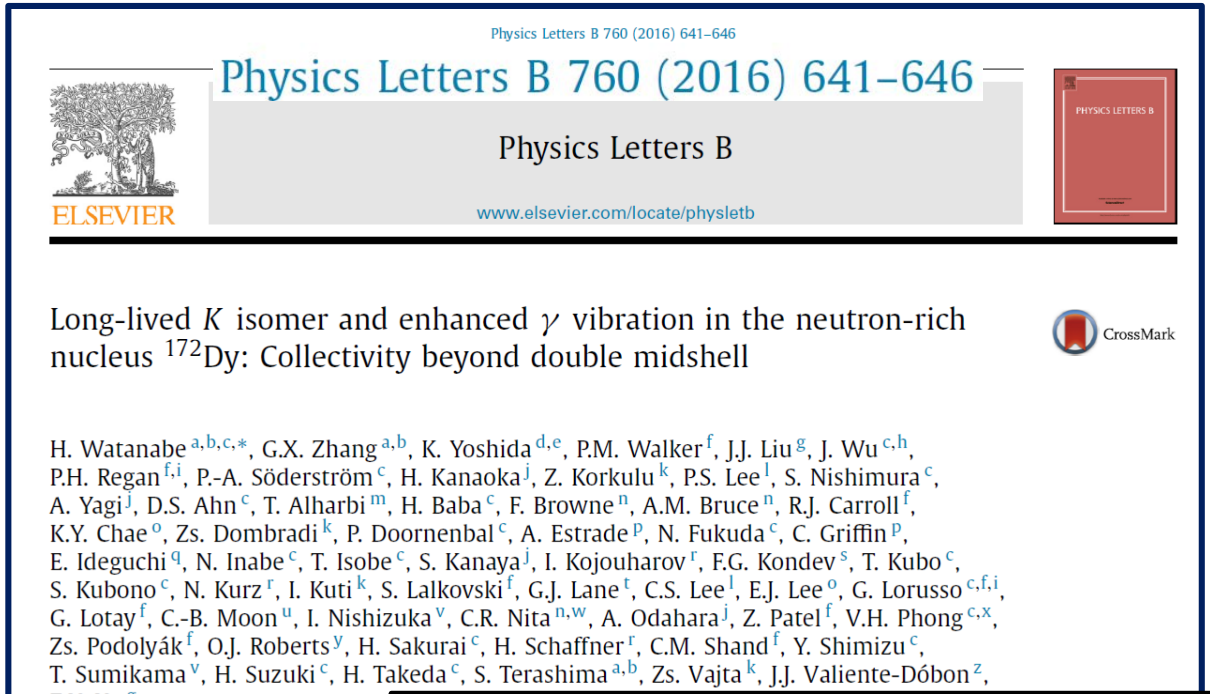






Decay and mixing with $K^{\pi}=2^{+}$ ‘gamma’ band and $K^{\pi}=6^{+}$ isomeric decay ‘reduces’ the Reduced hindrance Compared to Np.Nn Systematics for ^{170}Dy.

$^{172}Dy_{106}$: Past the mid-shell



Physics Letters B 760 (2016) 641–646

Physics Letters B 760 (2016) 641–646

Physics Letters B

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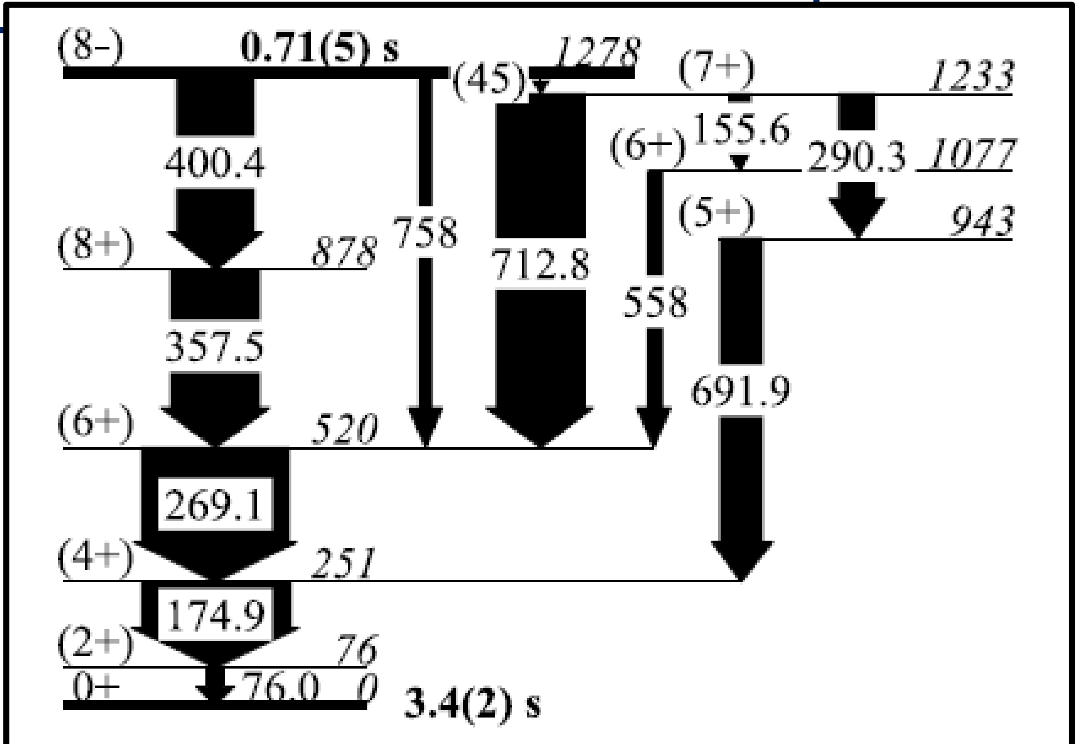
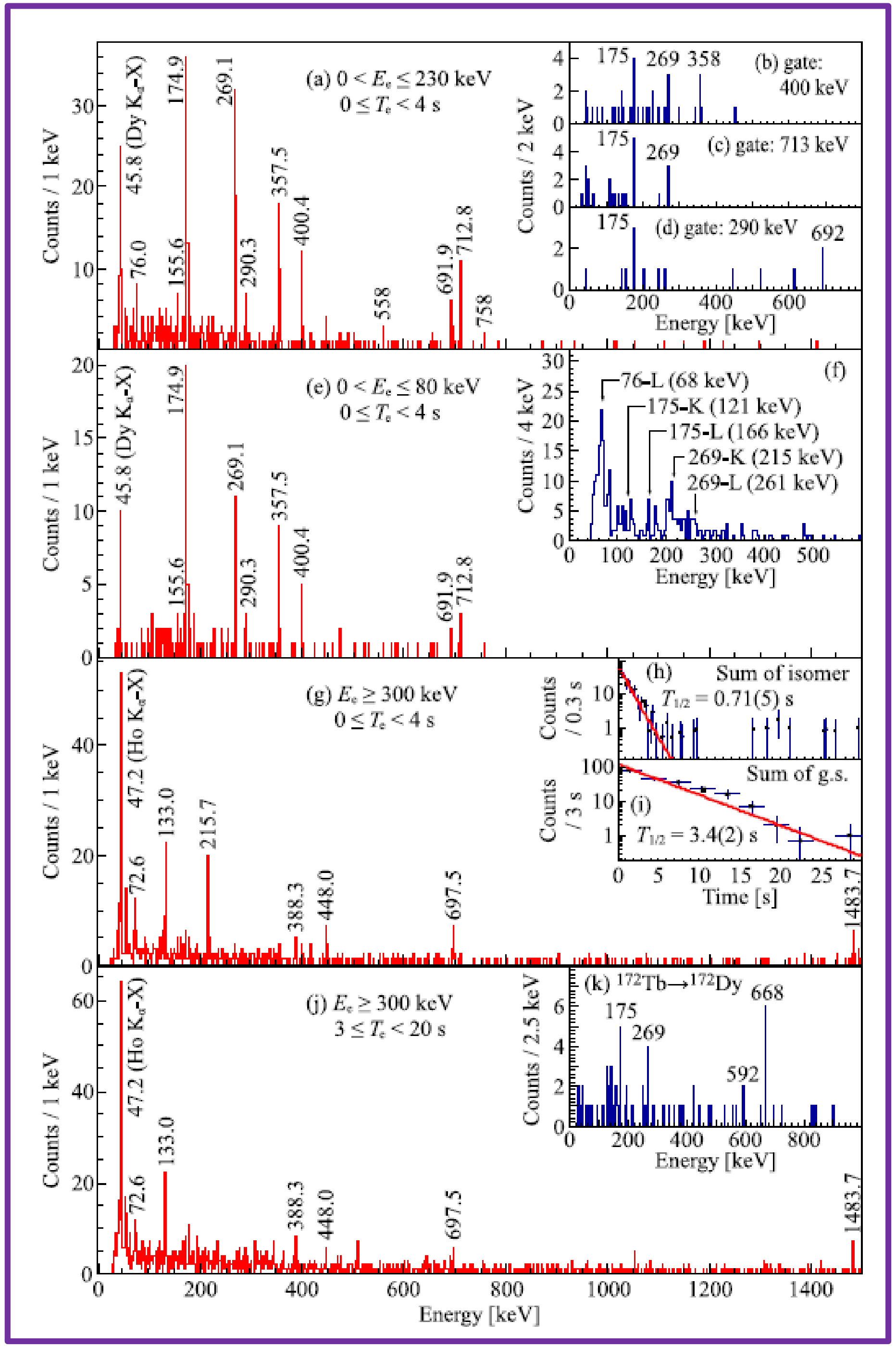
Long-lived K isomer and enhanced γ vibration in the neutron-rich nucleus ^{172}Dy: Collectivity beyond double midshell

H. Watanabe[a,b,c,*], G.X. Zhang[a,b], K. Yoshida[d,e], P.M. Walker[f], J.J. Liu[g], J. Wu[c,h], P.H. Regan[f,i], P.-A. Söderström[c], H. Kanaoka[j], Z. Korkulu[k], P.S. Lee[l], S. Nishimura[c], A. Yagi[j], D.S. Ahn[c], T. Alharbi[m], H. Baba[c], F. Browne[n], A.M. Bruce[n], R.J. Carroll[f], K.Y. Chae[o], Zs. Dombradi[k], P. Doornenbal[c], A. Estrade[p], N. Fukuda[c], C. Griffin[p], E. Ideguchi[q], N. Inabe[c], T. Isobe[c], S. Kanaya[j], I. Kojouharov[r], F.G. Kondev[s], T. Kubo[c], S. Kubono[c], N. Kurz[r], I. Kuti[k], S. Lalkovski[f], G.J. Lane[t], C.S. Lee[l], E.J. Lee[o], G. Lorusso[c,f,i], G. Lotay[f], C.-B. Moon[u], I. Nishizuka[v], C.R. Nita[n,w], A. Odahara[j], Z. Patel[f], V.H. Phong[c,x], Zs. Podolyák[f], O.J. Roberts[y], H. Sakurai[c], H. Schaffner[r], C.M. Shand[f], Y. Shimizu[c], T. Sumikama[v], H. Suzuki[c], H. Takeda[c], S. Terashima[a,b], Zs. Vajta[k], J.J. Valiente-Dóbon[z], Z.Y. Xu[g]





Dy GSB energy systematics: Moment of inertia systematics (‘deformation’ and stiffness?)

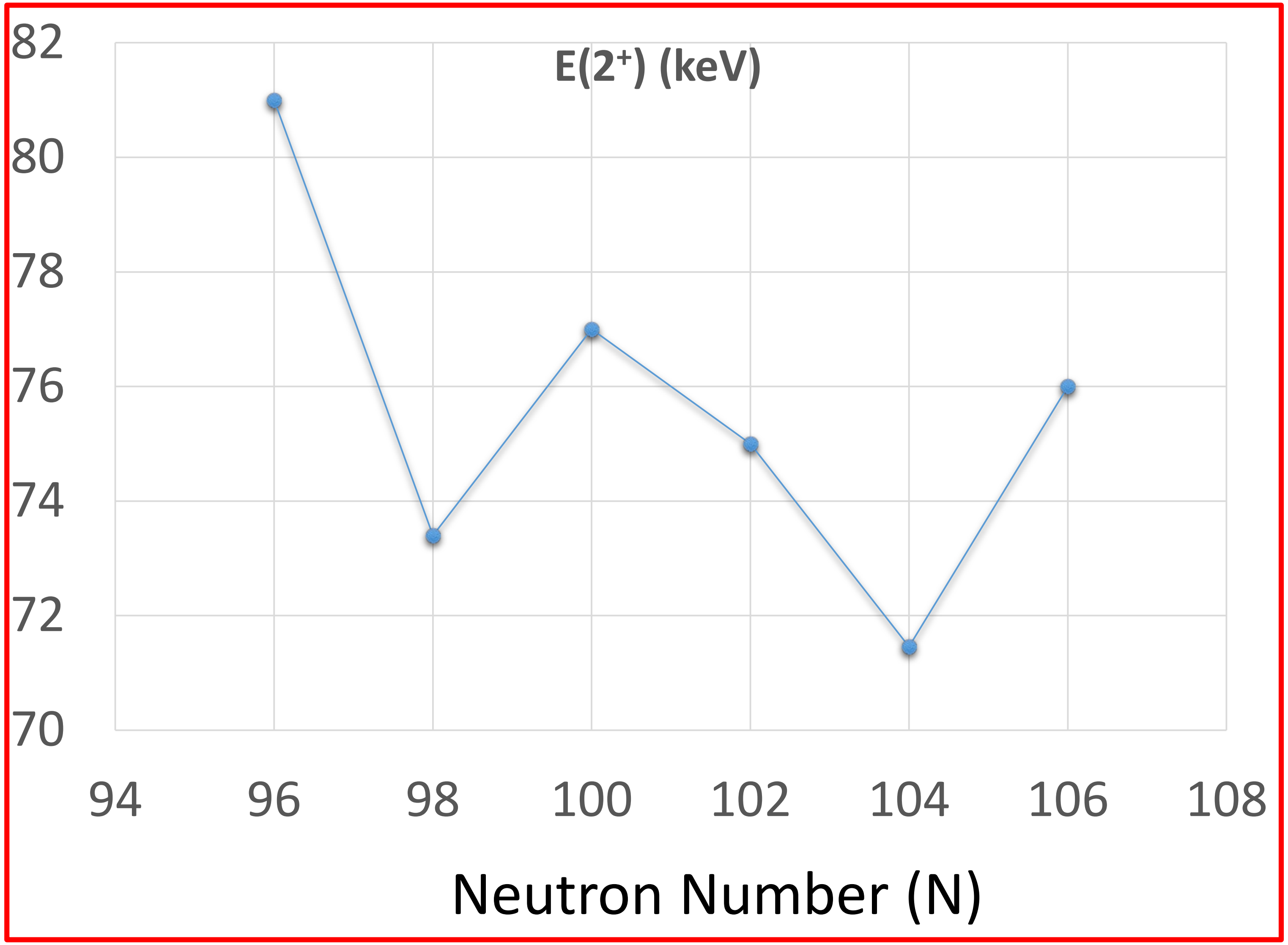
Test the rotational nature of the Dy isotopes across the valence maximum at N=104 using:

$E(I) = hbar^2/(2J)* I(I+1)$

J = moment of inertia.

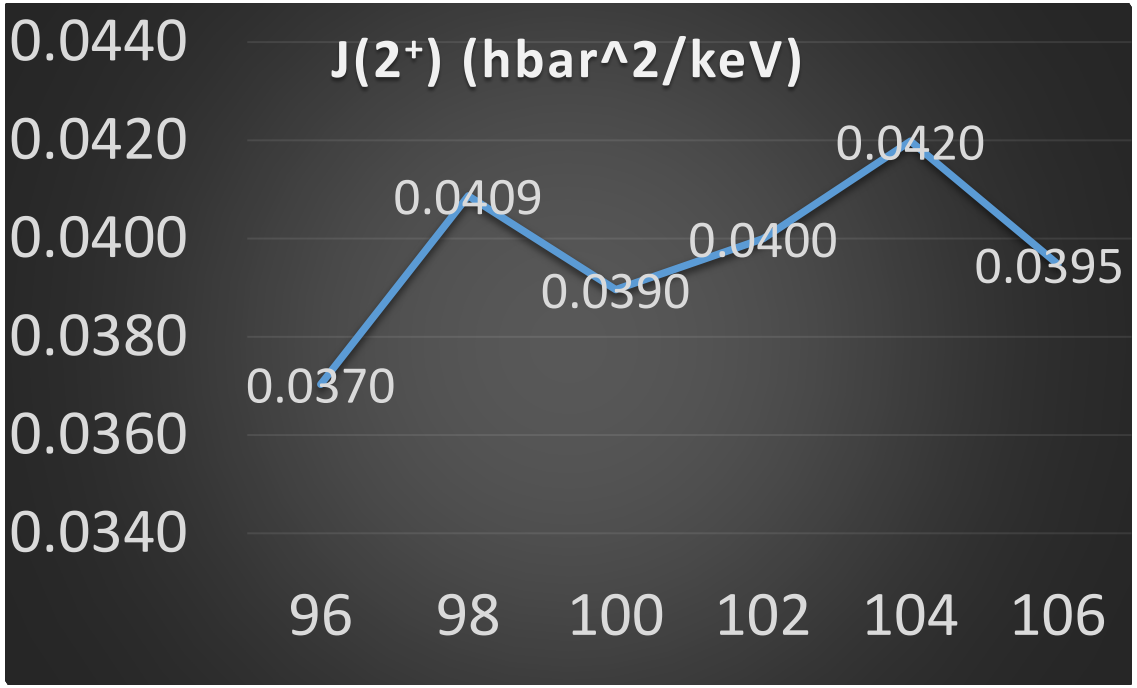
Classically, $J \sim (C*MR^2)$
with $\sim C*A^{5/3}$; A = mass number.

C is a measure of the mass distribution away from the rotation axis.

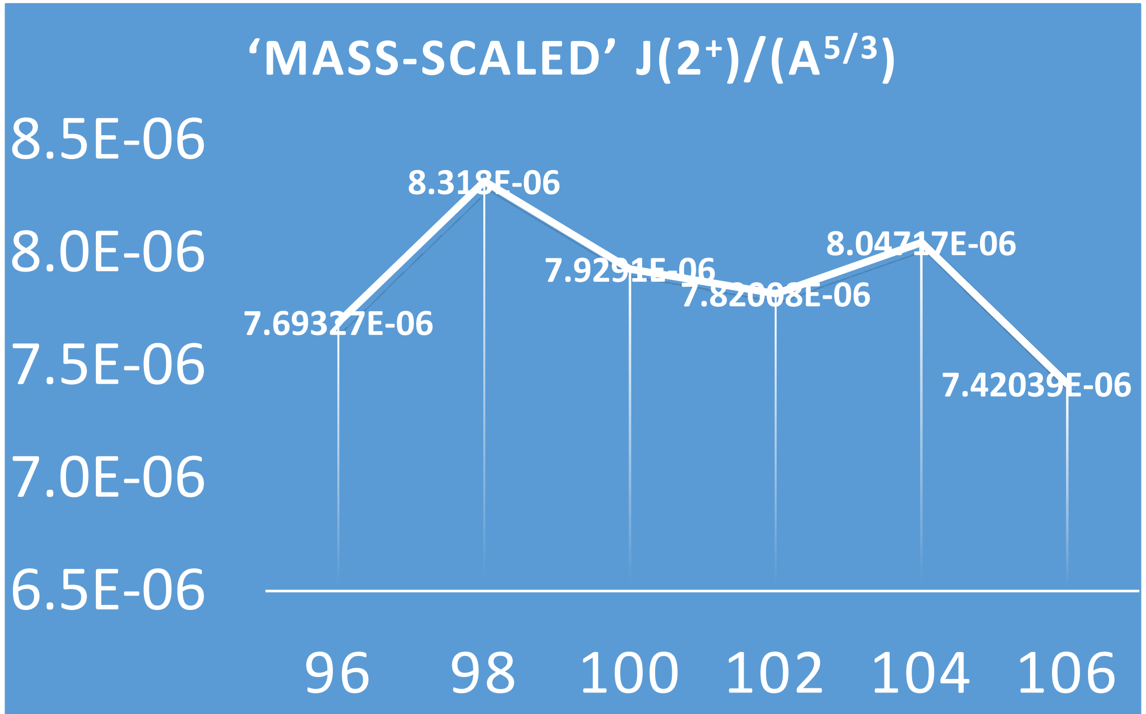


Bigger moments of inertia = larger quadrupole deformations.

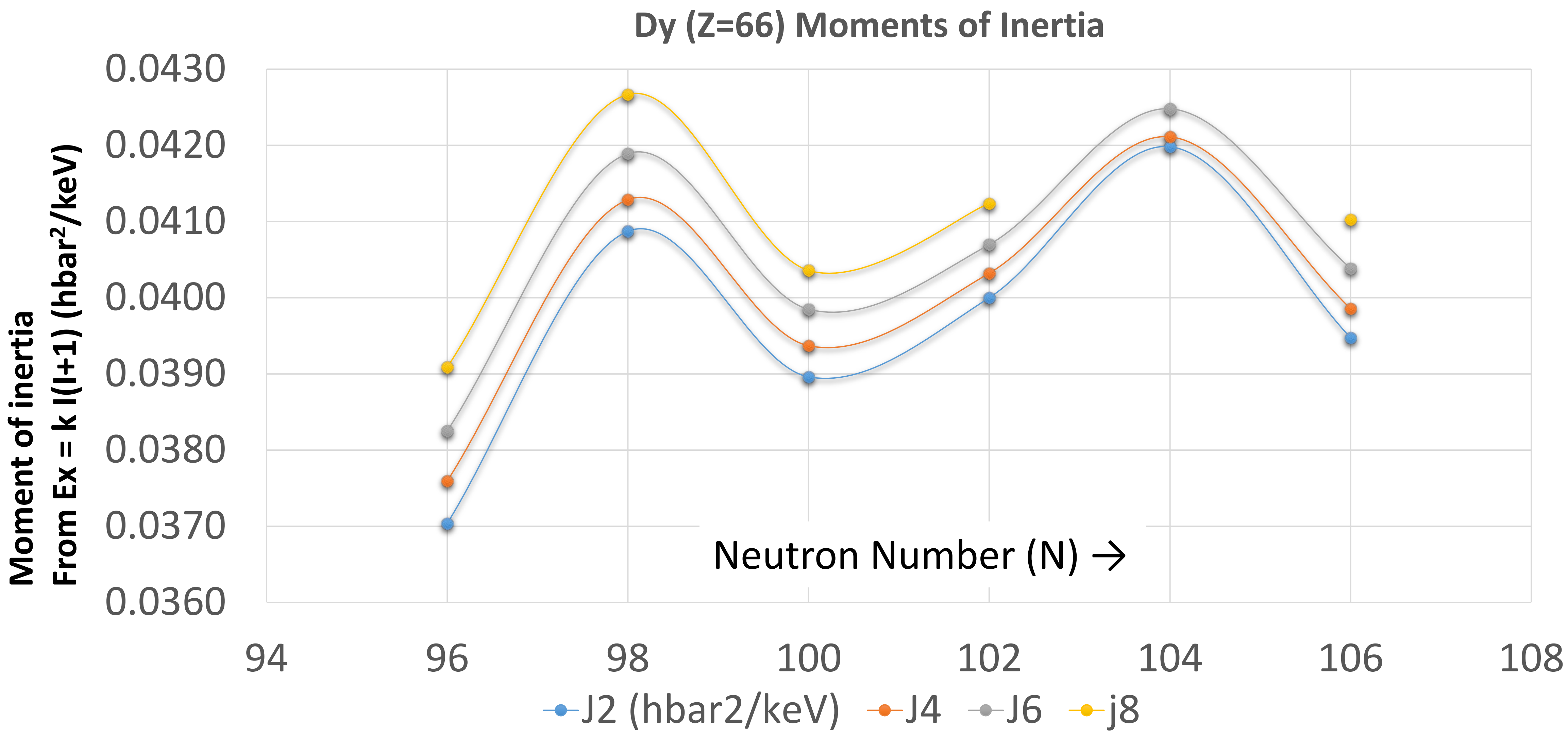
Moment of inertia from
$I^{\pi}=2^{+}$ state energy shows
Highest moment of inertia
For ^{170}Dy.



BUT Mass scaled moment
of inertia suggest largest
Deformation is at N=98 (^{164}Dy).

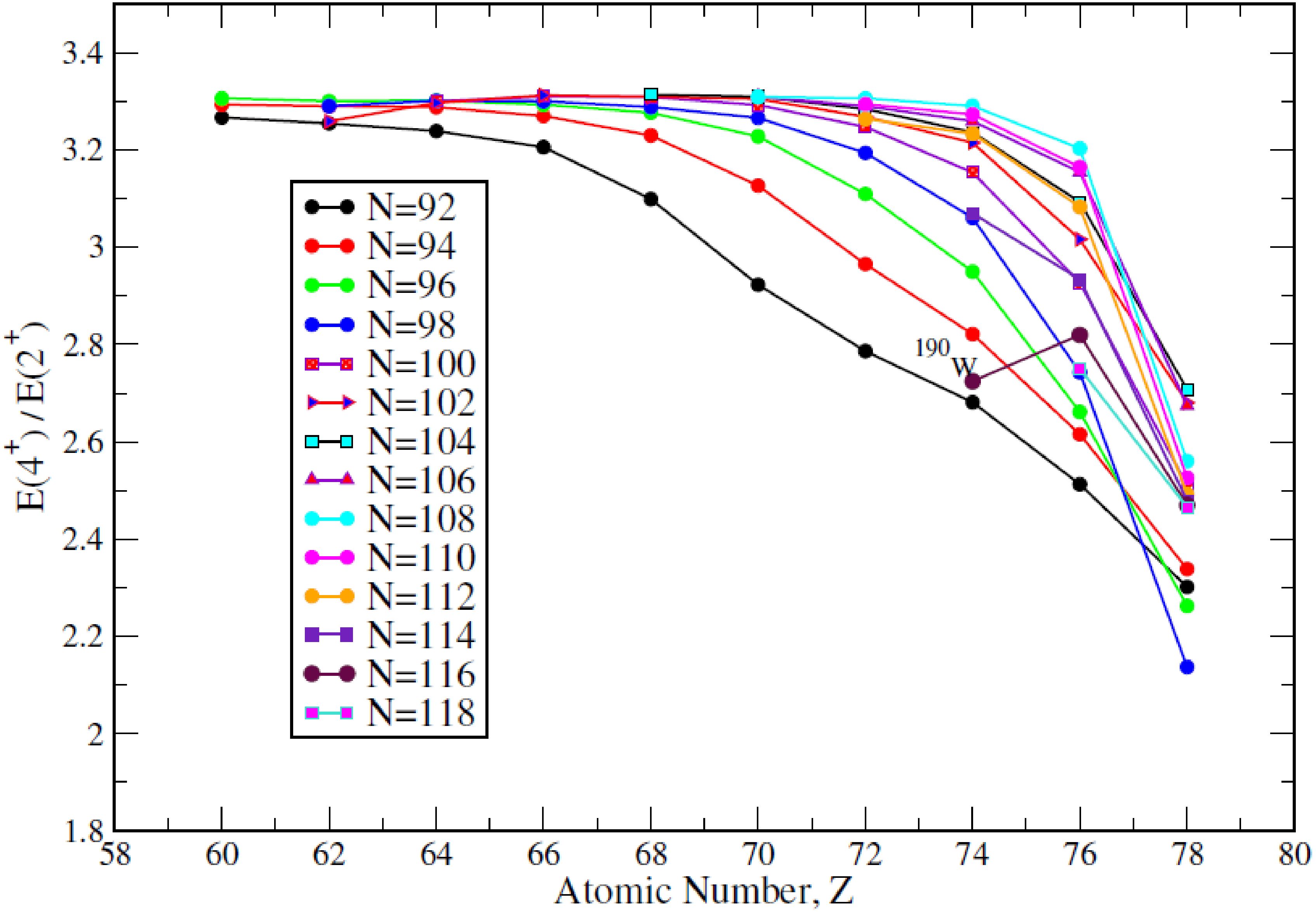


Stiffness and ‘small rotation stretching’?
(energy systematics suggest stiffest at N=104)

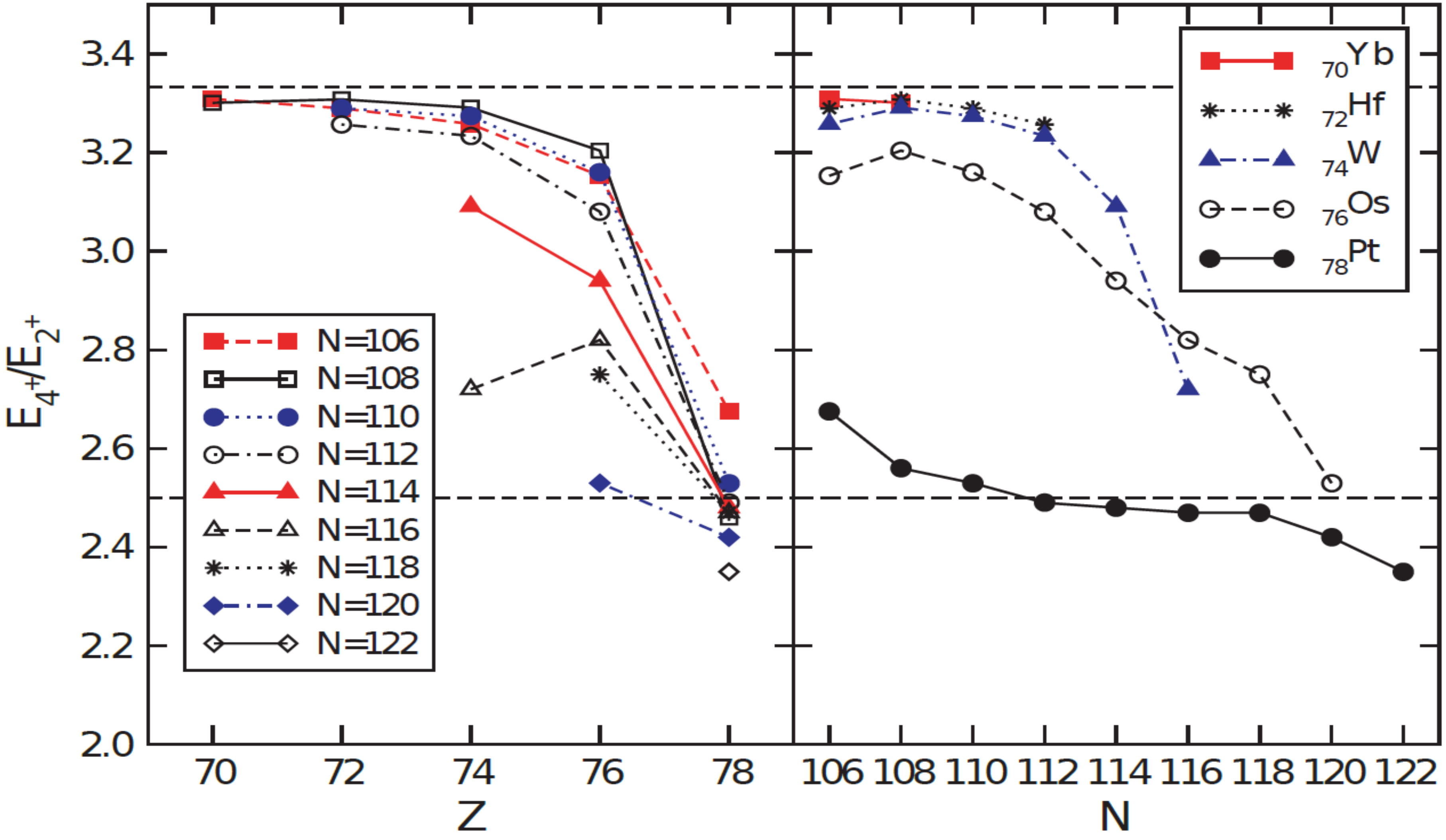


Going soft ?

R(4/2) systematics drop away from the rotational limit as ^{208}Pb is approached.



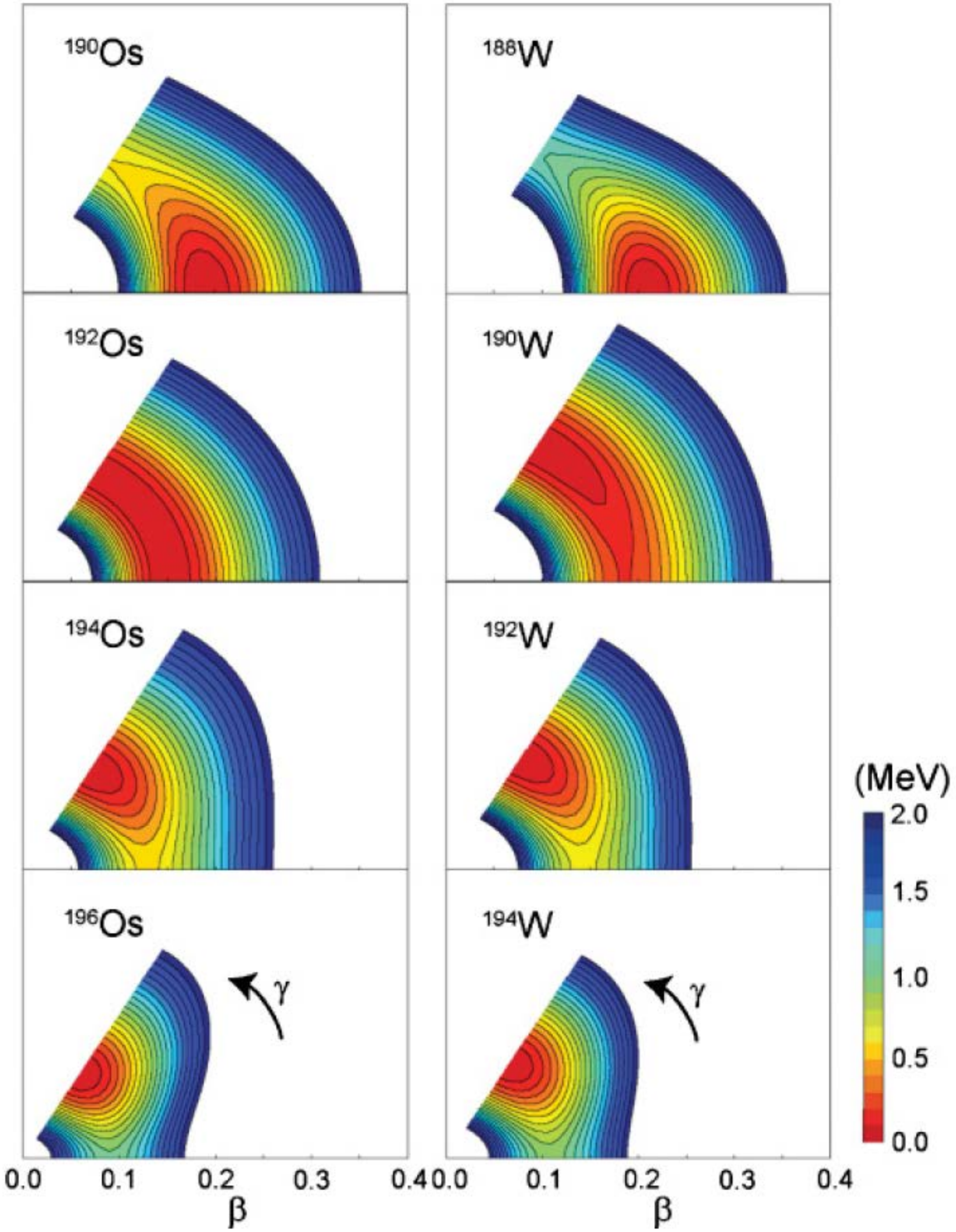
Shape Evolution at A~190

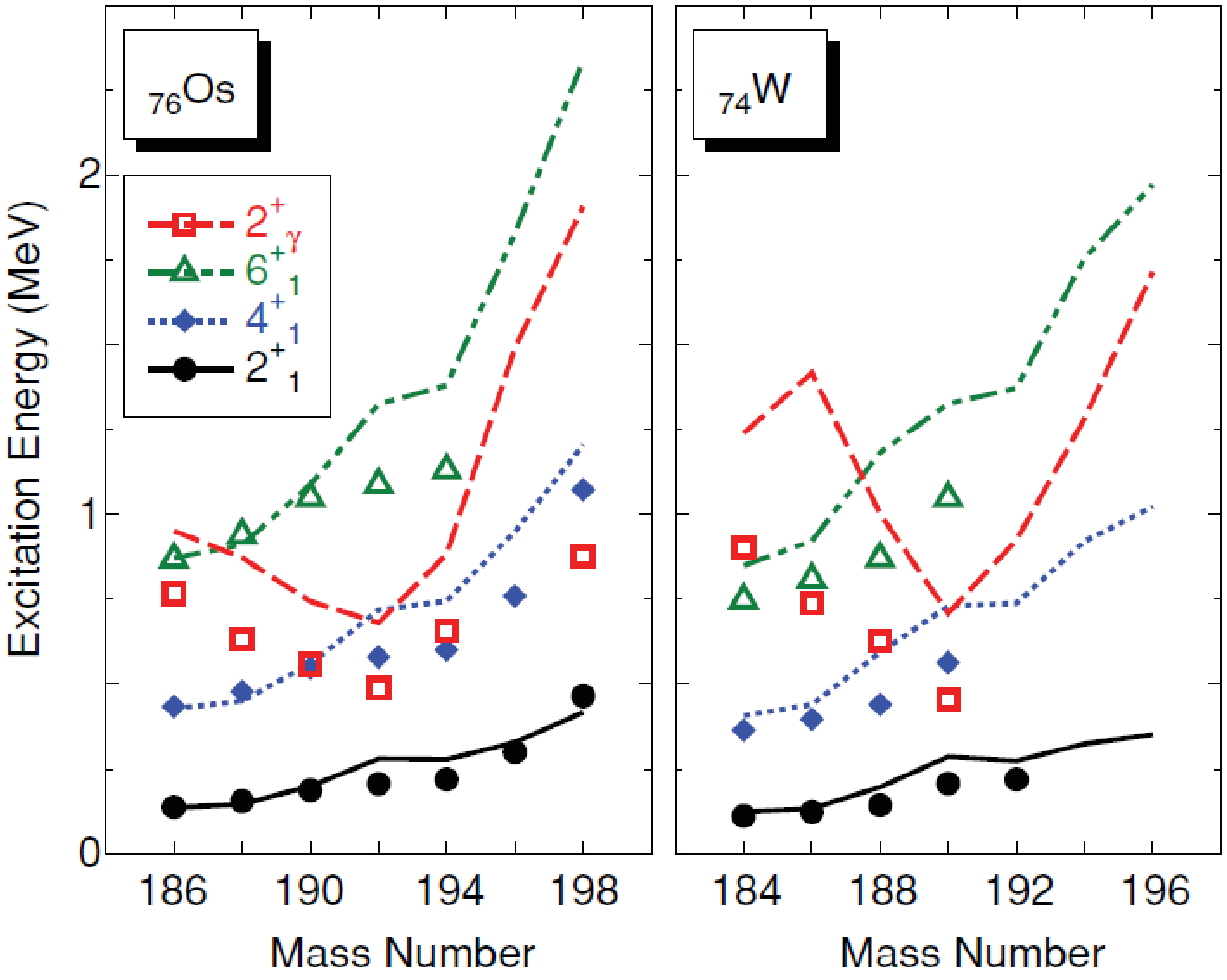


- Evolution of collectivity away from ^{208}Pb
- Prolate-oblate shape transition toward N=126

Zs. Podolyák et al. / Physics Letters B 491 (2000) 225–231

W-Pt shape evolution across N~114,6





Spectroscopic calculations of the low-lying structure in exotic Os and W isotopes

K. Nomura,[1] T. Otsuka,[1,2,3] R. Rodríguez-Guzmán,[4] L. M. Robledo,[5] P. Sarriguren,[4] P. H. Regan,[6]
P. D. Stevenson,[6] and Zs. Podolyák[6]

Spectroscopy calculations using IBM projections from Gogny D1S EDF

PHYSICAL REVIEW C **80**, 064308 (2009)

β^--delayed spectroscopy of neutron-rich tantalum nuclei: Shape evolution in neutron-rich tungsten isotopes

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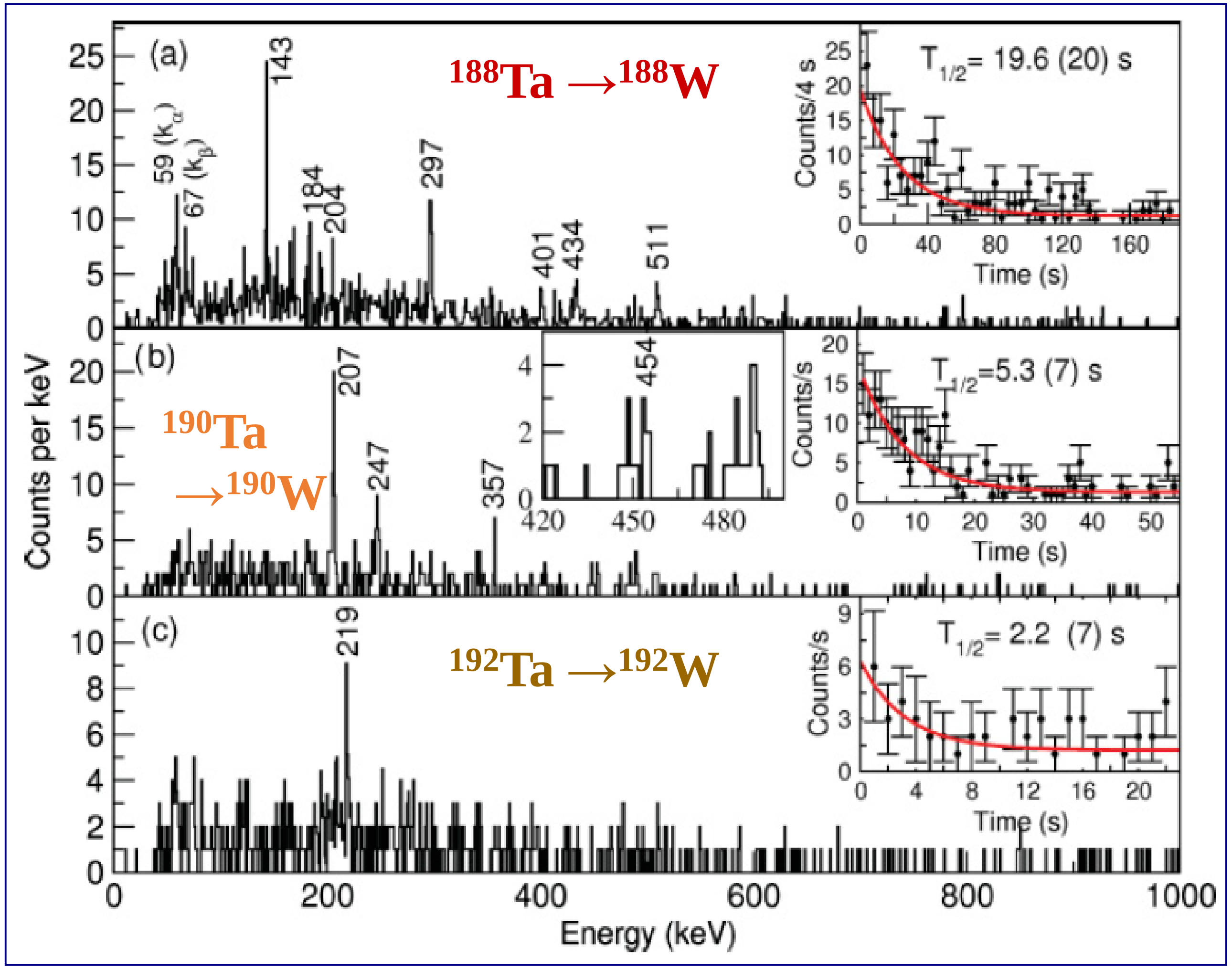
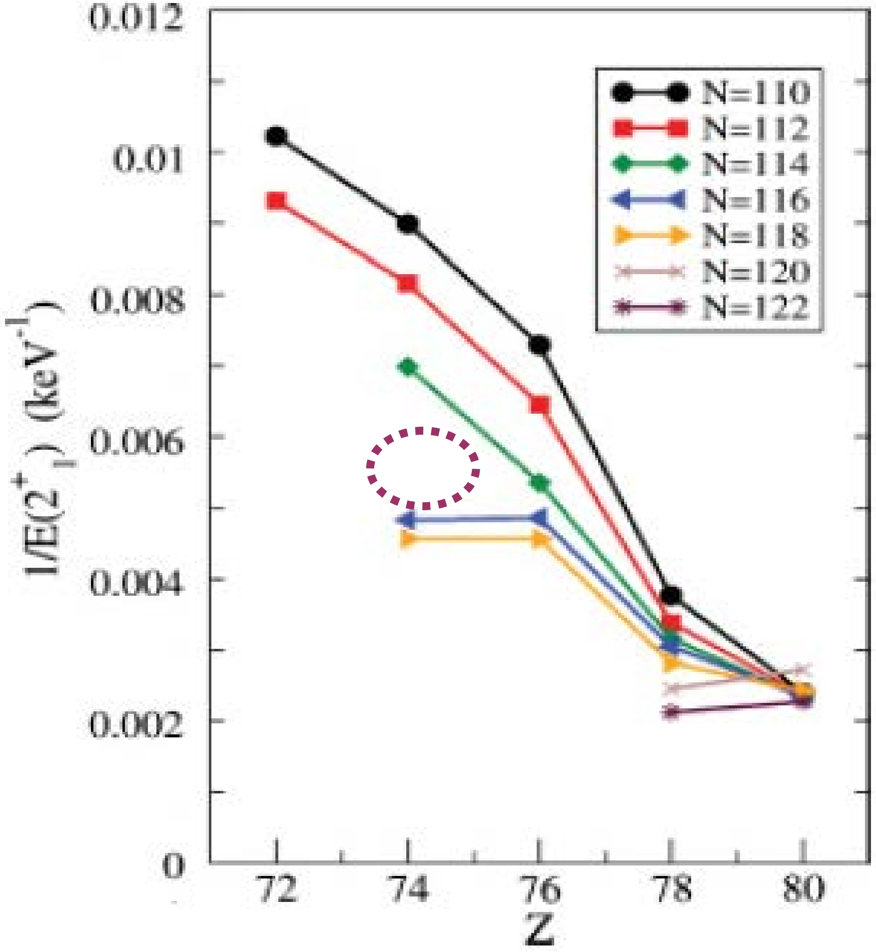
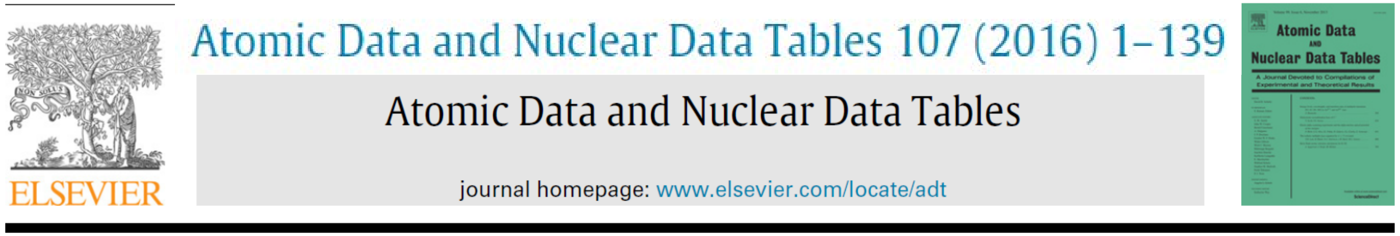




What the yrast $I^{\pi}=2^{+}$ lifetime can give you ?



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Atomic Data and Nuclear Data Tables

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Tables of E2 transition probabilities from the first 2^{+} states in even–even nuclei

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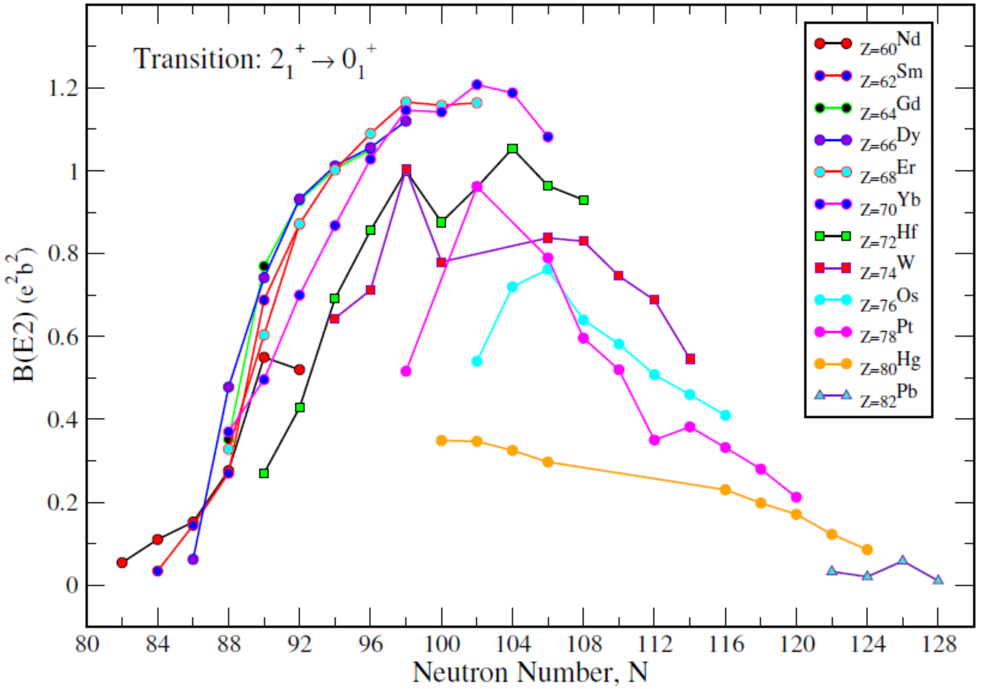


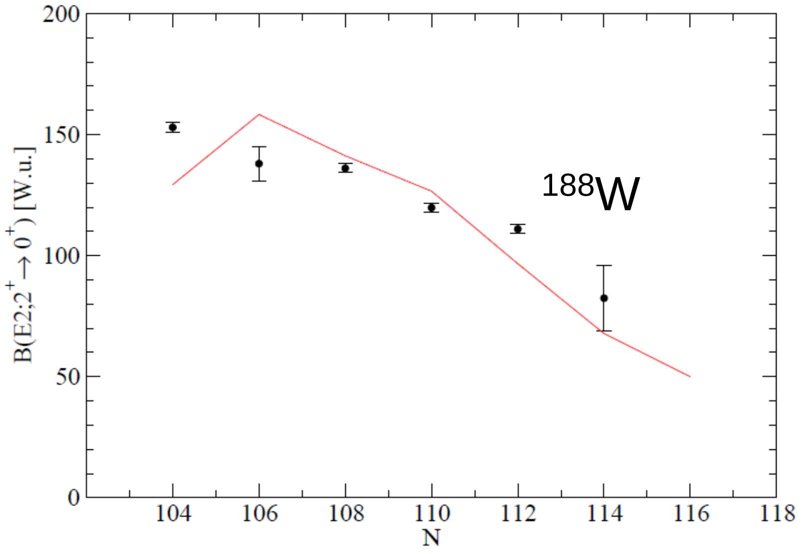
The current evaluation represents the recommended values of B(E2)↑ in e^2b^2, mean lifetimes (τ) in picoseconds (ps) and deformation parameters (β_2) for the first 2^+ states in $Z = 2$–104, even N nuclei. These quantities are mutually related:

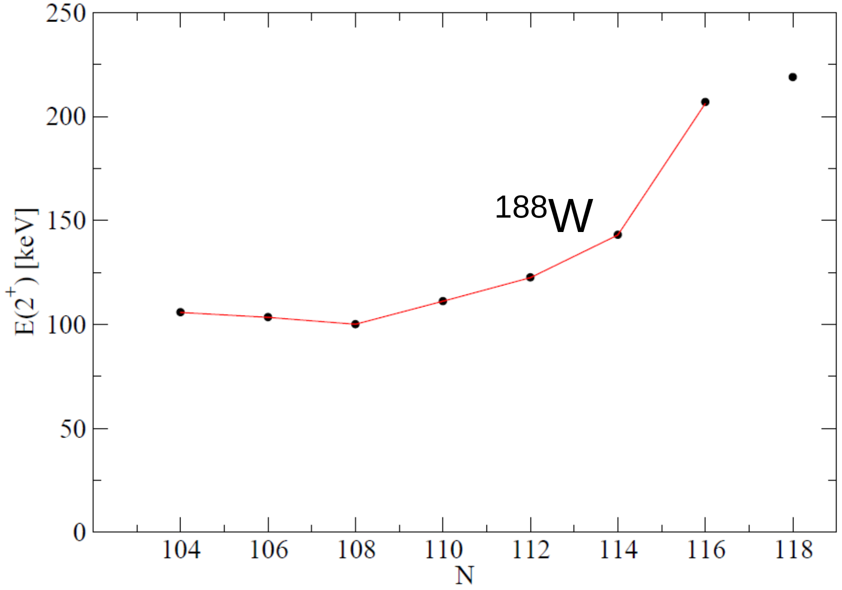
$$\tau = 40.81 \times 10^{13} E_{\gamma}^{-5} [B(E2) \uparrow / e^2 b^2]^{-1} (1 + \alpha_T)^{-1} \qquad (1)$$

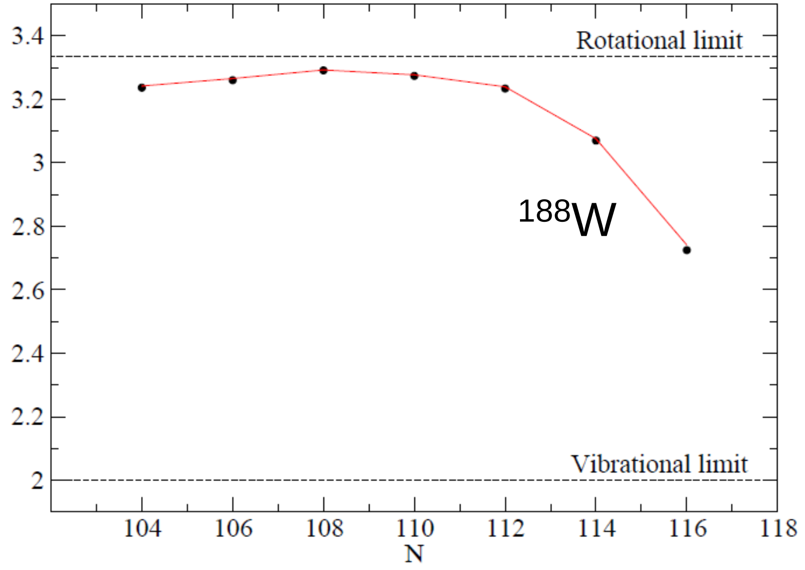
$$\beta_2 = (4\pi / 3ZR_0^2)[B(E2) \uparrow / e^2]^{1/2}, \qquad (2)$$

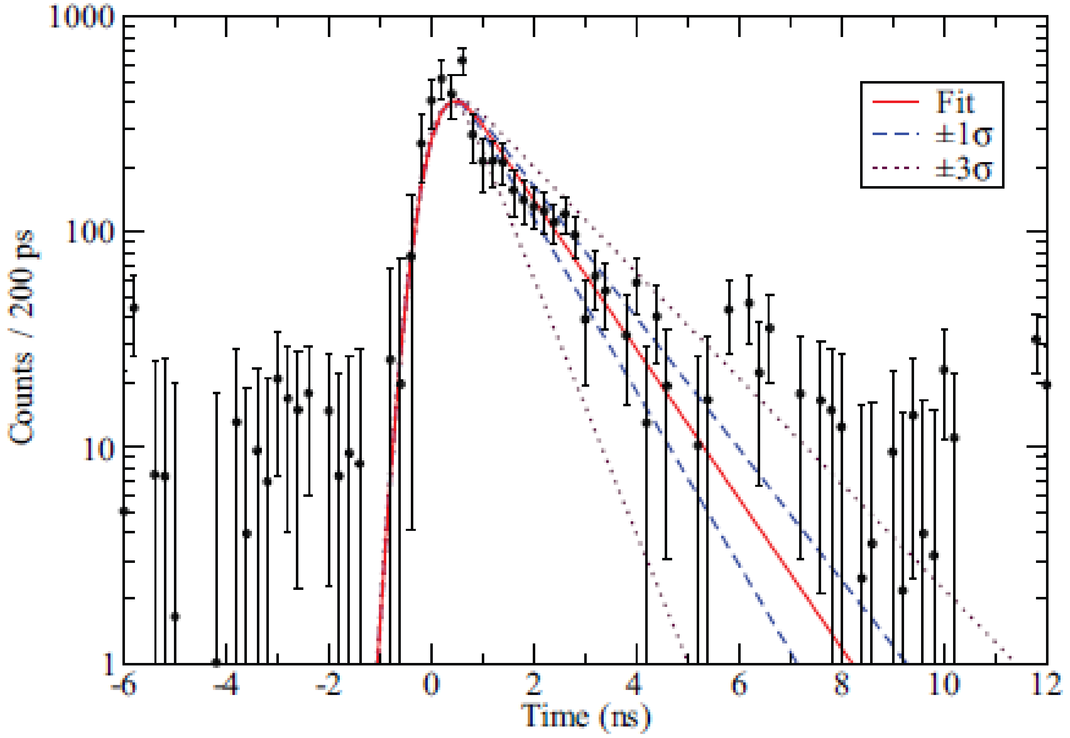
where E_γ and α_T are the γ-ray energy in keV and the total conversion electron coefficient, respectively, and $R_0^2 = (1.2 \times 10^{-13} A^{1/3}\ \mathrm{cm})^2$. To introduce an additional measure of collectivity for nuclear excitations, Weisskopf units (W.u.) are added. Transition quadrupole moment values Q_0 in barns (b) are not included in the current evaluation, however can be deduced from the presented work

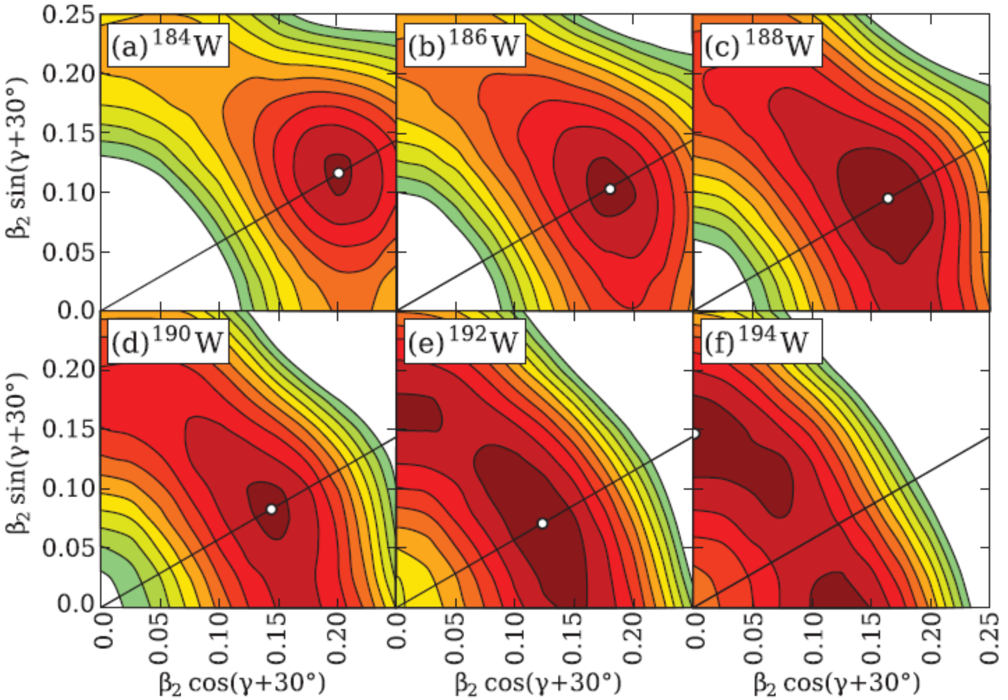
$$Q_0 = [16\pi B(E2) \uparrow / 5e^2]^{1/2}. \qquad (3)$$











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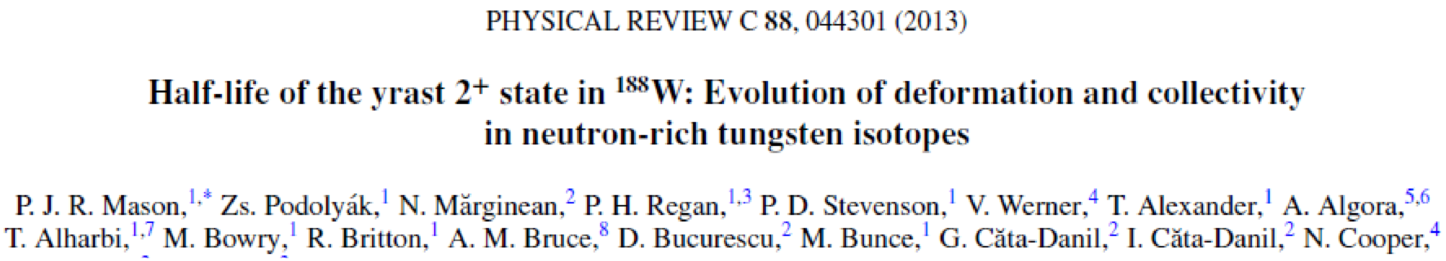
^{188,190,192}W



PHYSICAL REVIEW C 88, 044301 (2013)

Half-life of the yrast 2^+ state in ^{188}W: Evolution of deformation and collectivity in neutron-rich tungsten isotopes

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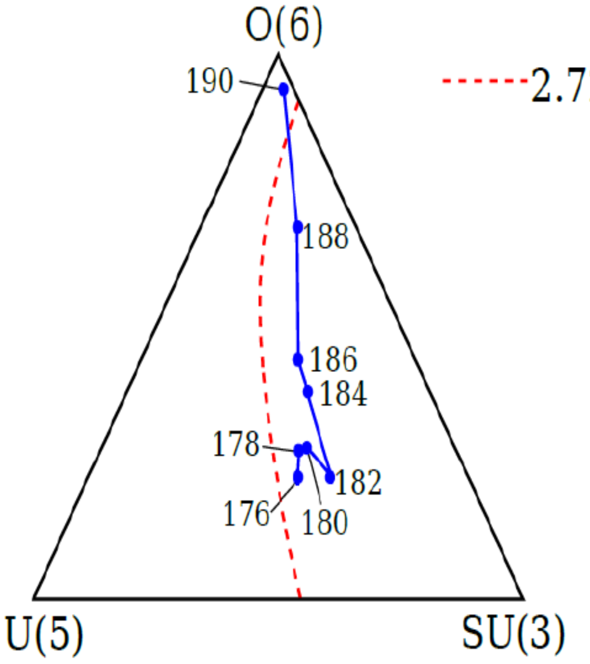
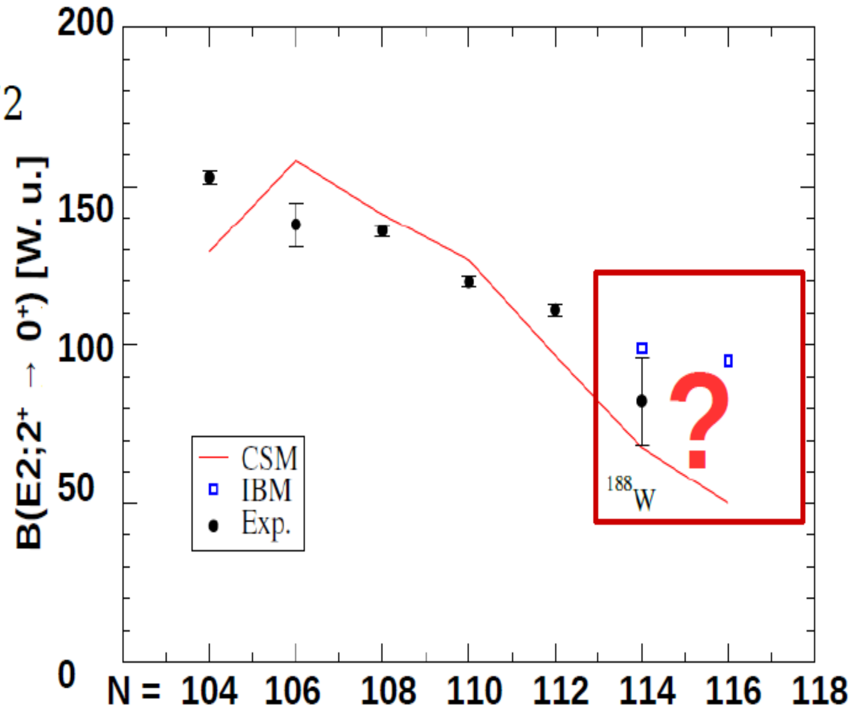
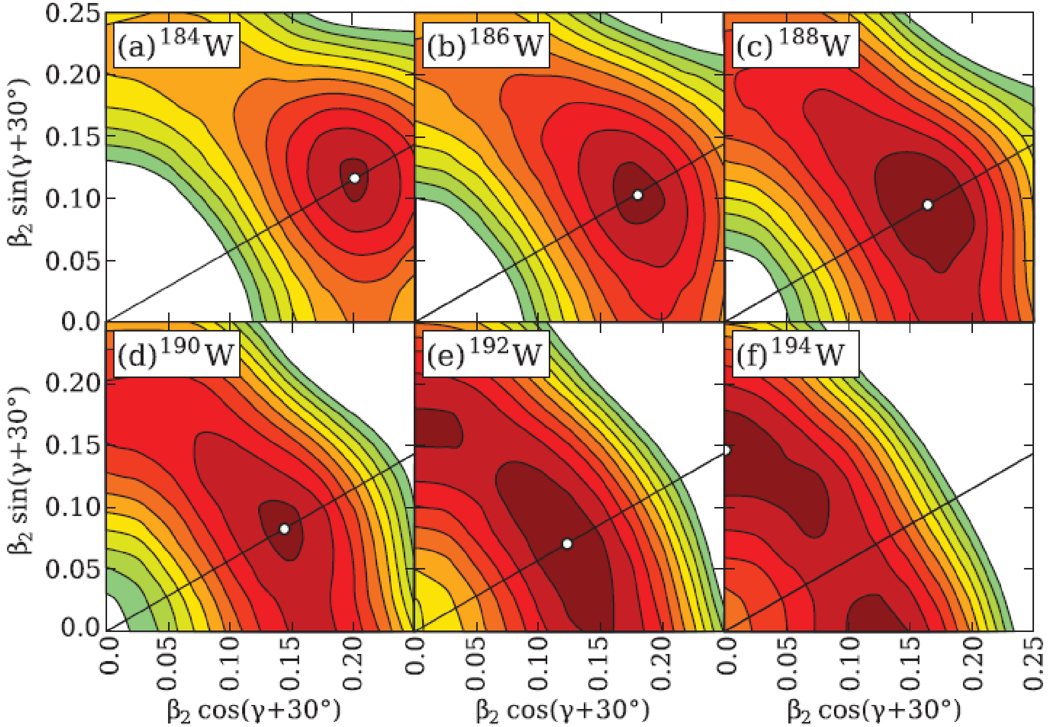


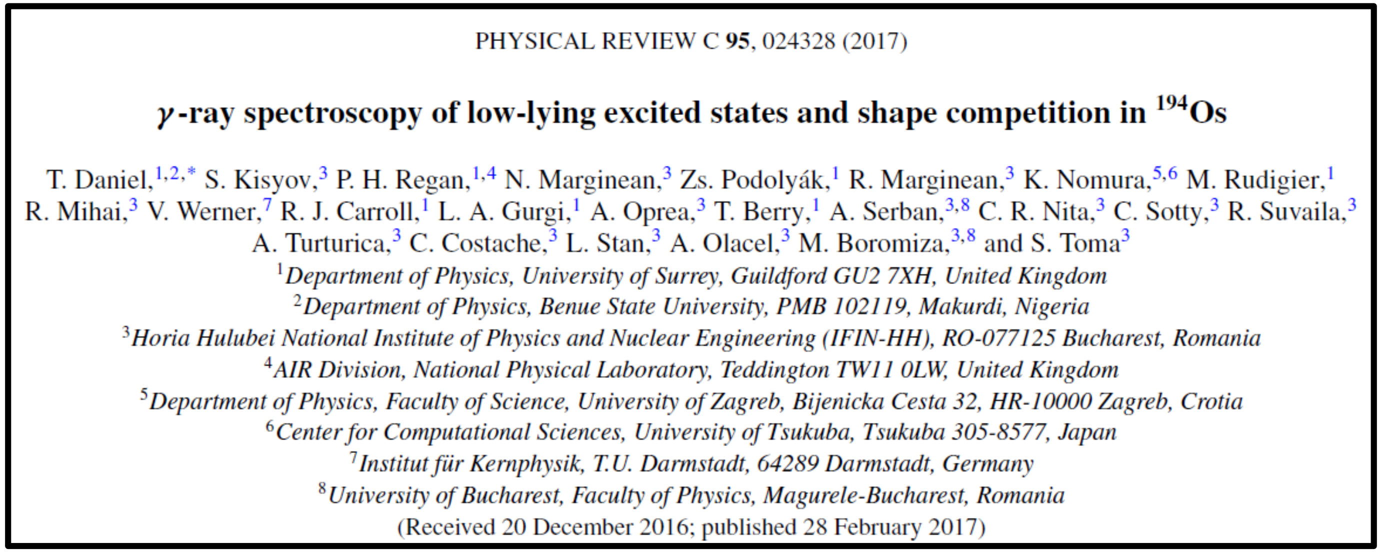




- Reduction of $R_{4/2}$ at N=114 structural change toward γ-soft / IBM- O(6) symmetry.
- Possible (deformed / triaxial) sub-shell closure at N=116
- $B(E2;2^+_1 \rightarrow 0^+_1)$ values give (evolution of) transitional quadrupole moments with N.

^{194}Os spectroscopy and lifetimes

^{192}Os(^{18}O,^{16}O)^{194}Os (2 neutron transfer reaction);
E_{BEAM}=80 MeV on a 20 mg/cm^2 ^{192}Os target,
I~20 pnA over 9 days of beam time.



PHYSICAL REVIEW C **95**, 024328 (2017)

γ-ray spectroscopy of low-lying excited states and shape competition in ^{194}Os

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(Received 20 December 2016; published 28 February 2017)

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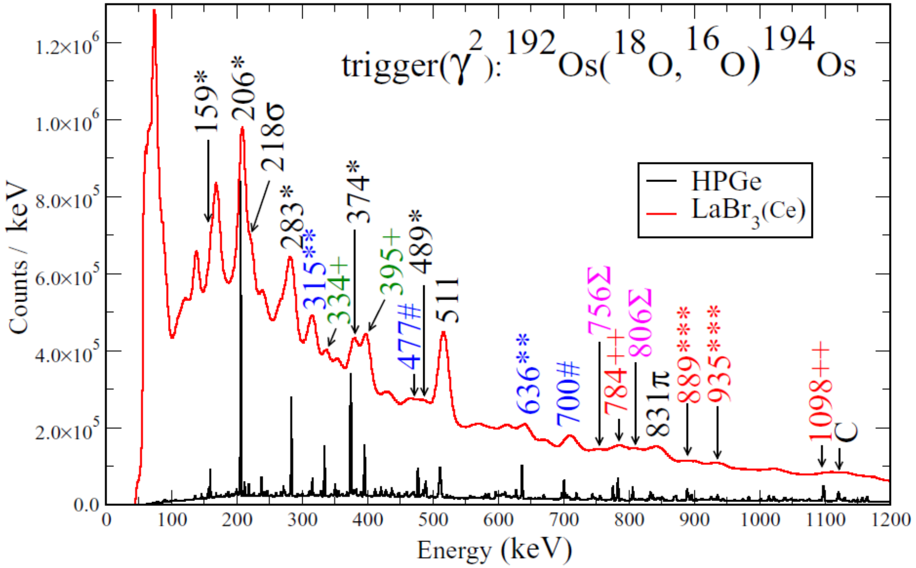
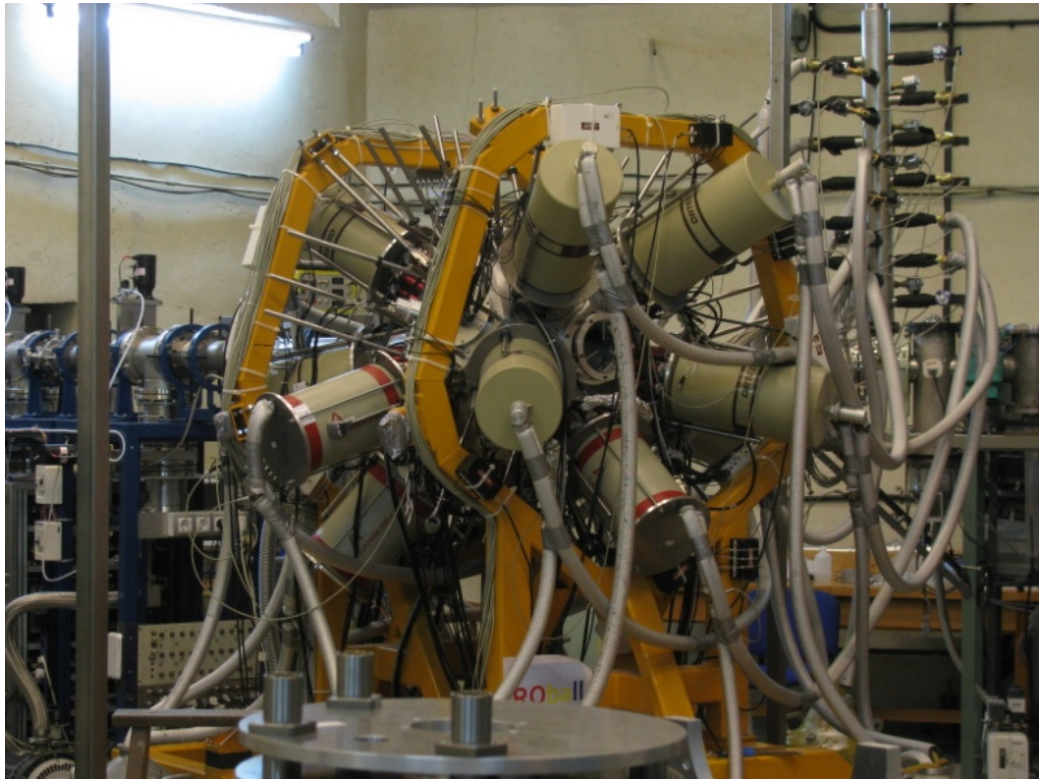
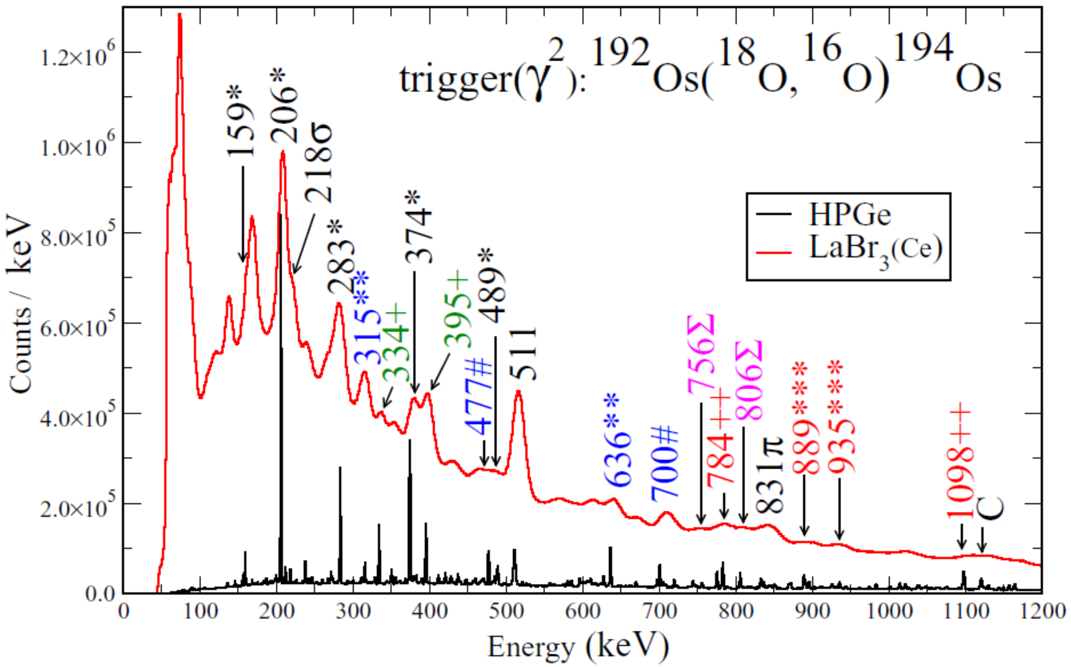


FIG. 1. Total projections of the HPGe and LaBr$_3$(Ce) detectors with double prompt coincidence condition applied. Peaks identified with an asterisk are associated with ^{192}Os, $\sigma = {}^{194}$Os, $++ = {}^{50}$Cr, $\pi = {}^{51}$Mn, $\Sigma = {}^{54}$Fe, $\# = {}^{206}$Po, $+ = {}^{205}$Po, $*** = {}^{67}$Ga and C = contamination.





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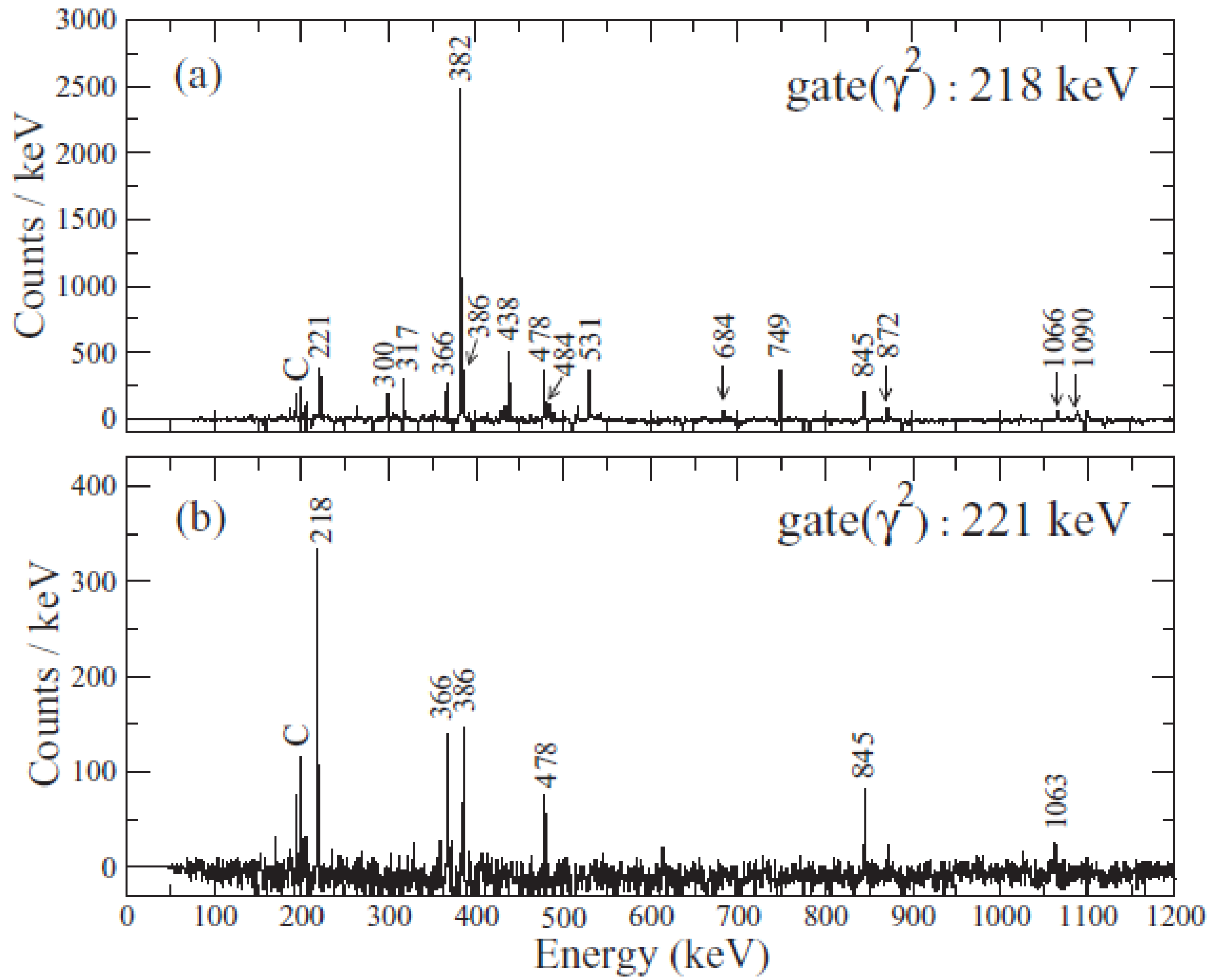


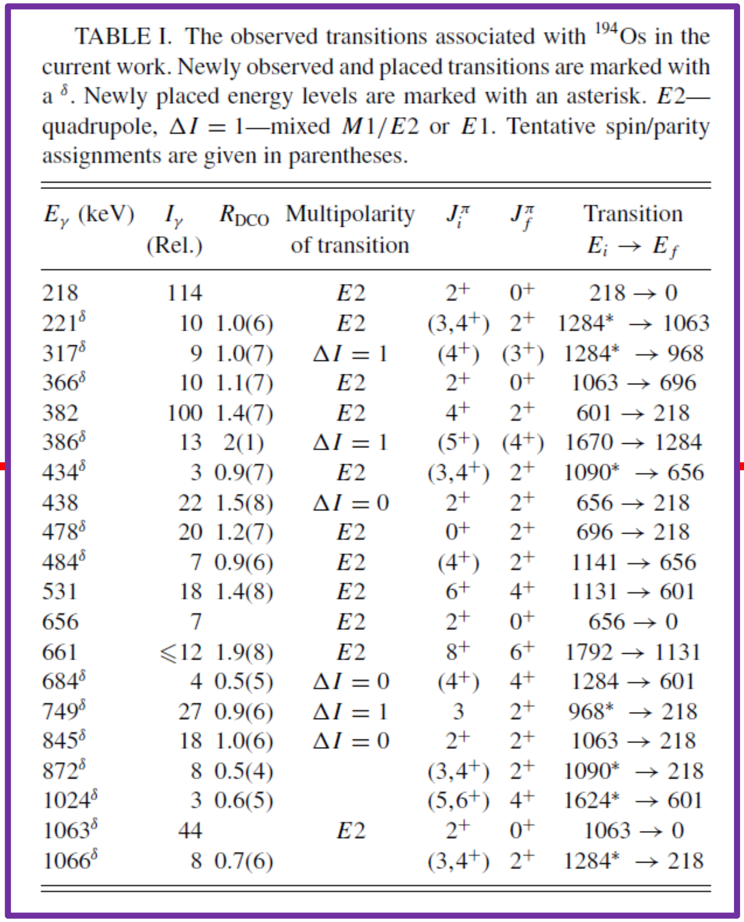
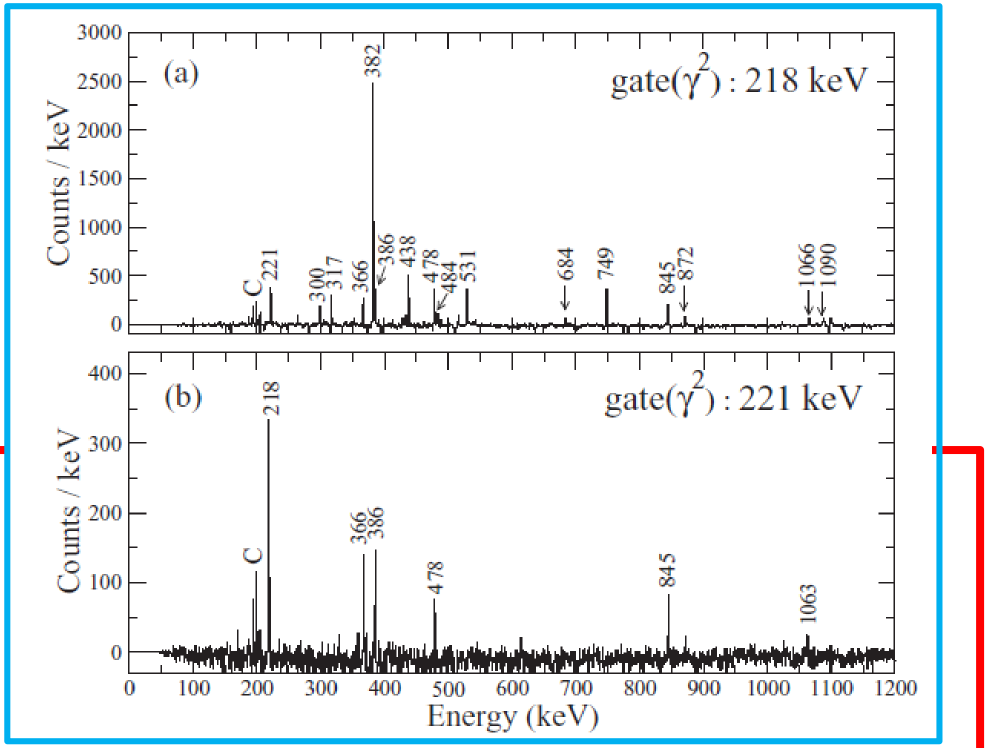
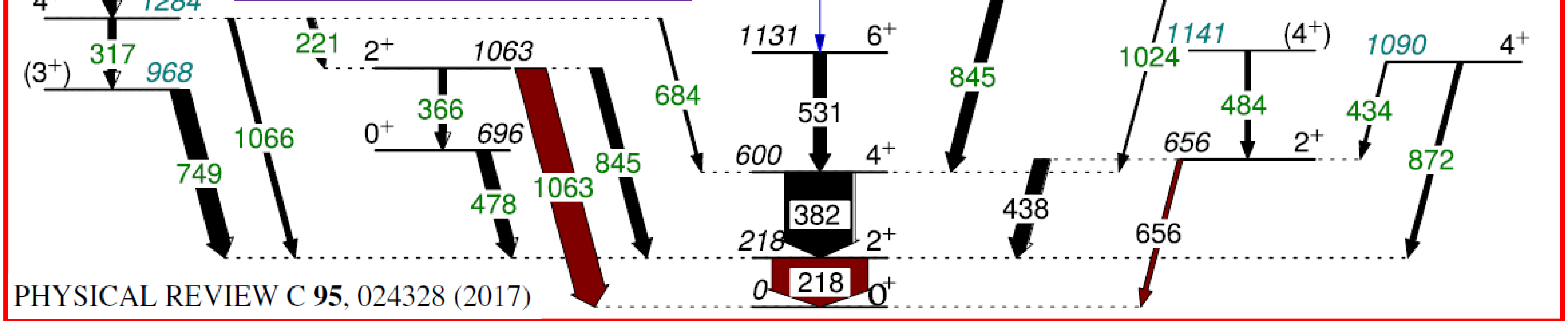


TABLE I. The observed transitions associated with ^{194}Os in the current work. Newly observed and placed transitions are marked with a $^{\delta}$. Newly placed energy levels are marked with an asterisk. $E2$—quadrupole, $\Delta I = 1$—mixed $M1/E2$ or $E1$. Tentative spin/parity assignments are given in parentheses.

E_γ (keV)	I_γ (Rel.)	R_{DCO}	Multipolarity of transition	J_i^π	J_f^π	Transition $E_i \to E_f$
218	114		$E2$	2^+	0^+	218 → 0
221$^{\delta}$	10	1.0(6)	$E2$	$(3,4^+)$	2^+	1284* → 1063
317$^{\delta}$	9	1.0(7)	$\Delta I = 1$	(4^+)	(3^+)	1284* → 968
366$^{\delta}$	10	1.1(7)	$E2$	2^+	0^+	1063 → 696
382	100	1.4(7)	$E2$	4^+	2^+	601 → 218
386$^{\delta}$	13	2(1)	$\Delta I = 1$	(5^+)	(4^+)	1670 → 1284
434$^{\delta}$	3	0.9(7)	$E2$	$(3,4^+)$	2^+	1090* → 656
438	22	1.5(8)	$\Delta I = 0$	2^+	2^+	656 → 218
478$^{\delta}$	20	1.2(7)	$E2$	0^+	2^+	696 → 218
484$^{\delta}$	7	0.9(6)	$E2$	(4^+)	2^+	1141 → 656
531	18	1.4(8)	$E2$	6^+	4^+	1131 → 601
656	7		$E2$	2^+	0^+	656 → 0
661	⩽12	1.9(8)	$E2$	8^+	6^+	1792 → 1131
684$^{\delta}$	4	0.5(5)	$\Delta I = 0$	(4^+)	4^+	1284 → 601
749$^{\delta}$	27	0.9(6)	$\Delta I = 1$	3	2^+	968* → 218
845$^{\delta}$	18	1.0(6)	$\Delta I = 0$	2^+	2^+	1063 → 218
872$^{\delta}$	8	0.5(4)		$(3,4^+)$	2^+	1090* → 218
1024$^{\delta}$	3	0.6(5)		$(5,6^+)$	4^+	1624* → 601
1063$^{\delta}$	44		$E2$	2^+	0^+	1063 → 0
1066$^{\delta}$	8	0.7(6)		$(3,4^+)$	2^+	1284* → 218



^{194}Os



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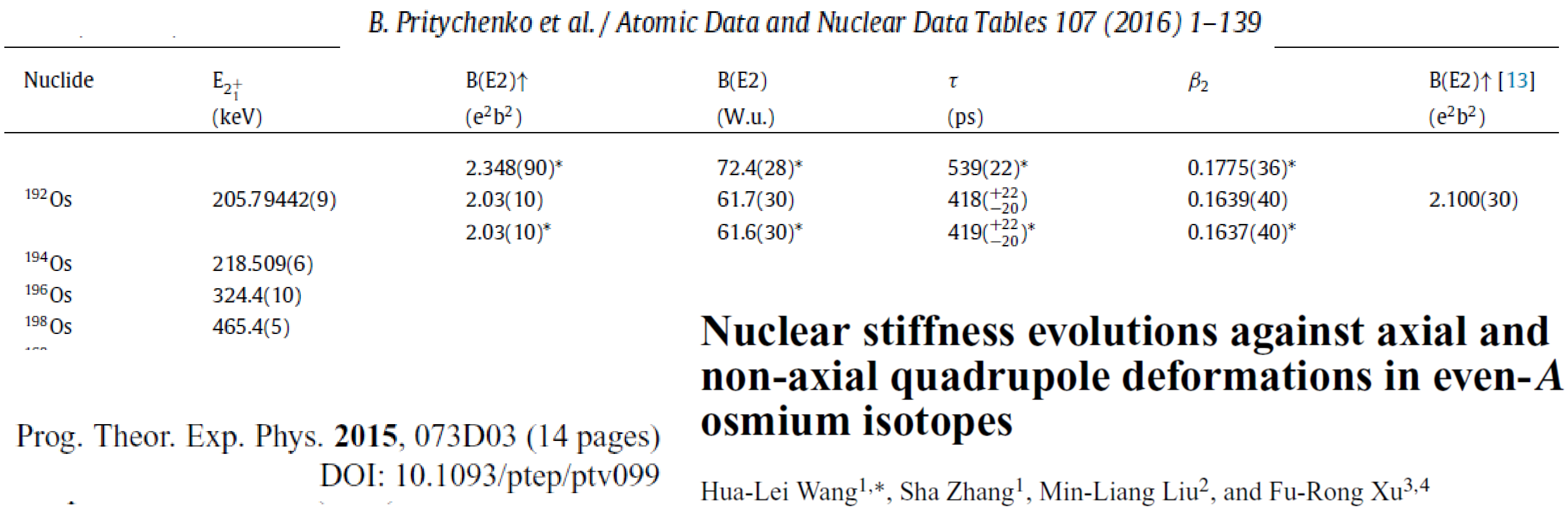
Current state of the art and predictions?



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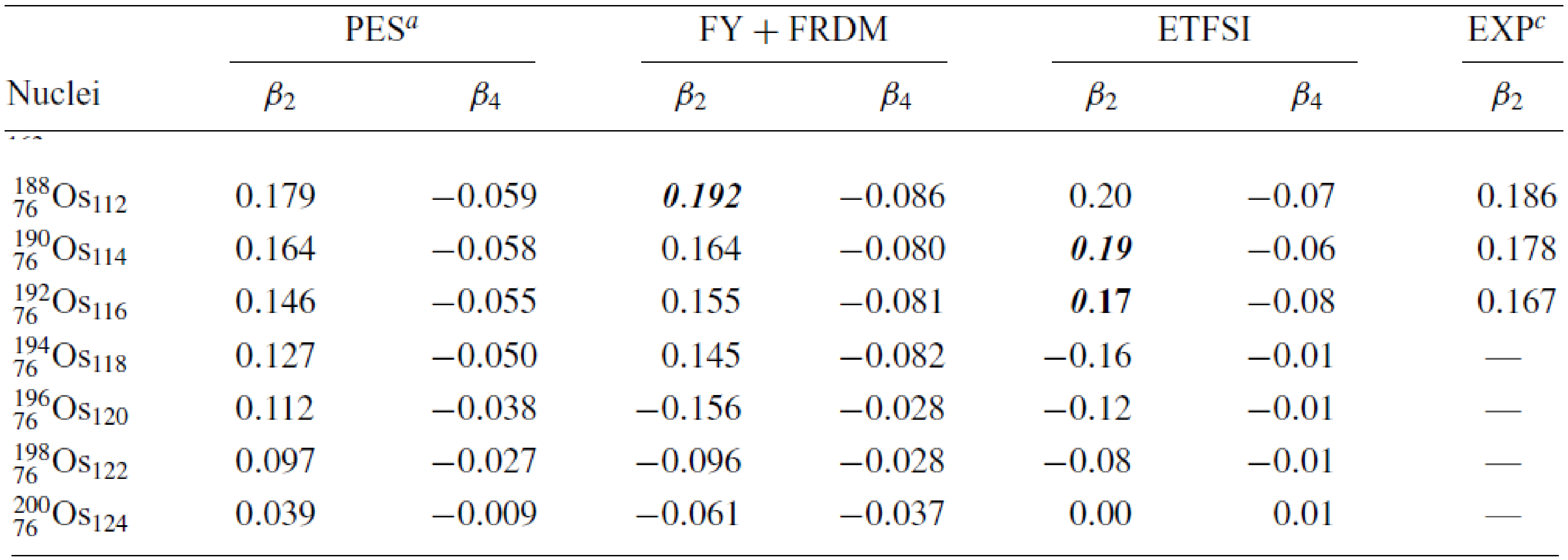
Nuclide	$E_{2_1^+}$ (keV)	B(E2)↑ (e^2b^2)	B(E2) (W.u.)	τ (ps)	β_2	B(E2)↑ [13] (e^2b^2)
^{192}Os	205.79442(9)	2.348(90)*	72.4(28)*	539(22)*	0.1775(36)*	2.100(30)
		2.03(10)	61.7(30)	$418(^{+22}_{-20})$	0.1639(40)	
		2.03(10)*	61.6(30)*	$419(^{+22}_{-20})$*	0.1637(40)*	
^{194}Os	218.509(6)					
^{196}Os	324.4(10)					
^{198}Os	465.4(5)					

Prog. Theor. Exp. Phys. **2015**, 073D03 (14 pages)
DOI: 10.1093/ptep/ptv099

Nuclear stiffness evolutions against axial and non-axial quadrupole deformations in even-*A* osmium isotopes

Hua-Lei Wang[1,*], Sha Zhang[1], Min-Liang Liu[2], and Fu-Rong Xu[3,4]



	PES^a		FY + FRDM		ETFSI		EXP^c
Nuclei	β_2	β_4	β_2	β_4	β_2	β_4	β_2
$^{188}_{76}\mathrm{Os}_{112}$	0.179	−0.059	***0.192***	−0.086	0.20	−0.07	0.186
$^{190}_{76}\mathrm{Os}_{114}$	0.164	−0.058	0.164	−0.080	***0.19***	−0.06	0.178
$^{192}_{76}\mathrm{Os}_{116}$	0.146	−0.055	0.155	−0.081	***0.17***	−0.08	0.167
$^{194}_{76}\mathrm{Os}_{118}$	0.127	−0.050	0.145	−0.082	−0.16	−0.01	—
$^{196}_{76}\mathrm{Os}_{120}$	0.112	−0.038	−0.156	−0.028	−0.12	−0.01	—
$^{198}_{76}\mathrm{Os}_{122}$	0.097	−0.027	−0.096	−0.028	−0.08	−0.01	—
$^{200}_{76}\mathrm{Os}_{124}$	0.039	−0.009	−0.061	−0.037	0.00	0.01	—

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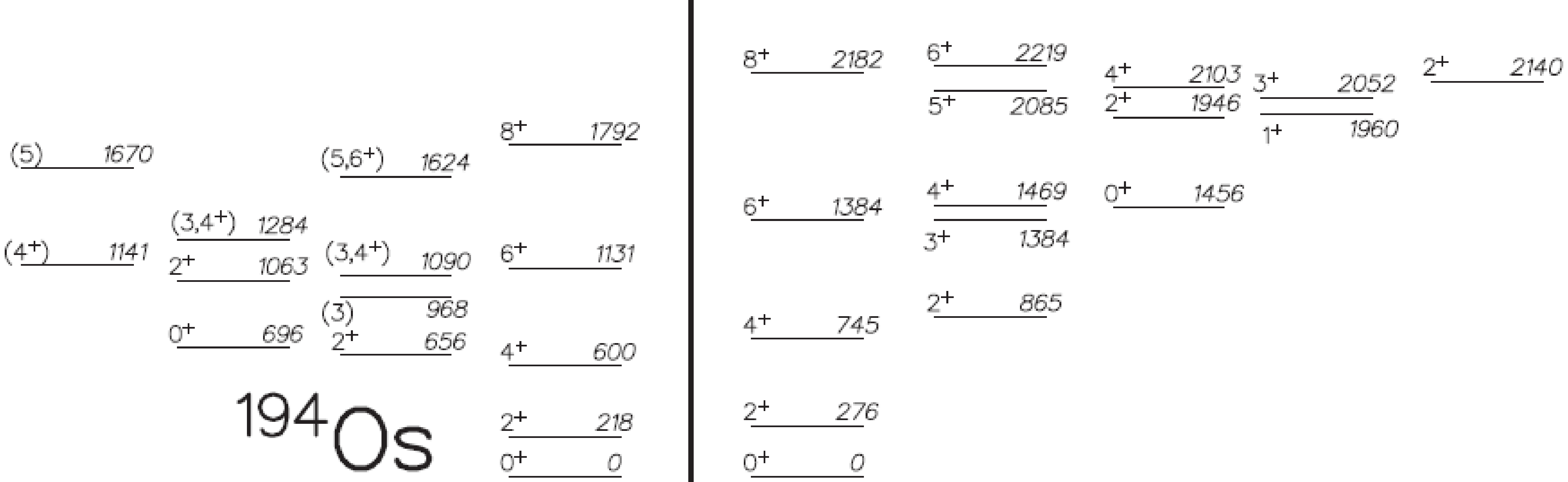

Experimental

IBM calculations (Nomura et al.,)

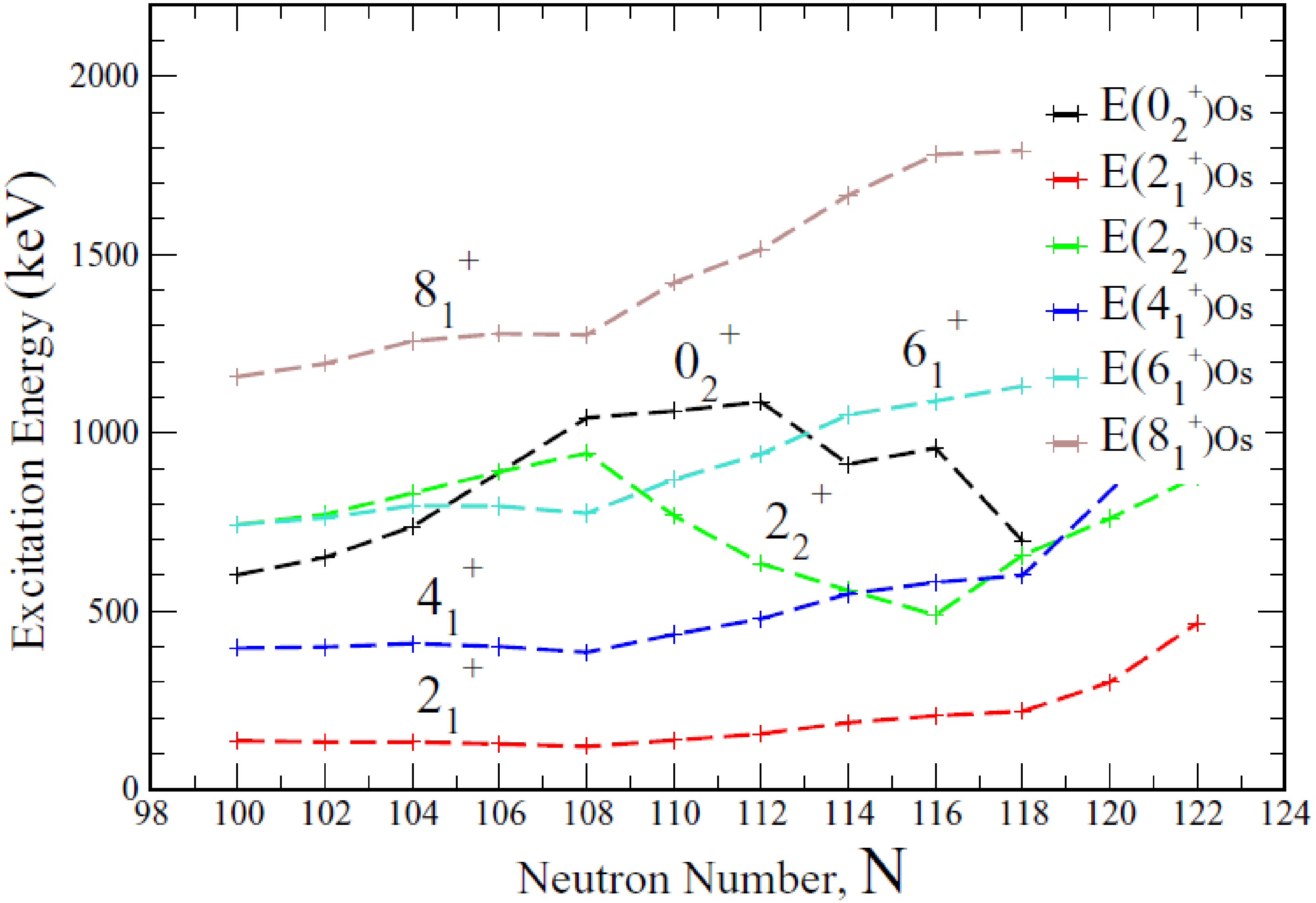

FIG. 8. Systematics of the ground state band $E(2_1^+)$, $E(4_1^+), E(6_1^+), E(8_1^+)$ and $E(0_2^+), E(2_2^+)$ for Os isotopes with $N =$ 100–122.

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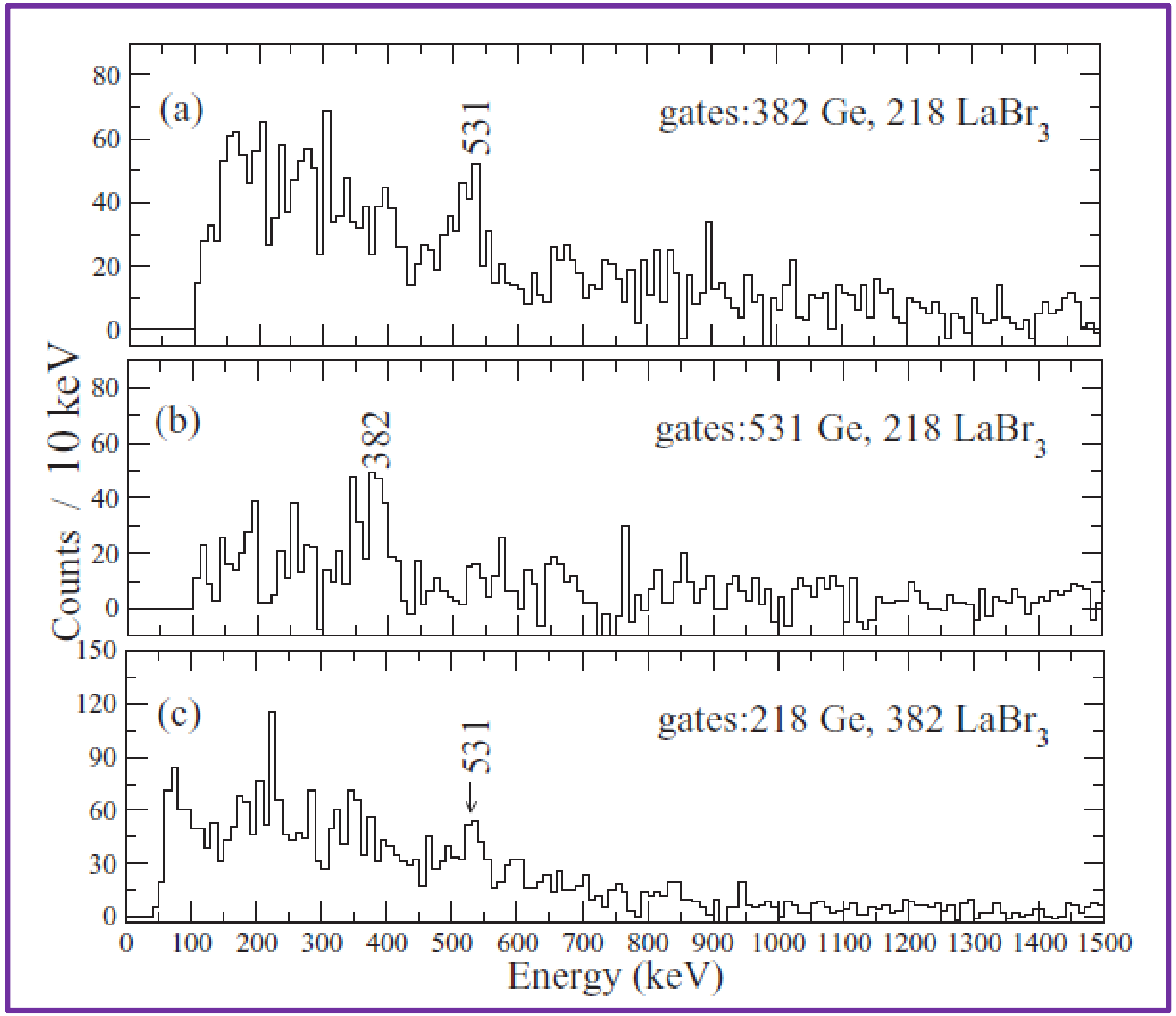
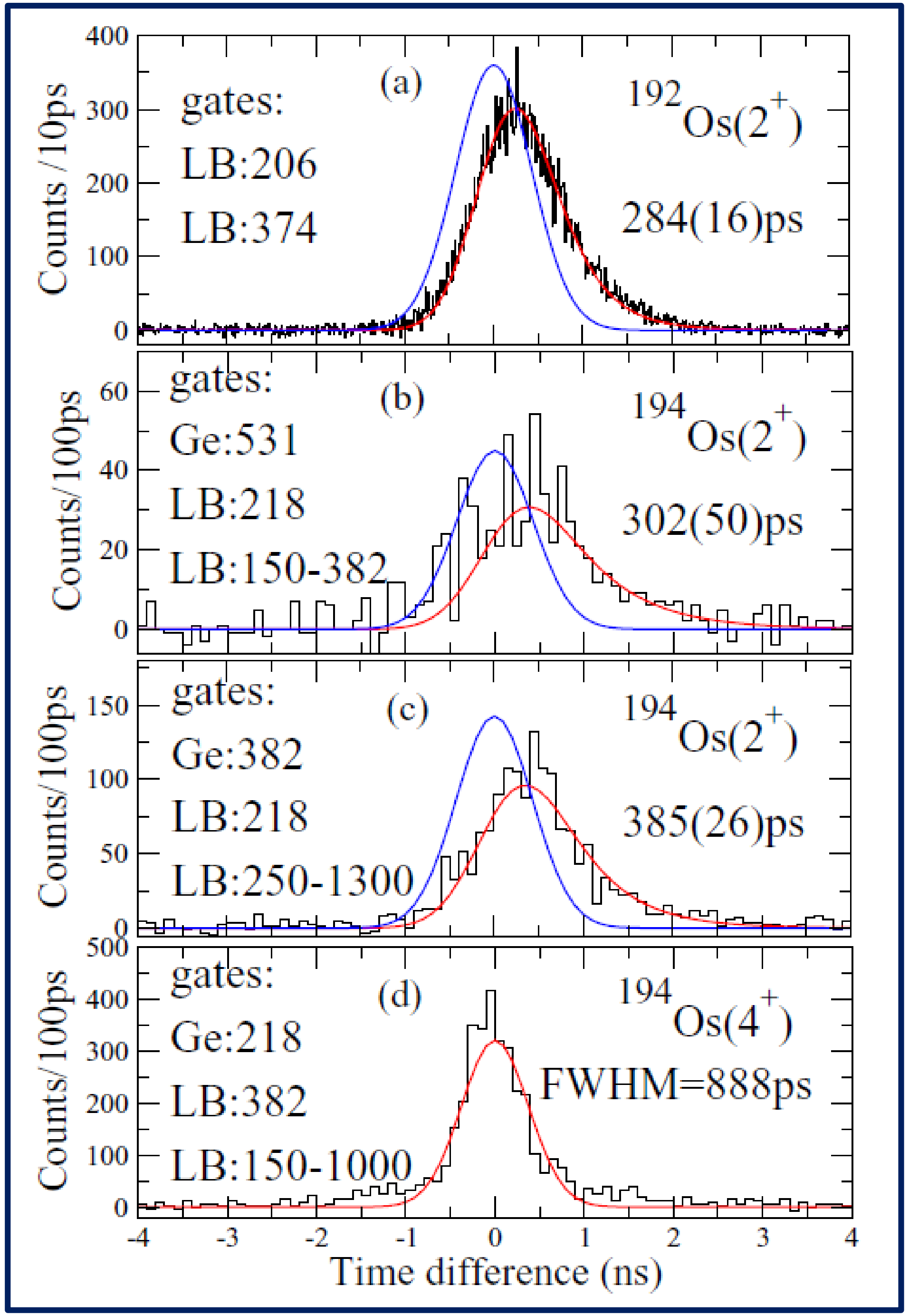
Include Compton scattered signals for ^{194}Os lifetime measurements.





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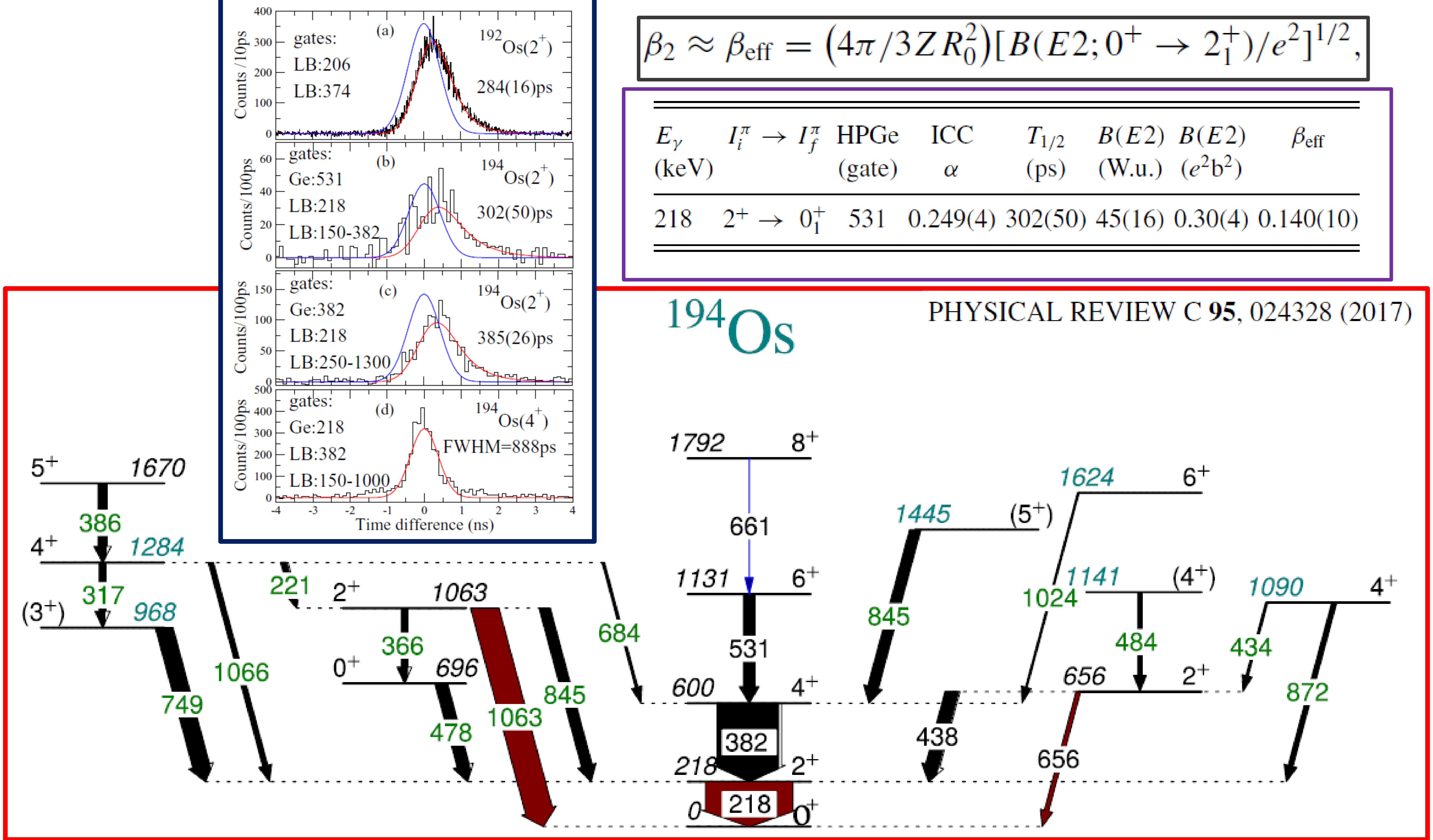
$$\beta_2 \approx \beta_{\mathrm{eff}} = (4\pi/3ZR_0^2)[B(E2;0^+ \rightarrow 2_1^+)/e^2]^{1/2},$$

E_γ (keV)	$I_i^\pi \rightarrow I_f^\pi$	HPGe (gate)	ICC α	$T_{1/2}$ (ps)	$B(E2)$ (W.u.)	$B(E2)$ (e^2b^2)	β_{eff}
218	$2^+ \rightarrow 0_1^+$	531	0.249(4)	302(50)	45(16)	0.30(4)	0.140(10)



^{194}Os

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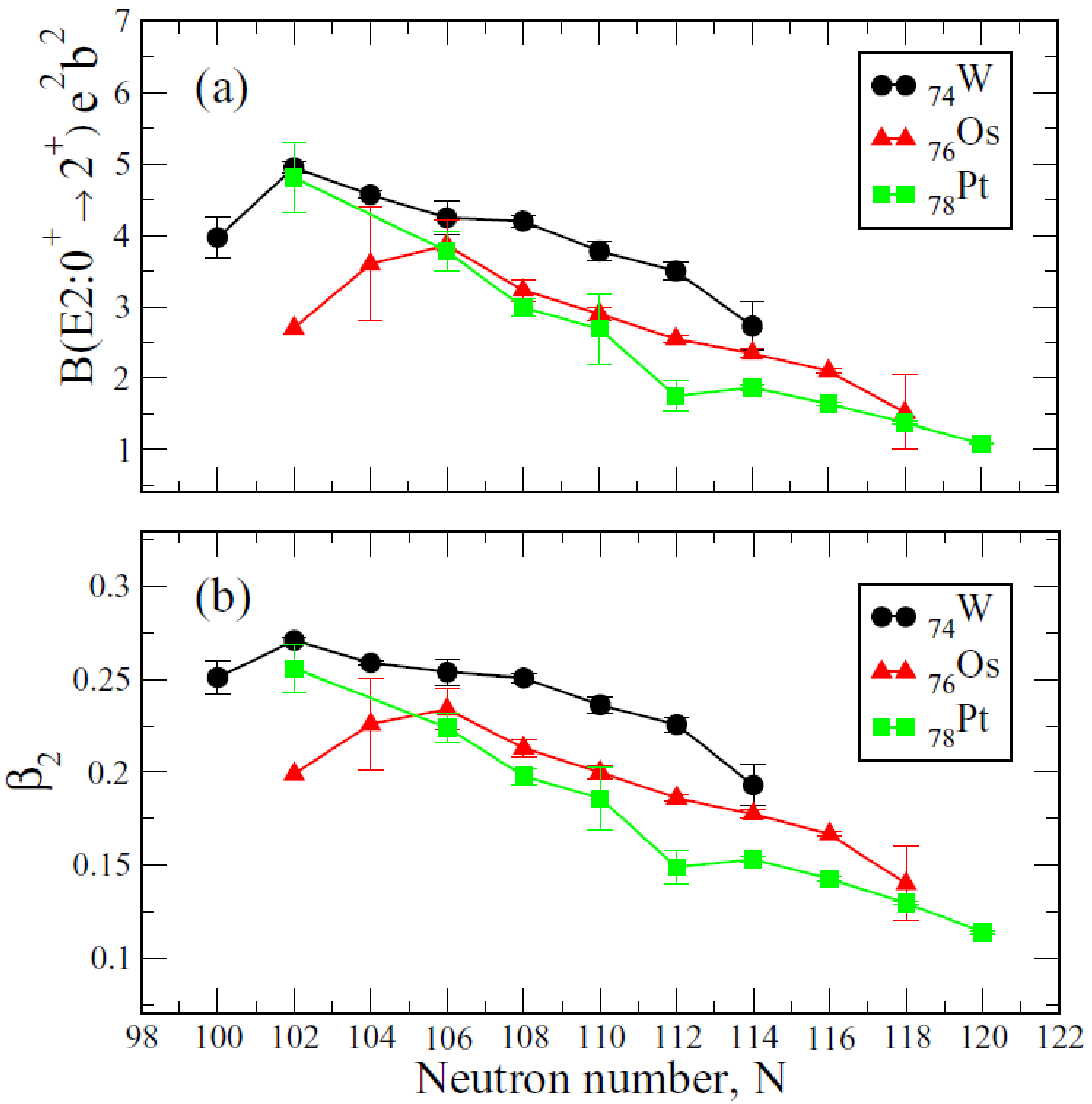

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Summary

- (Deformed) nuclear structure around the double-mid-shell $^{170}Dy_{104}$ now well established.
- GSB structures are 'stiff' and idealised axially symmetric, deformed nuclear rotors.
- Energy systematics are good indicators; lifetimes give additional insights (Q_t)
- Transition quadrupole moments established for 'near triaxial'/gamma-soft ^{188}W and ^{194}Os around N~116 using FAST-TIMING nuclear spectroscopy.

More to come - first NuBALL@Orsay experiment is on lifetimes and isomers in ^{166}Dy end of Nov. 2017.