

The B4/2 anomaly

Observation and theoretical interpretation

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1ο ΠΑΝΕΛΛΗΝΙΟ ΣΥΜΠΟΣΙΟ
ΘΕΩΡΗΤΙΚΗΣ ΠΥΡΗΝΙΚΗΣ ΦΥΣΙΚΗΣ

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΟΝΙΚΗΣ

24-25 ΑΠΡΙΛΙΟΥ 1990

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Δ.Μπονάτσος (ΕΚΕΦΕ "Δημόκριτος")
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Σ.Μάσεν
Χ.Πάνος

indicators of collectivity

$$R_{4/2} = E(4)/E(2)$$

U(5) 2.0	O(6) 2.5	SU(3) 3.33
E(5) 2.20	Z(5) 2.35	X(5) 2.90

$$B_{4/2} = B(E2; 4 \rightarrow 2) / B(E2; 2 \rightarrow 0)$$

U(5) 2.0	O(6) 1.43	SU(3) 1.43
E(5) 1.67	Z(5) 1.59	X(5) 1.60

Nuclei with $B_{4/2} < 1$

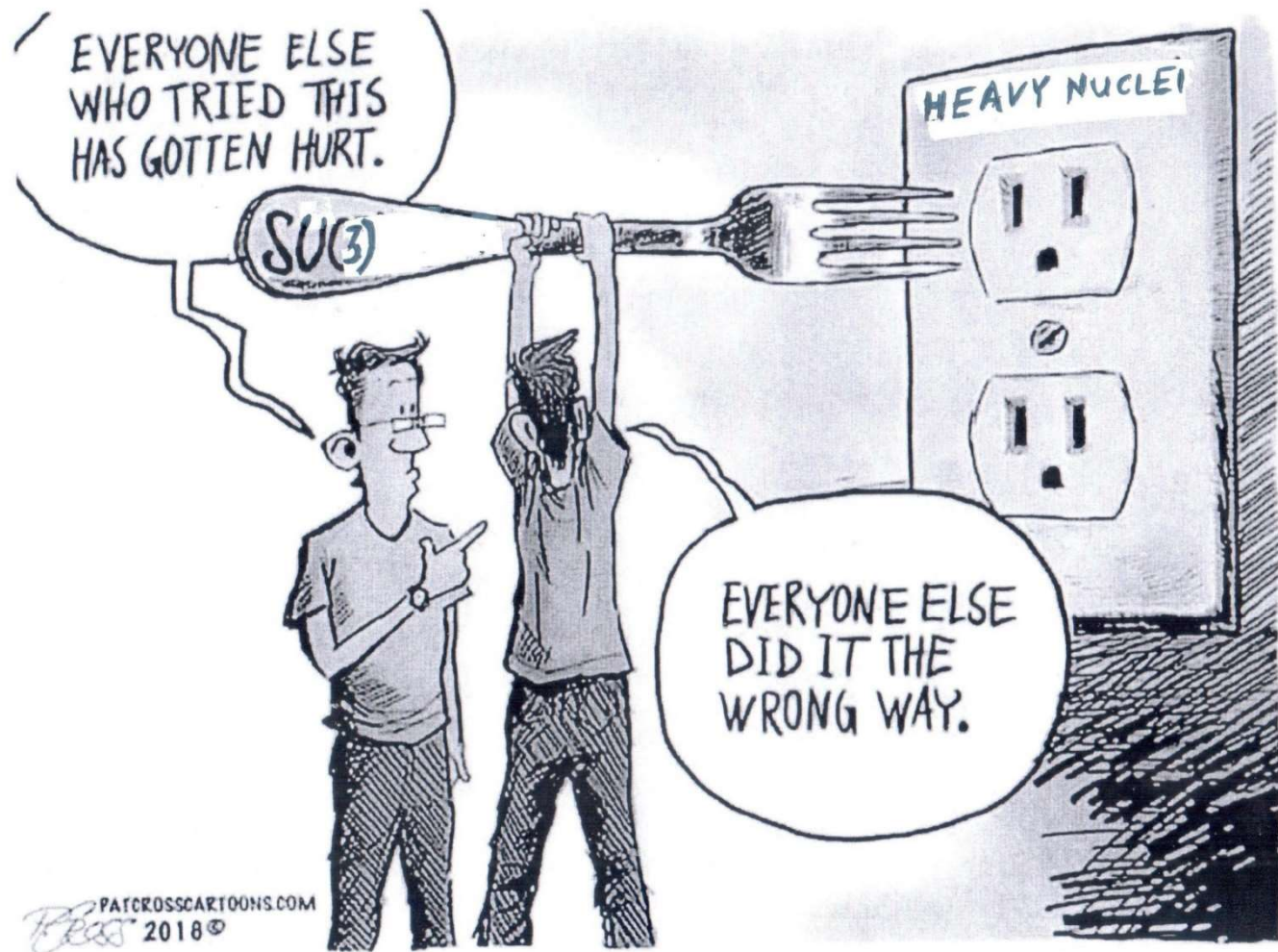
in more than 10 years

	Z	N
166W	74	92
168,170Os	76	92,94
172Pt	78	94
190,192,194,196,198Hg	80	110-118
94,96Sr	38	56,58
110,112Mo	42	68,70
114Pd	46	68

Theory: triaxiality

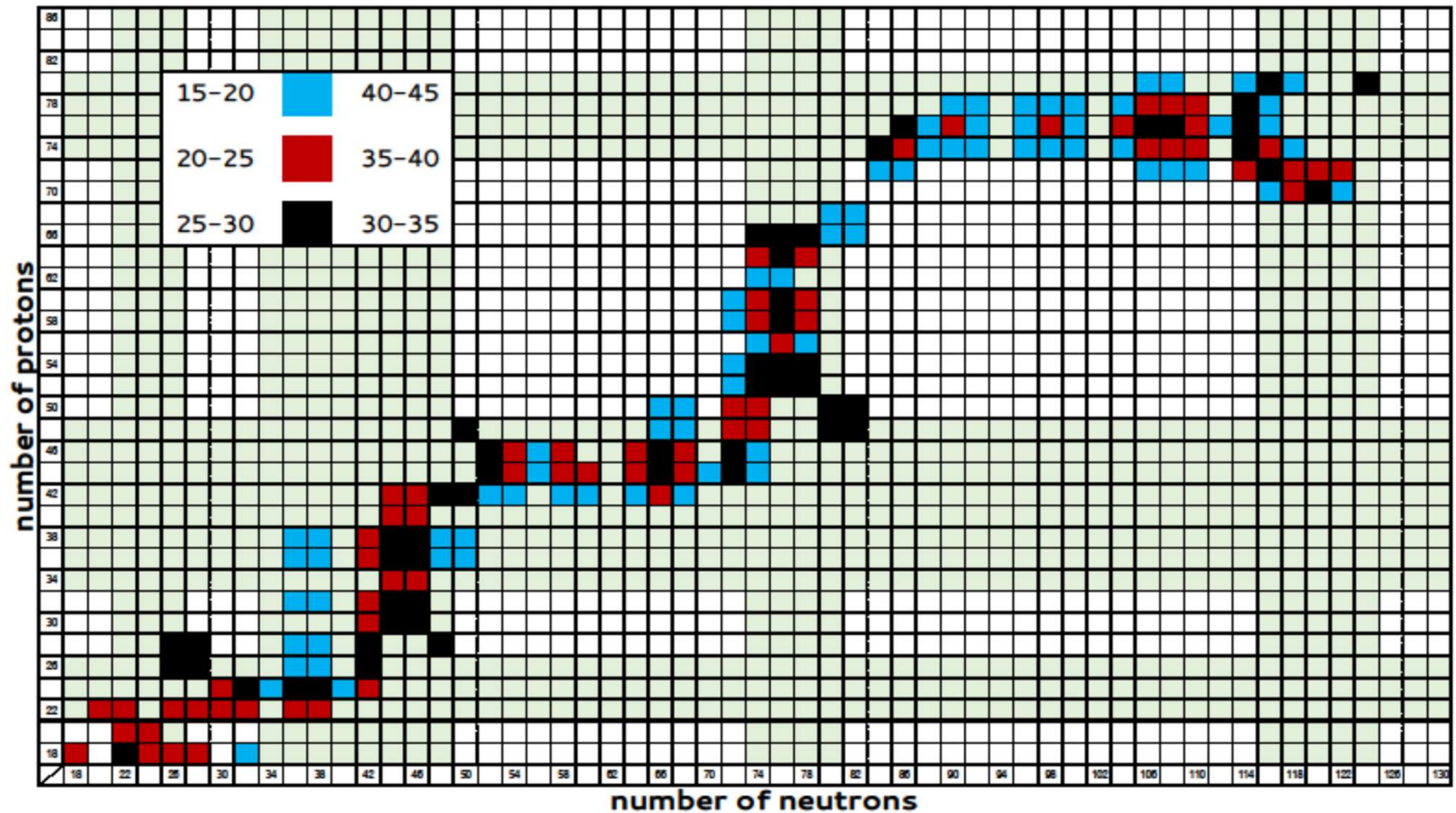
- IBM-1 with higher order terms
SU3IBM Tao Wang
- IBM CQF with triaxial rotor terms
Yu Zhang, Feng Pan
- IBM-1 with configuration mixing
- IBM-2 $SU(3)^*$
Wei Tang, Yu Zhang

Proxy-SU(3) (2017)



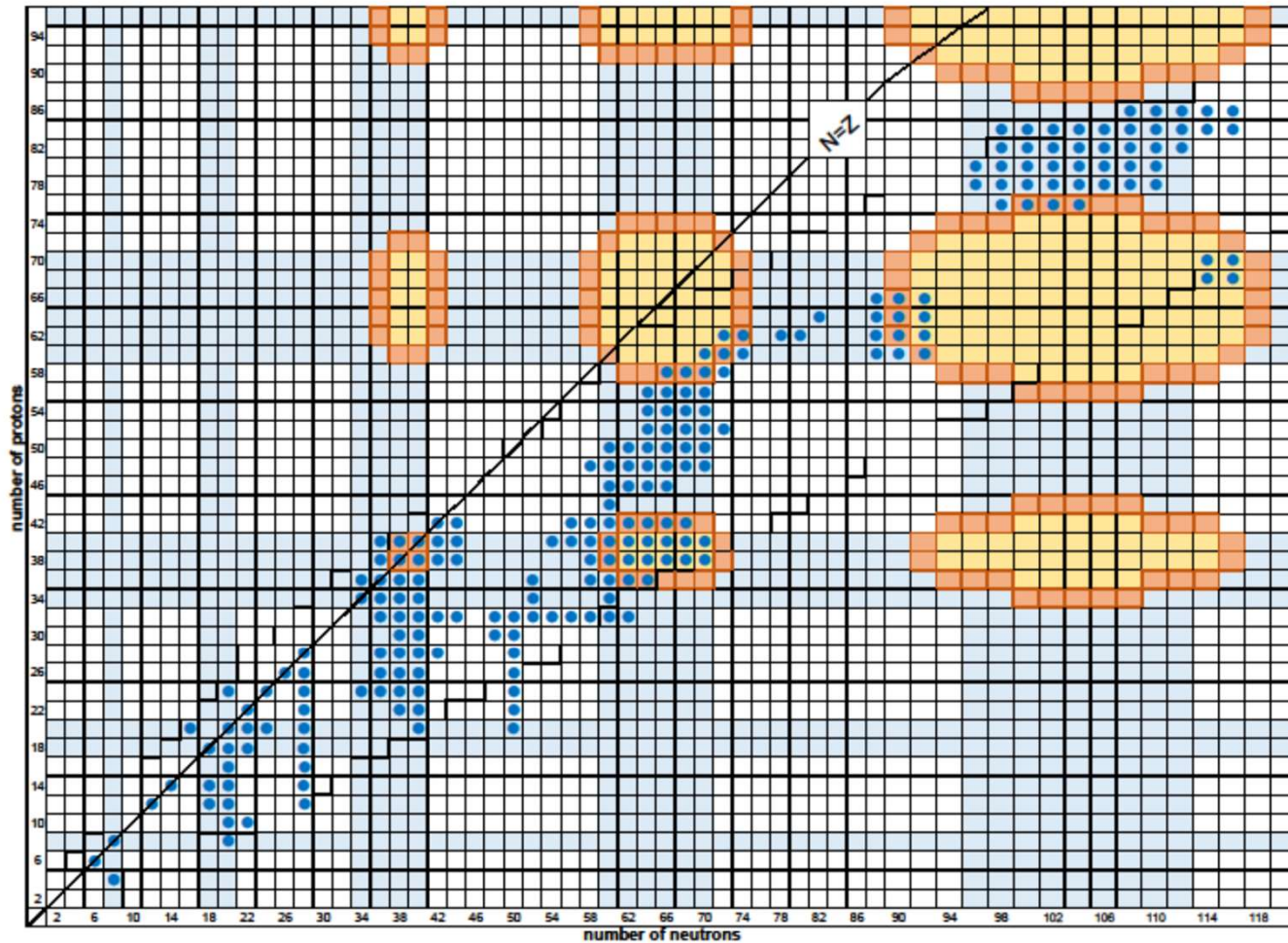
large triaxiality in proxy-SU(3)

Atoms 13 (2025) 47_



nuclei with shape coexistence

Atoms 11 (2023) 117 (cover story)



A. Martinou, Ph.D. thesis (2018)

2



ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ
ΣΧΟΛΗ ΕΦΑΡΜΟΣΜΕΝΩΝ ΜΑΘΗΜΑΤΙΚΩΝ
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ΑΣΤΑΘΕΙΣ ΠΥΡΗΝΕΣ

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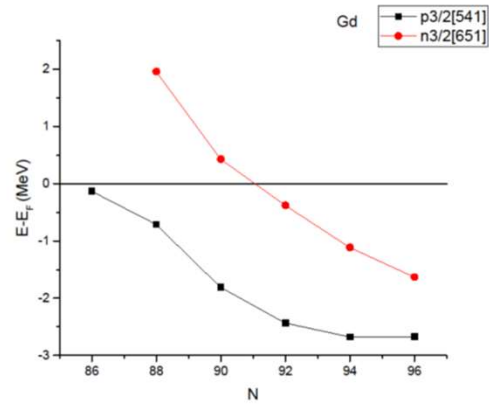
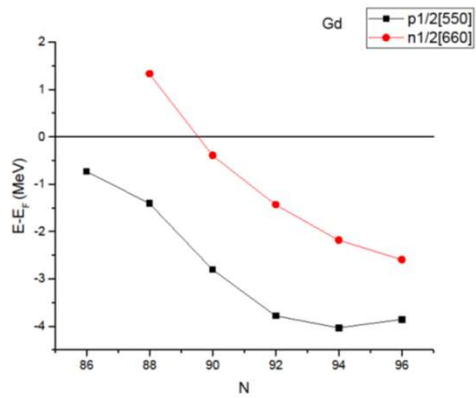
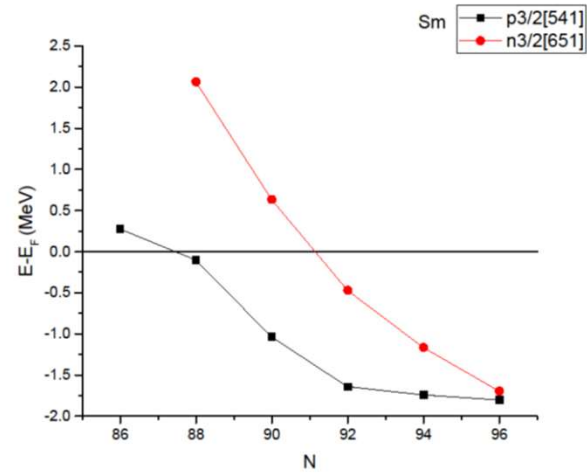
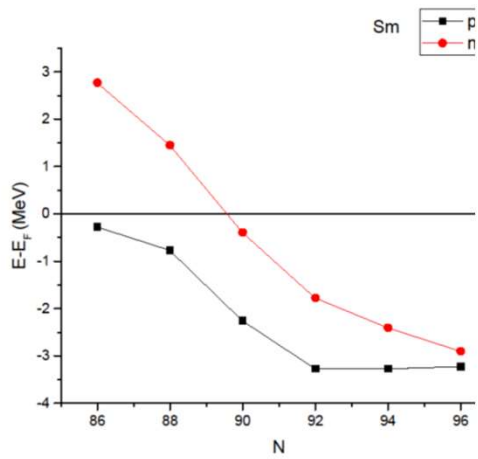
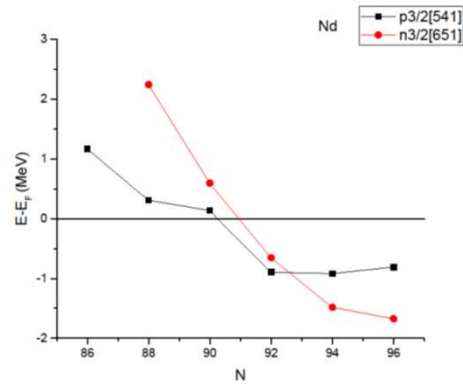
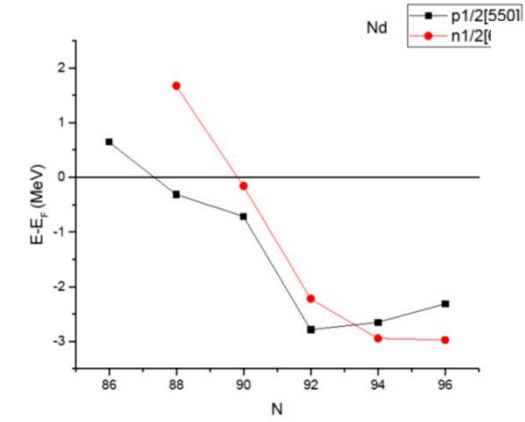
Αθήνα, Φεβρουάριος 2018

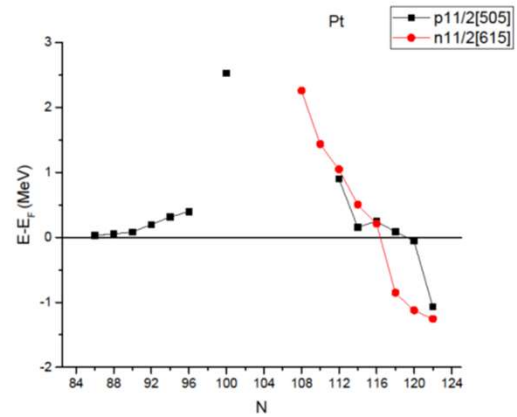
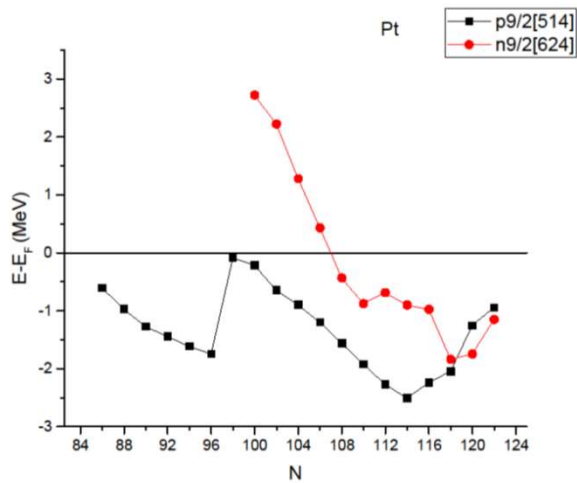
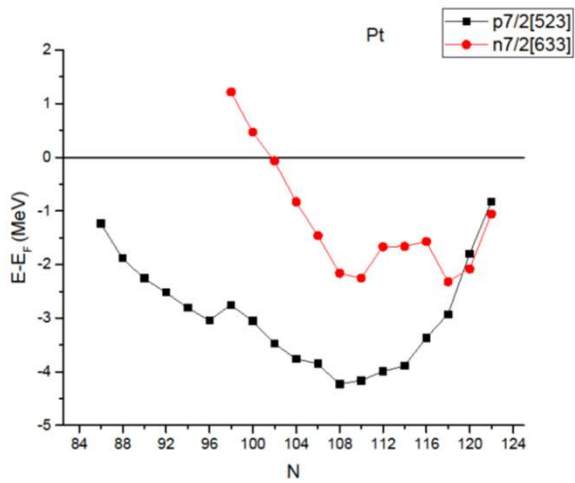
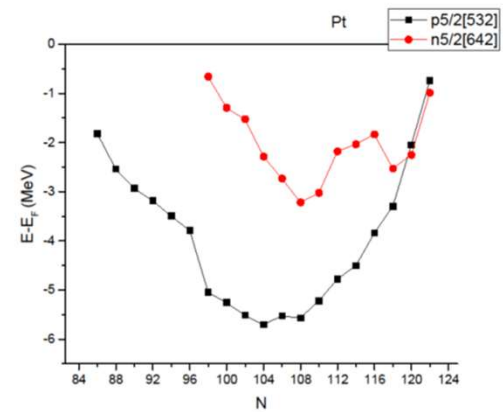
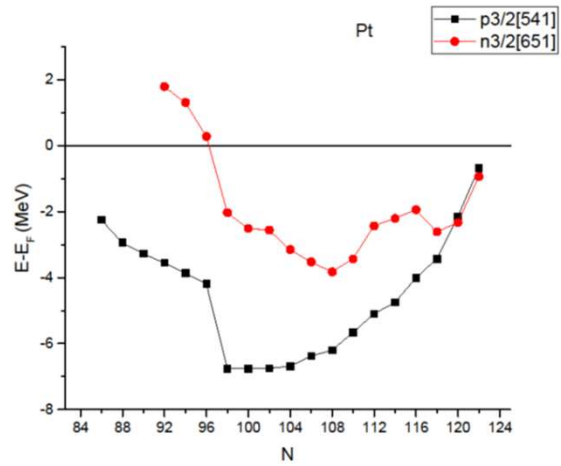
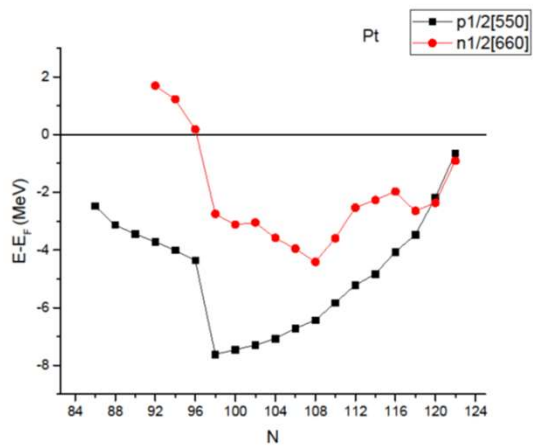
- Triaxiality in proxy-SU(3)
22-26, 34-48, 74-80, 116-124, 172-182
- Shape coexistence in proxy-SU(3)
7-8, 17-20, 34-40, 59-70, 96-112, 146-168
- SC corroborated by
CDFT calculations with DDME2 functional
HFB calculations with Skyrme-Skl3

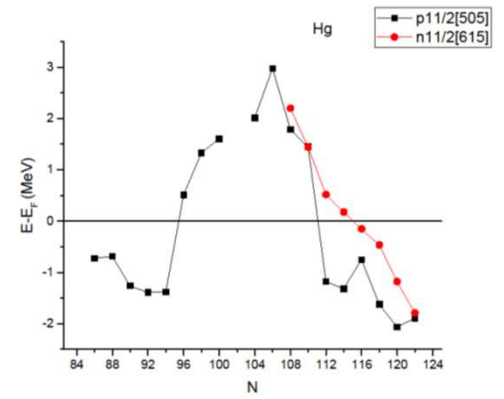
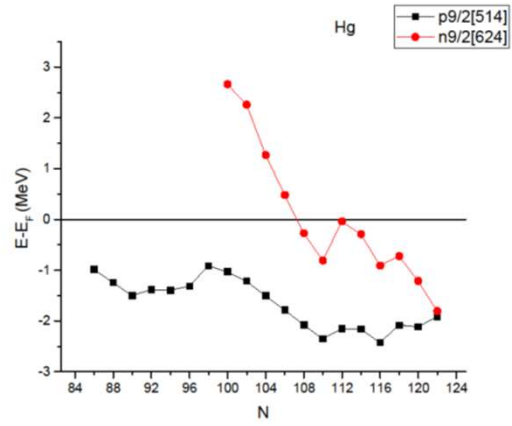
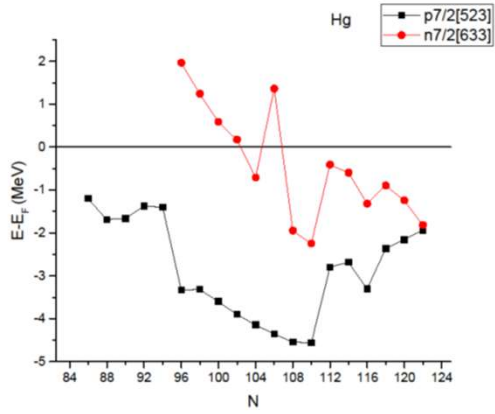
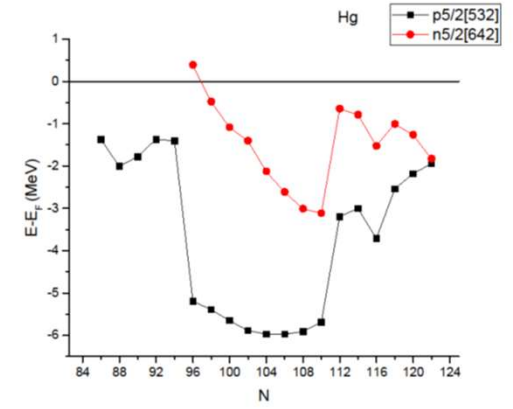
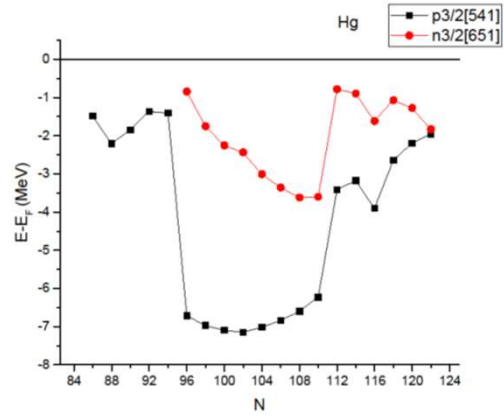
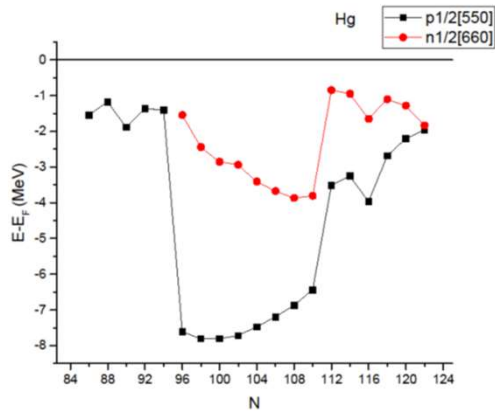
p-n $0[110]$ pairs

- $0[110]$ pairs maximize p-n interaction
- Nilsson notation $K[N N_z \Lambda]$
- Identical angular momenta
- Maximal spatial overlaps
- Intruder orbitals involved
- Responsible for onset of deformation
- Signify the borders of SC regions

X(5)







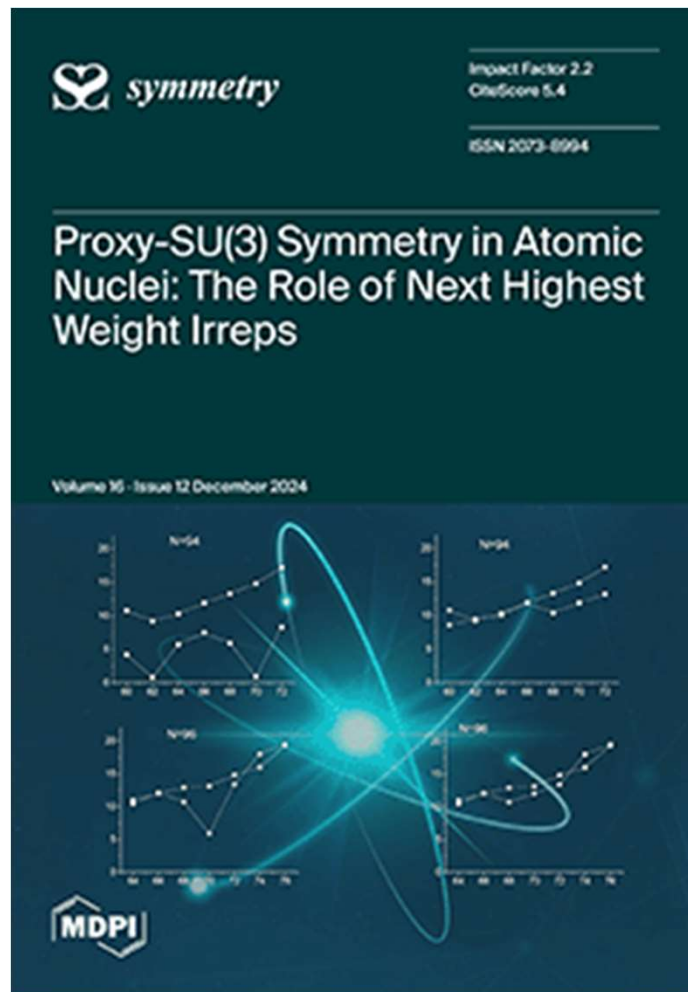
	$1/2$	$3/2$	$5/2$	$7/2$	$9/2$	$11/2$
Nd	90	92				
Sm	90	92				
Gd	90	92				
Dy	92	96				
W	94	96	98	102	108	
Os	96	96	98	104	108	122
Pt	98	98	98	102	108	120
Hg			98	104	108	116

- Shape coexistence 59-70, 96-112
- W, Os, Pt, Hg $Z=74-80 > 70$, outside SC
- B4/2 in W, Os, Pt at $N = 92, 94 < 96$,
just outside SC
- B4/2 in Hg at $N=110-118$,
mostly outside SC

Conclusions

- Triaxiality does not suffice
to induce the B4/2 anomaly
- B4/2 anomaly occurs
close to and outside of the borders of SC
- This is why few examples have been found
over more than 10 years
- Further experiments should be
focused on favored areas

εμβληματικές vs. εγκληματικές δραστηριότητες



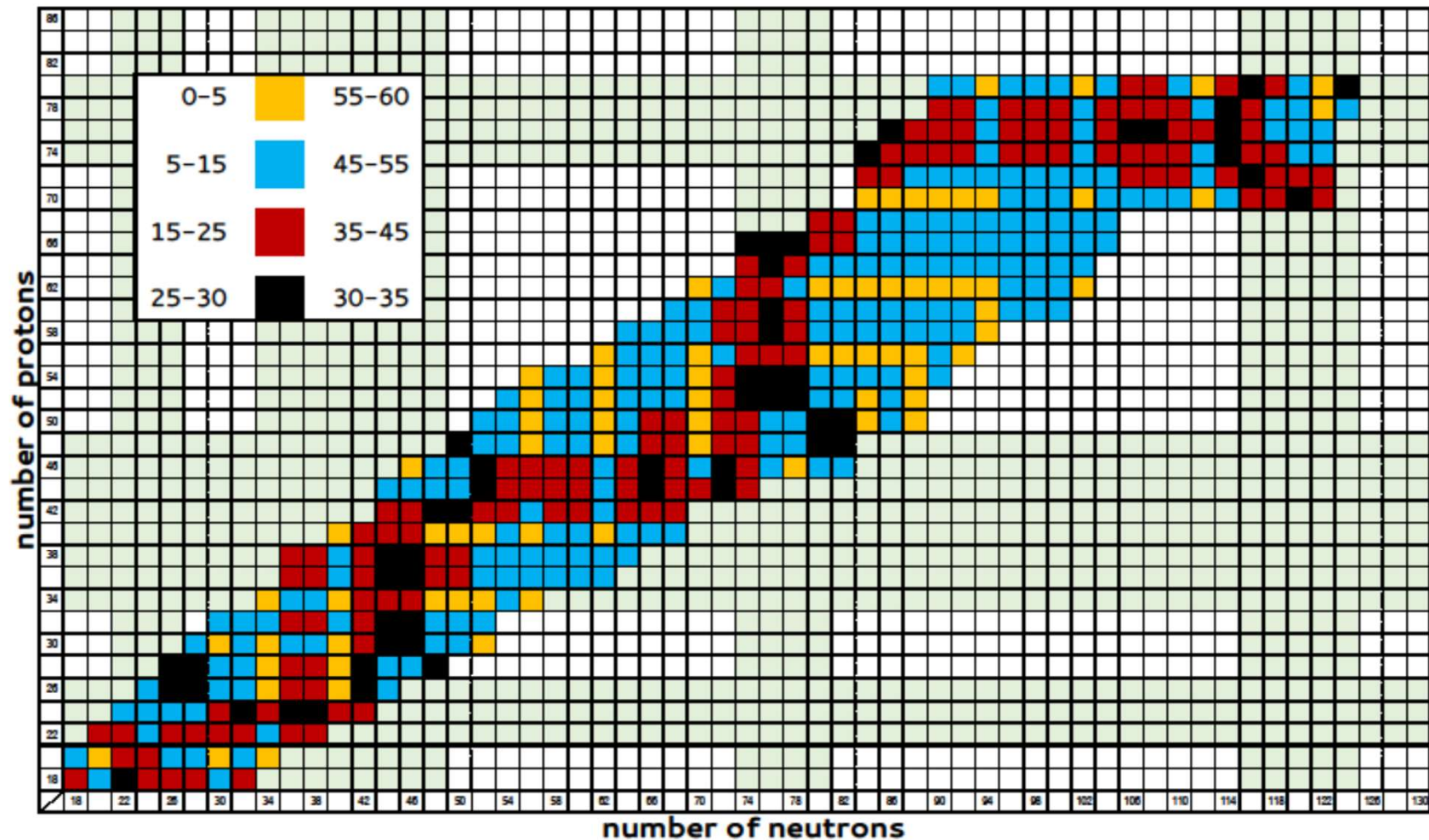
BACK UP

- 166W B. Saygi et al., PRC 96 (2017) 021301(R)
- 168Os T. Grahn et al., PRC 94 (2016) 044327
- 170Os A. Goasduff et al., PRC 100 (2019) 034302
- 172Pt B. Cederwall et al., PRL 121 (2018) 022502
- 190,192,196,200Hg
 - B. Olaizola et al., PRC100 (2019) 024301
- 192,194,196Hg
 - A. Esmaylzadeh et al., PRC98 (2018) 014313
- 94,96Sr J.-M. Regis et al., PRC 95 (2017) 054319
- 96Sr E. Clement et al., PRC 94 (2016) 054326
- 110,112Mo B. Moon et al., PLB 870 (2015) 139904
- 114Pd E.R. Gamba et al., PRC 100 (2019) 044309

- SU3IBM Tao Wang, EPL 129 (2020) 52001
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- IBM CQF Yu Zhang et al., PLB 834 (2022) 137443
Feng Pan et al, PRC110 (2024) 054324
- IBM CM Y. Zhang, W. Teng, PRC 111 (2025) 014324
Wei Teng et al., NPA 1063 (2025) 123214
- IBM-2 Wei Teng et al. , PLB 865 (2025) 139487
Wei Teng et al., ChinPC 49 (2025) 084106

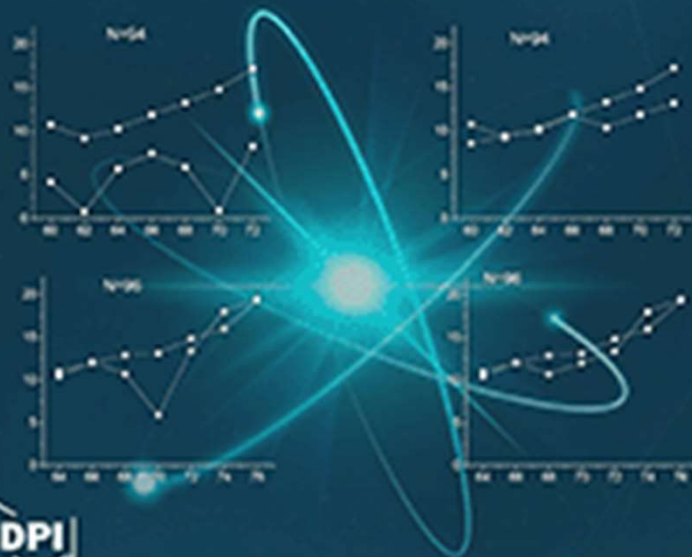
triaxiality in proxy-SU(3)

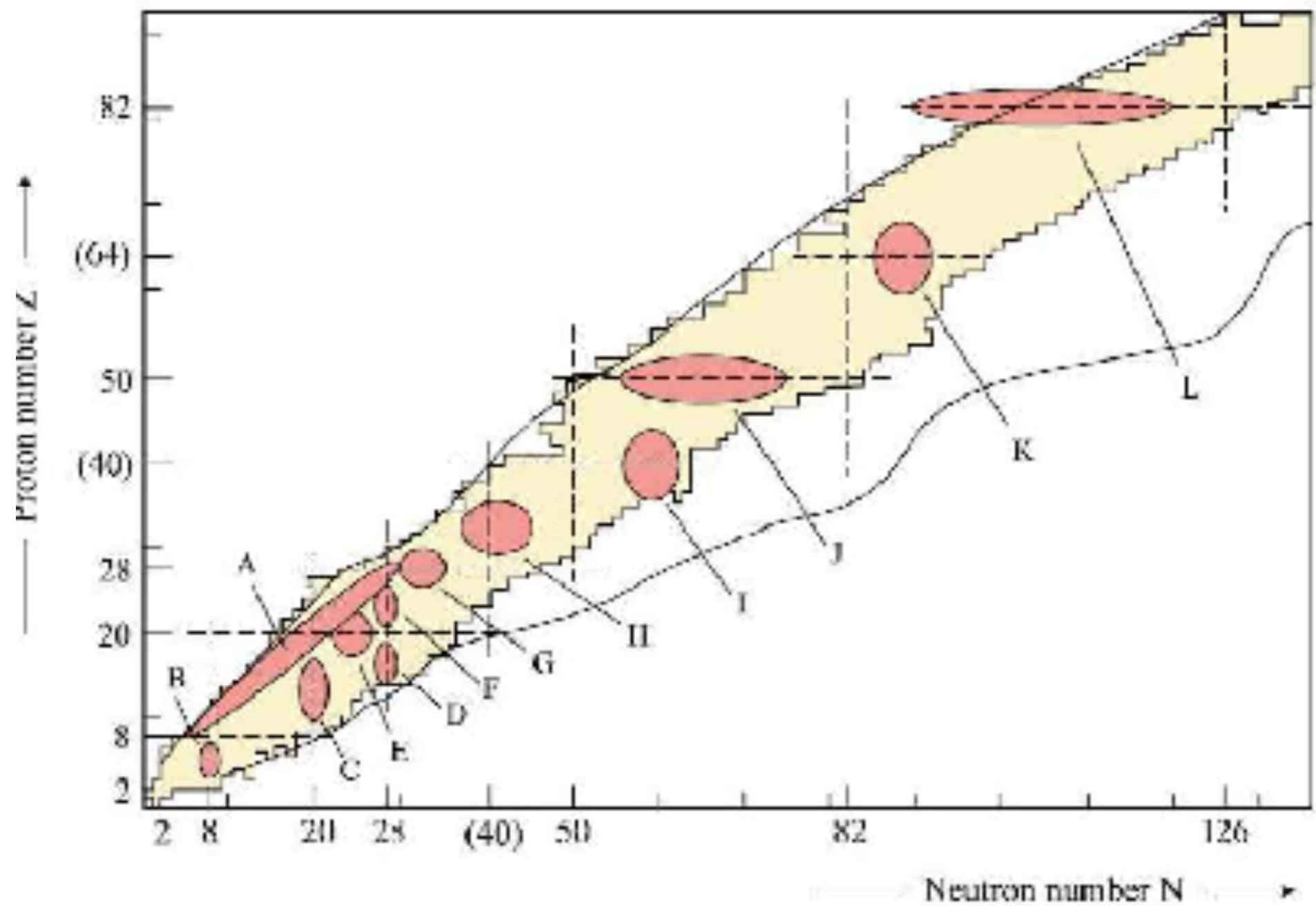
Atoms 13 (2025) 47



Proxy-SU(3) Symmetry in Atomic Nuclei: The Role of Next Highest Weight Irreps

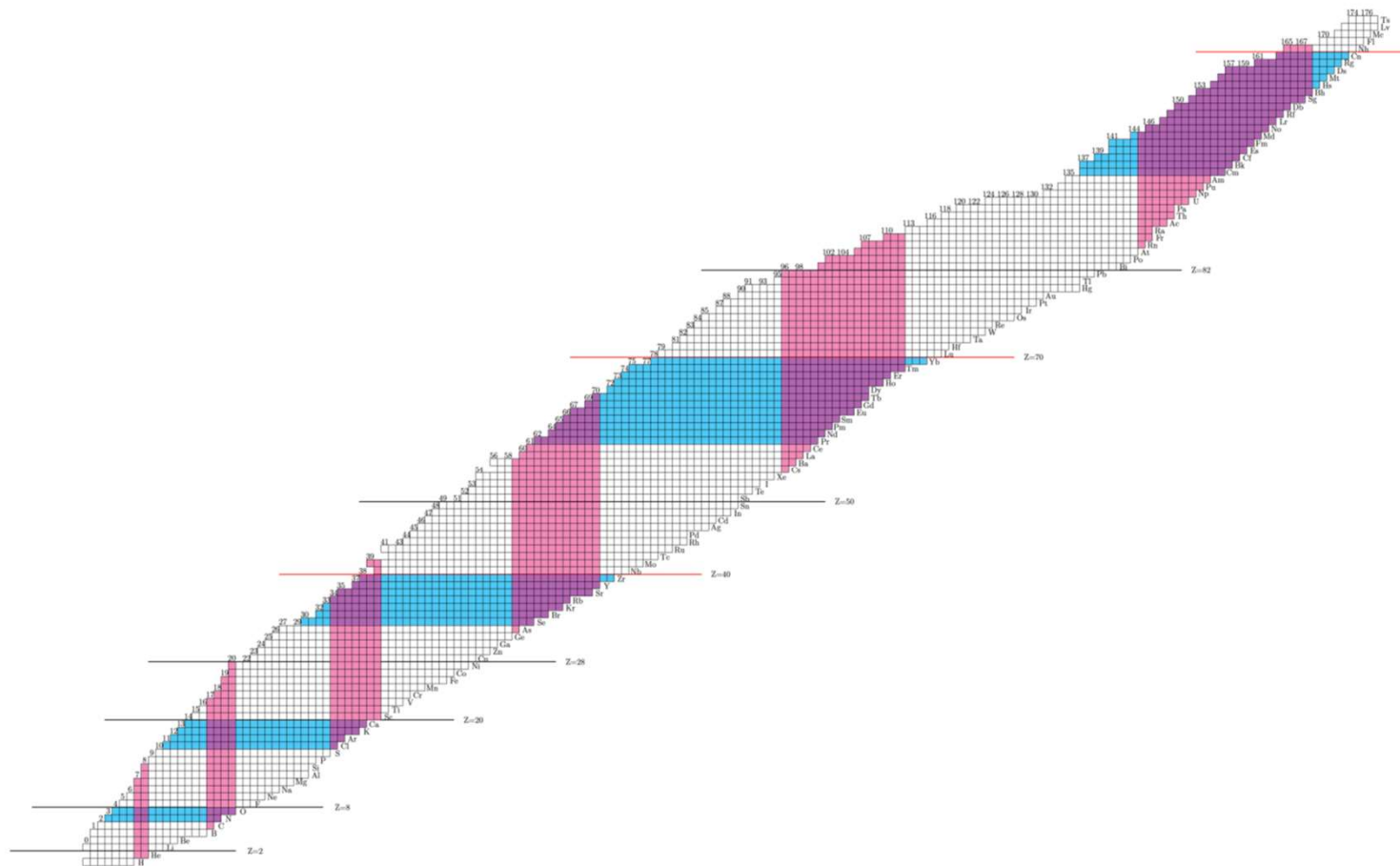
Volume 16 - Issue 12 December 2024





proxy-SU(3) symmetry dual shell mechanism for shape coexistence

A. Martinou et al. EPJA 57 (2021) 84

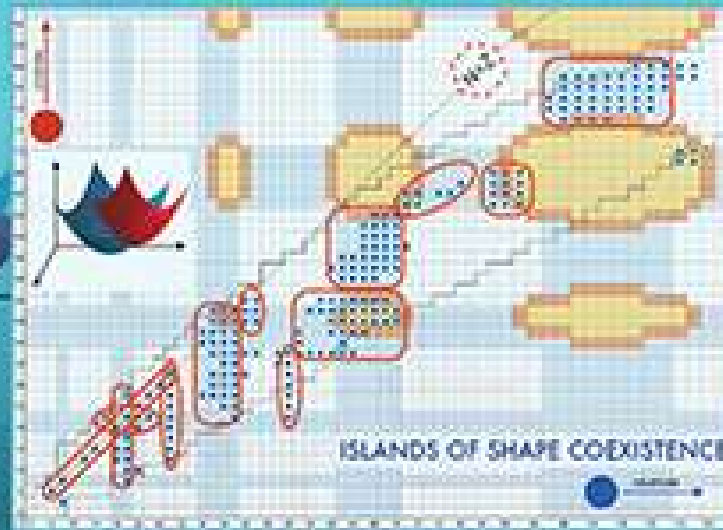




atoms

IMPACT
FACTORS
1.8

ISSUES
3.1



Shape Coexistence in Even-Even Nuclei: A Theoretical Overview

Volume 11 • Issue 9 | September 2023



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ISSN 2218-2004

- Triaxiality Symmetry 16 (2024) 1625
J. Phys. G 52 (2025) 015102
Atoms 13 (2025) 47
- Shape Coexistence A. Martinou
EPJA 57 (2021) 84
Symmetry 15 (2023) 29
- CDFT with DDME2 K. E. Karakatsanis
PLB 829 (2022) 137099
PRC 106 (2022) 044323
- HFB with Skyrme-SKI3 Malik A. Hasan (Kirkuk)
PRC 113 (2026) 024302

p-n [1 1 0] pairs

- Mini-valence Wigner-like energy
Double differences of binding energies
R. B. Cakirli et al.,
PRC 82 (2010) 061304 (R)
PRC 111 (2025) 014305
- DFT corroboration
M. Stoitsov et al., PRL 98 (2007) 132502
- Spatial overlaps
S. Karampagia, PRC 88 (2013) 054309

