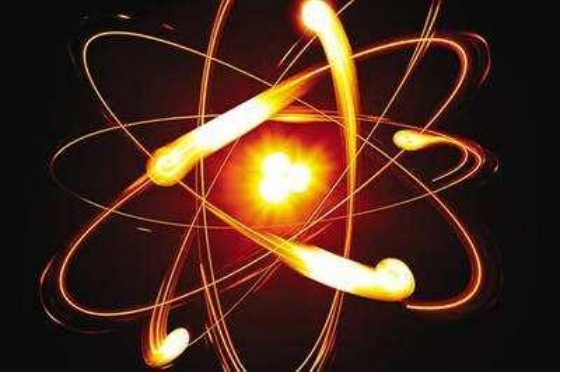

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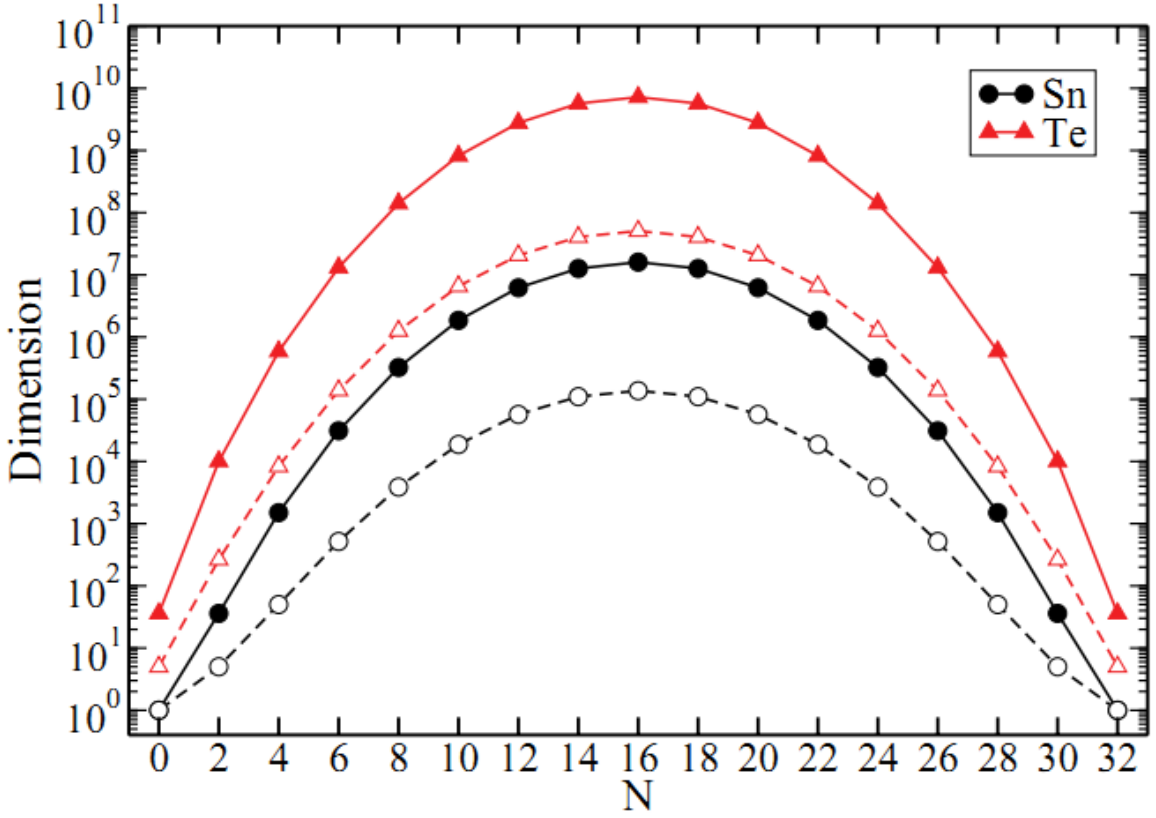
2020绵阳原子核结构理论研讨会

Non-collective nucleon pairs in even-even $^{124-128}$Sn

报告人： 何秉承
指导老师：罗延安
日期：2020年1月

Nuclear shell model

Hamiltonian: $$\mathcal{H} = \sum_{ij} \mathcal{K}_{ij} a_i^\dagger a_j - \sum_{\substack{i \leqslant j \\ k \leqslant l}} \mathcal{V}_{ijkl} a_i^\dagger a_j^\dagger a_k a_l .$$



图来自 Phys. Rev. C, 86, 044323 Chong Qi and Z. X. Xu

Nucleon-pair shell model

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$$A^{r\dagger}_{\mu}(ab) = (C^{\dagger}_{a} \times C^{\dagger}_{b})^{r}_{\mu}$$

Non-collective pairs

$$A^{r\dagger}_{\mu} = \sum_{ab} y(abr) A^{r\dagger}_{\mu}(ab)$$

Collective pairs

Basis:

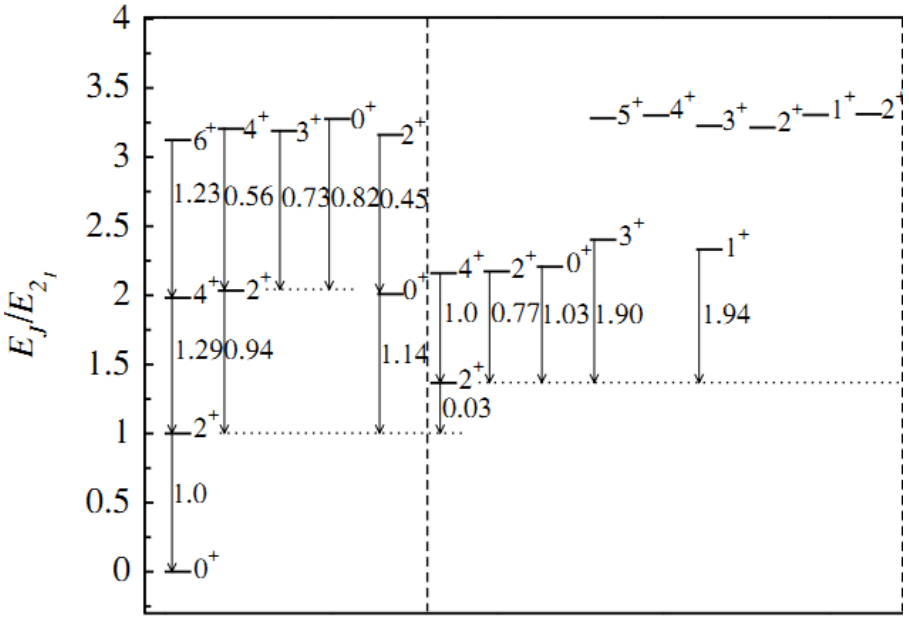
$$A^{J_N\dagger}_{M_N} = (\ldots((A^{r_1\dagger} \times A^{r_2\dagger})^{J_2} \times A^{r_3\dagger})^{J_3} \times \cdots \times A^{r_N\dagger})^{J_N}_{M_N}$$

Nucl. Phys. A, 626, 686(1997)
Phys. Rep. 545, 1 (2014)

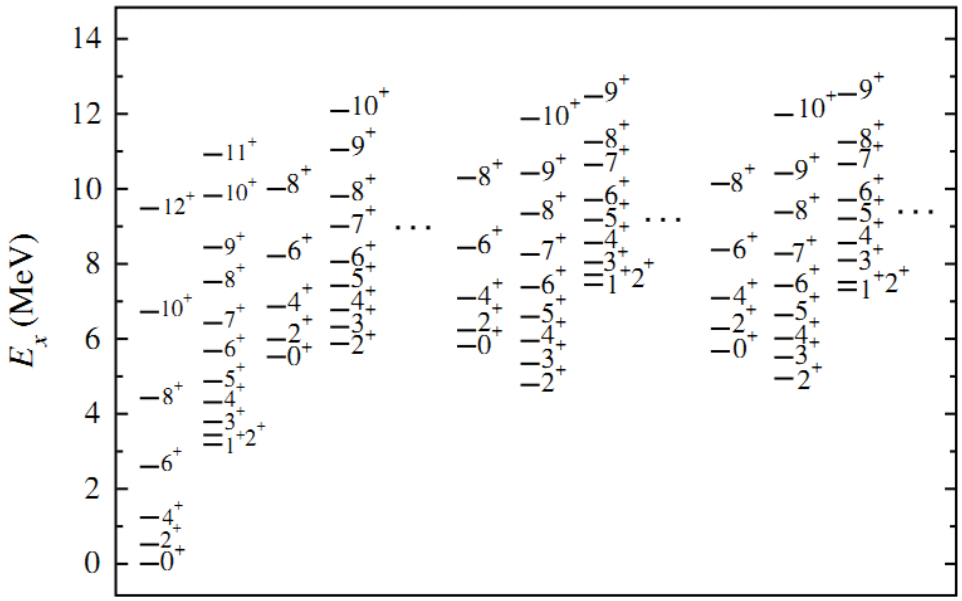
SD-pair shell model

sd boson → S(J=0) D(J=2) pairs

IBM → Shell model



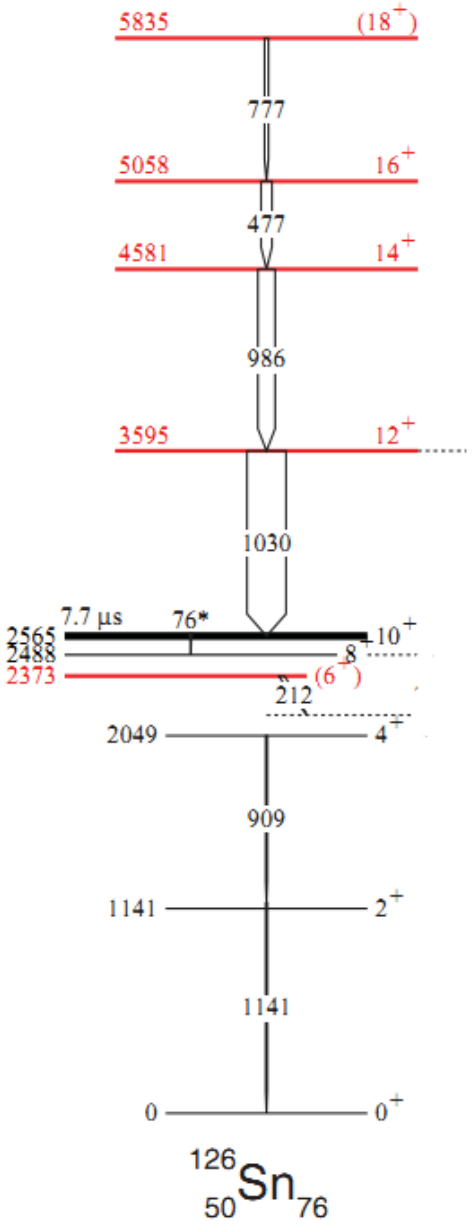
Vibrational spectrum



Rotational spectrum

图来自 Phys. Rev. C, 71, 044304

Experiment data of ^{126}Sn



Phys. Rev. Lett., 68, 11

Phys. Rev. C, 85, 054316

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$(\nu h_{11/2})^n$ → $(C^{\dagger}_{11/2} \times C^{\dagger}_{11/2})^r_{\mu}$

A>120

Backbending phenomena

Interaction and Configuration

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$$H = H_0 - G_0 P^{(0)} P^{(0)\dagger} - G_2 P^{(2)} P^{(2)\dagger} - \kappa Q^2 \cdot Q^2$$

$^{131}_{50}\mathrm{Sn}_{81}$ $G_0 = 0.15$ MeV, $G_2 = 0.017$ MeV$/r_0^4$ $\kappa = 0.045$ MeV$/r_0^4$

Configuration space:

SDP: S and D collective pairs

ONP: one non-collective pairs $(C^\dagger_{11/2} \times C^\dagger_{11/2})^r_\mu$

TNP: two non-collective pairs

^{128}Sn， ^{126}Sn ^{124}Sn

Spectrum

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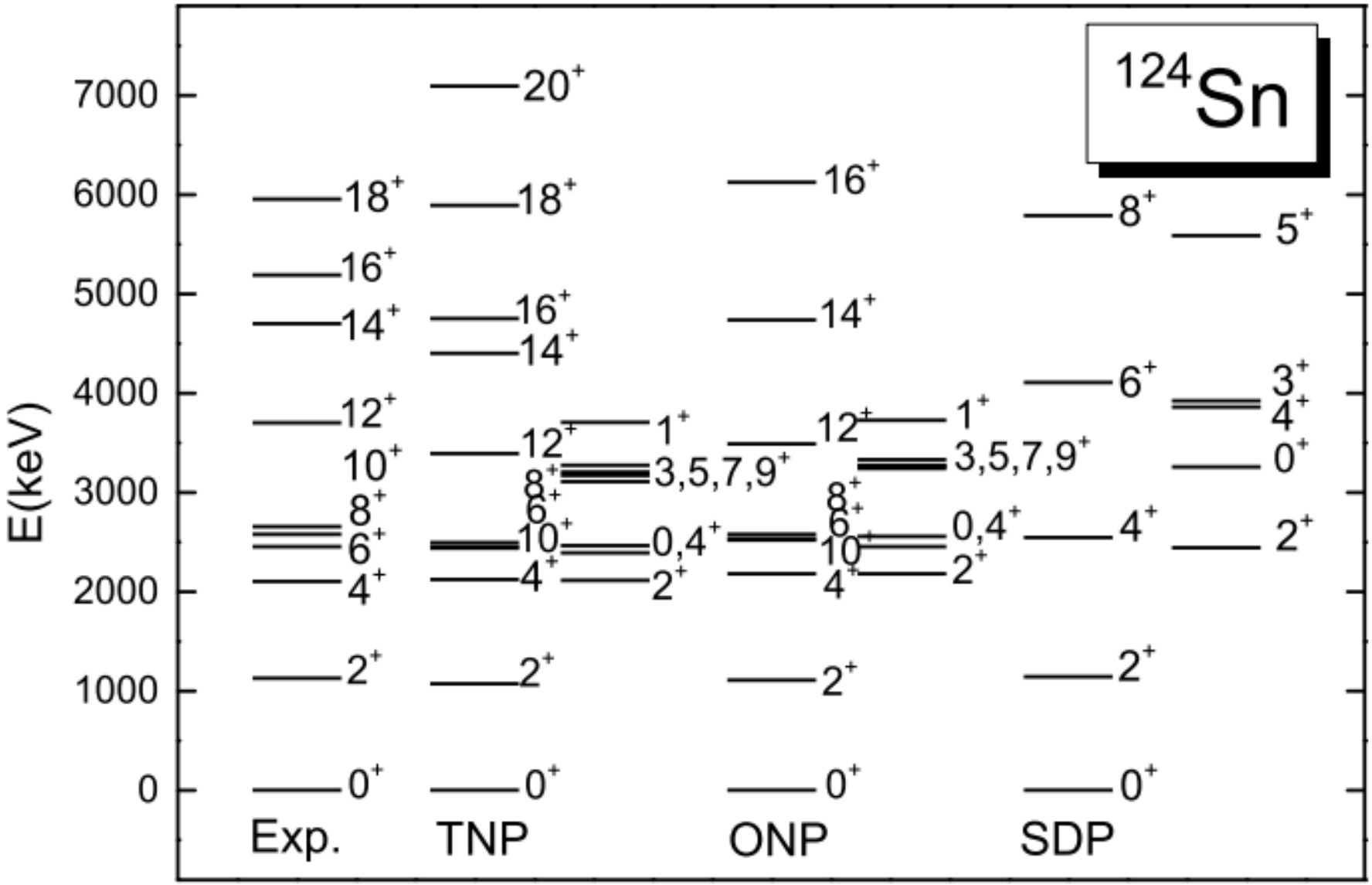
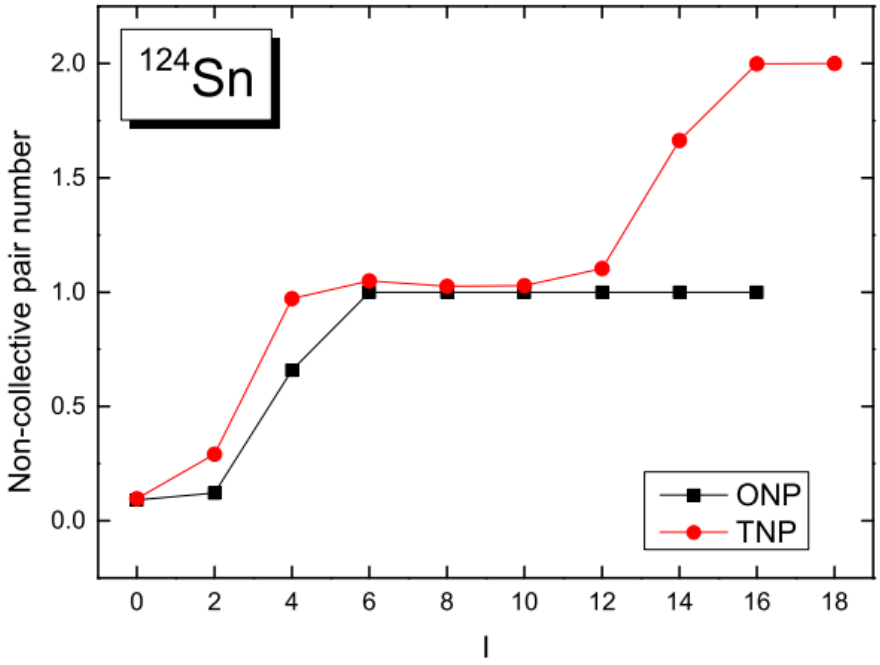
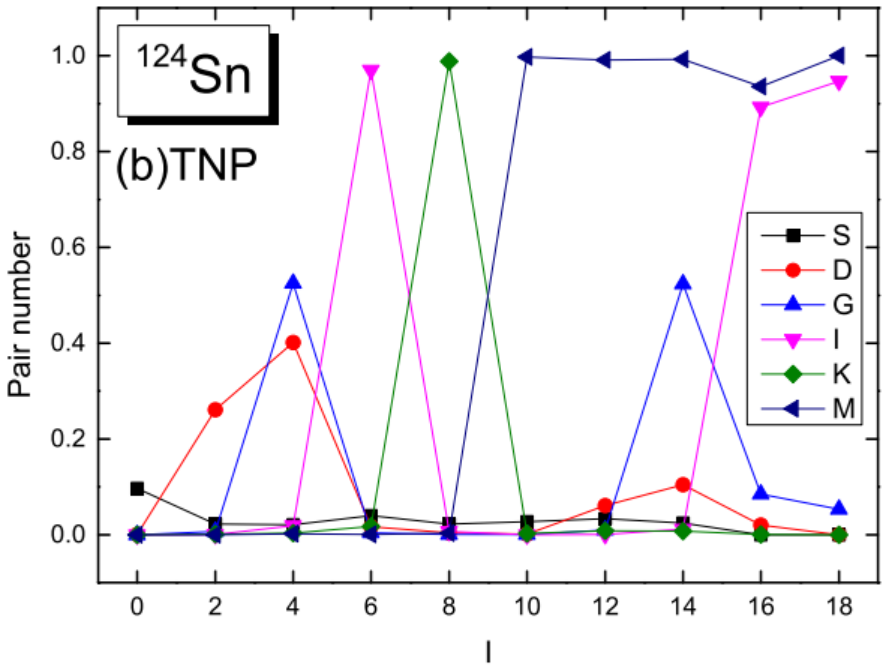
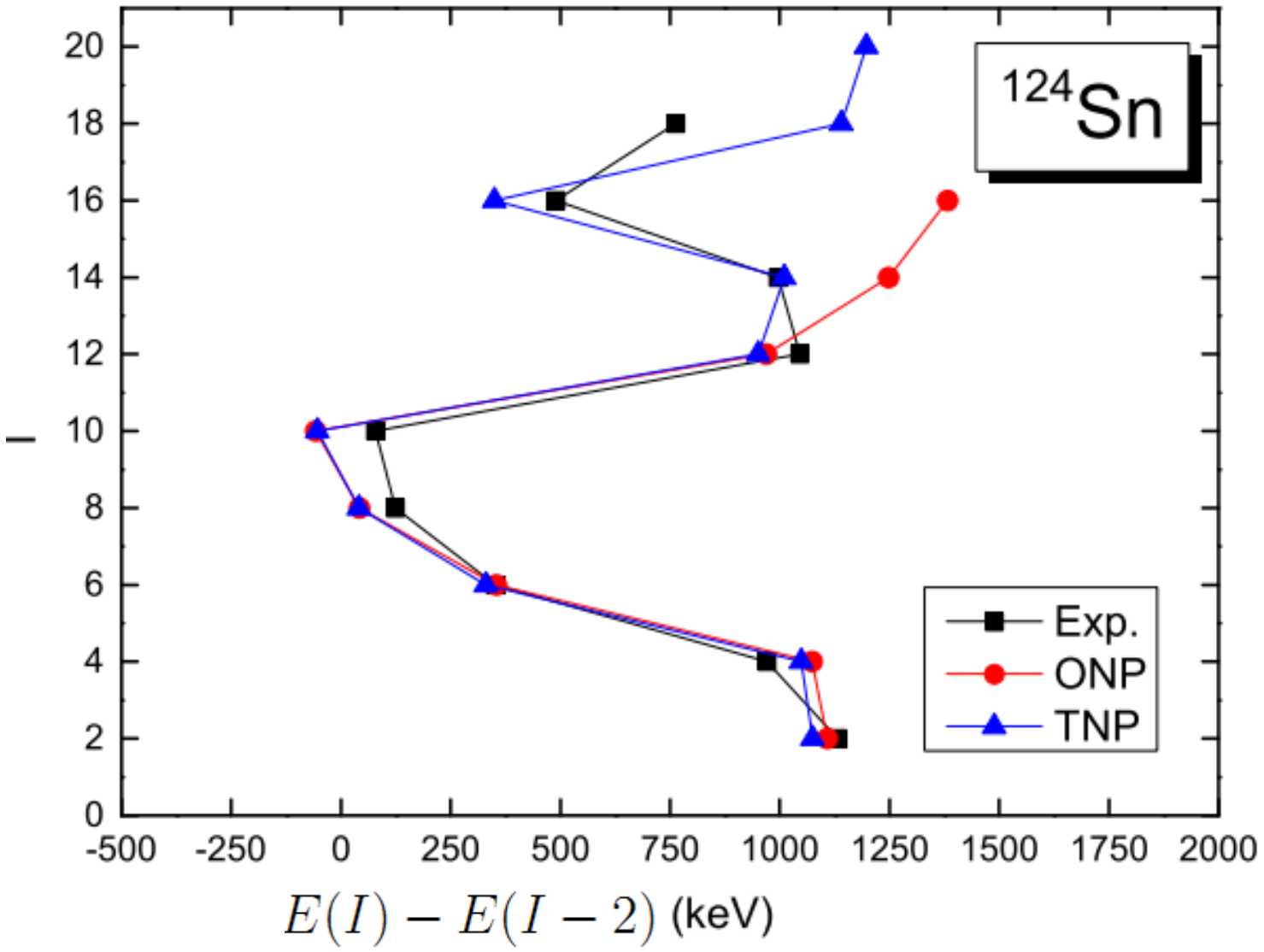


Pair number

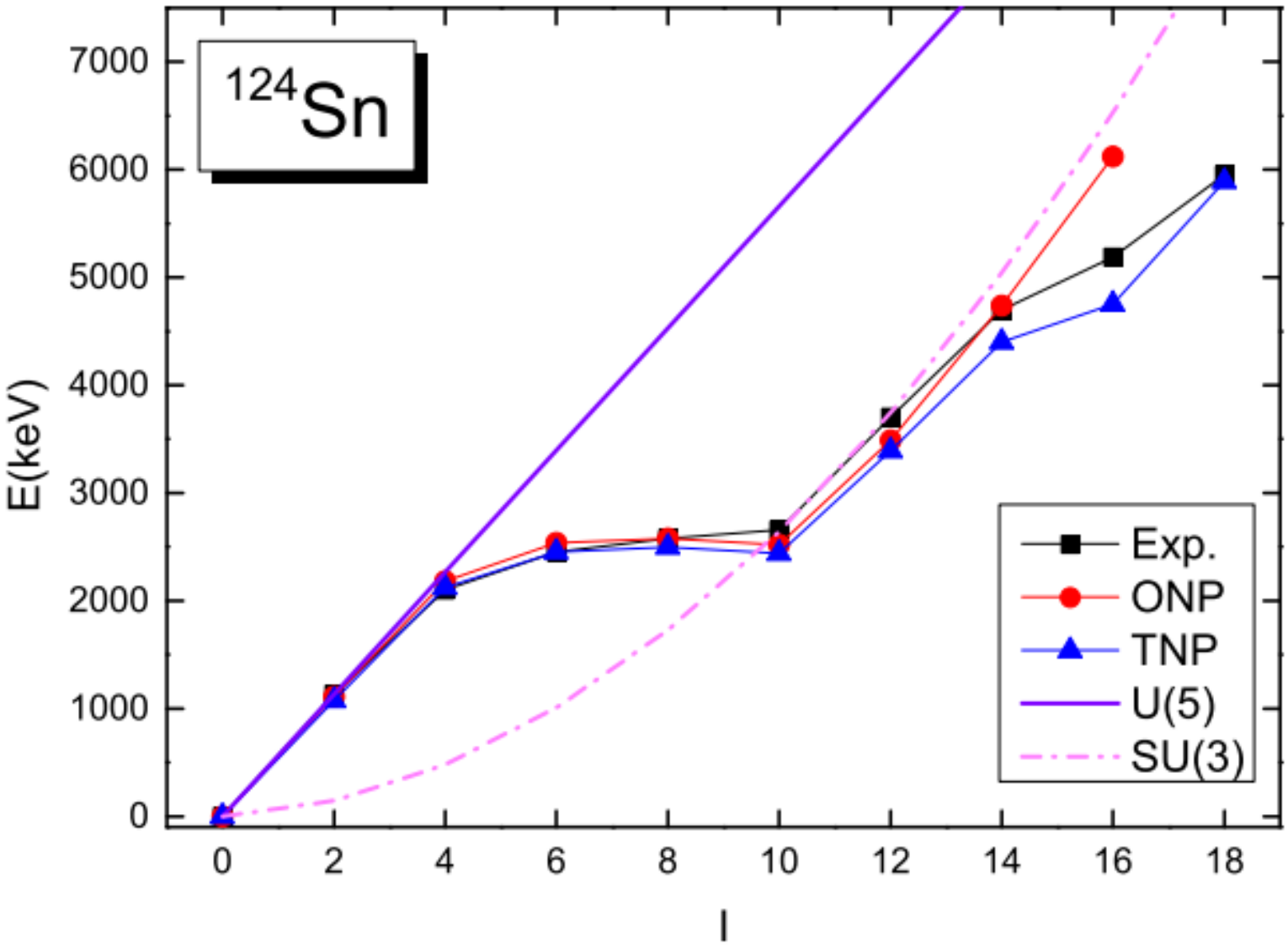

^{124}Sn
Non-collective pair number
I
ONP
TNP


^{124}Sn
(b)TNP
Pair number
I
S
D
G
I
K
M

Backbending phenomena



Shape transition



E-Gamma Over Spin

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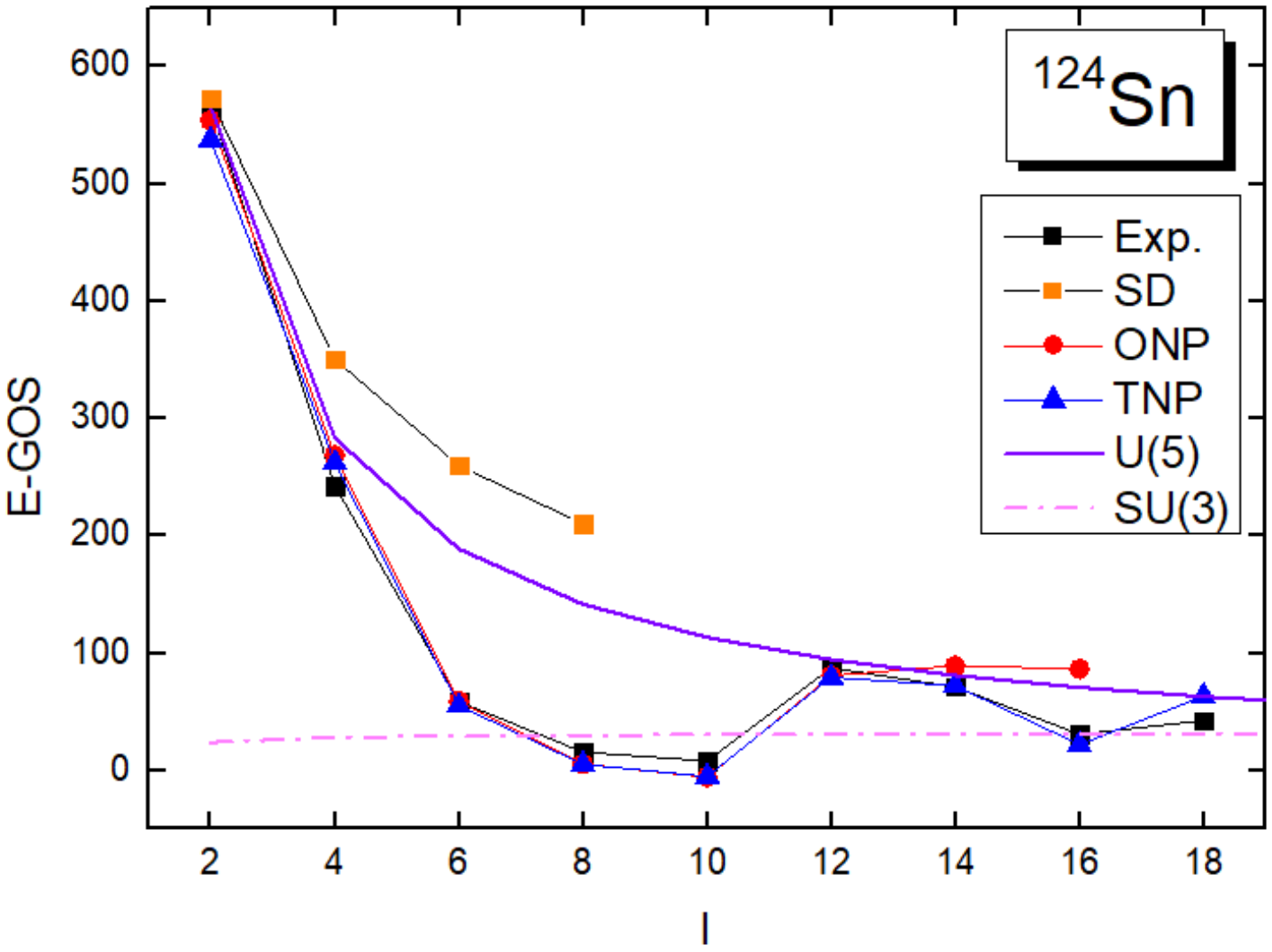

E-GOS:

$$R = \frac{E_\gamma(I \rightarrow I-2)}{I}$$

Phys. Rev. Lett., 90, 15

B(E2) ratios

$$T(E2) = e_\nu Q^{(2)}$$

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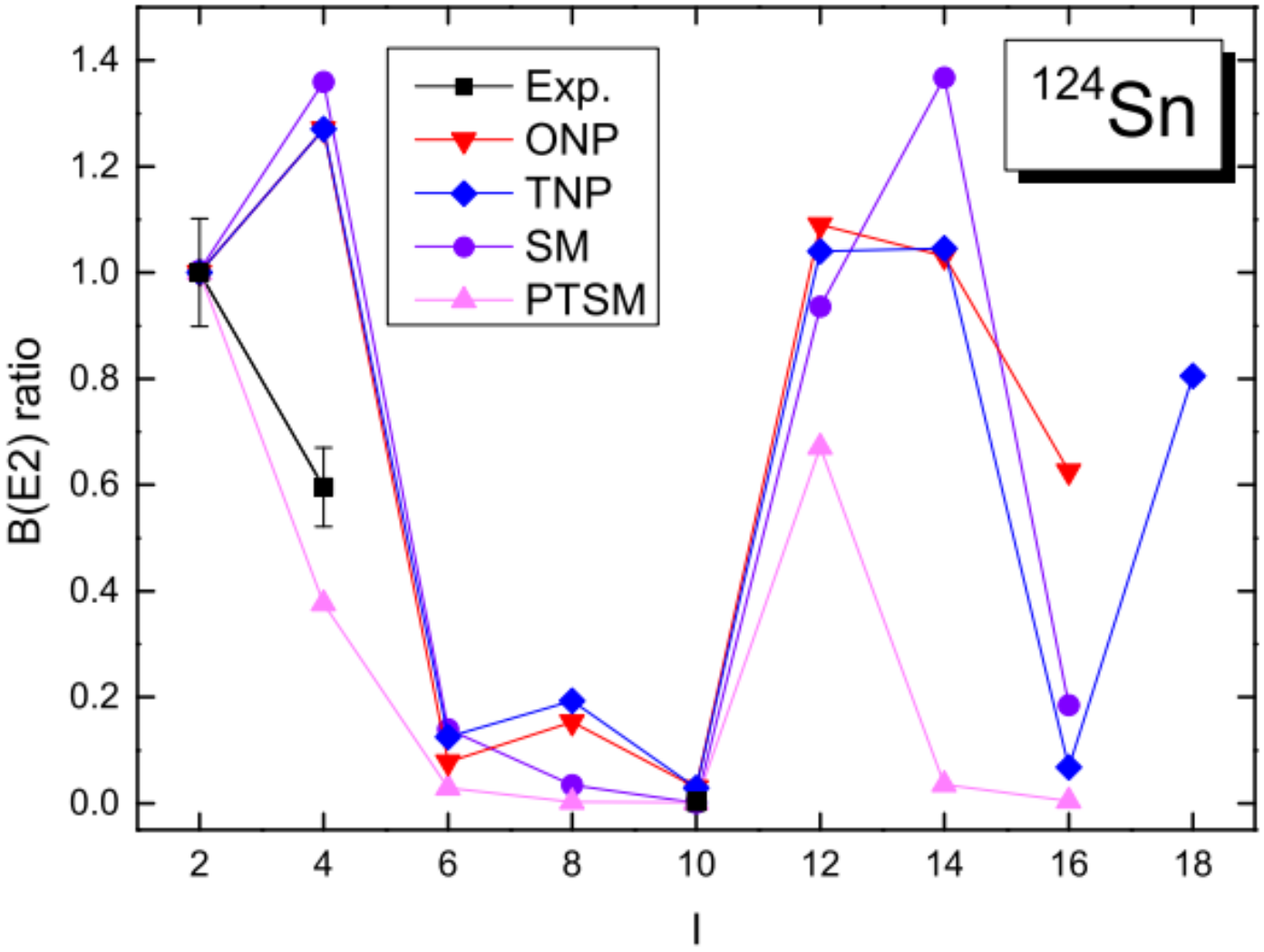
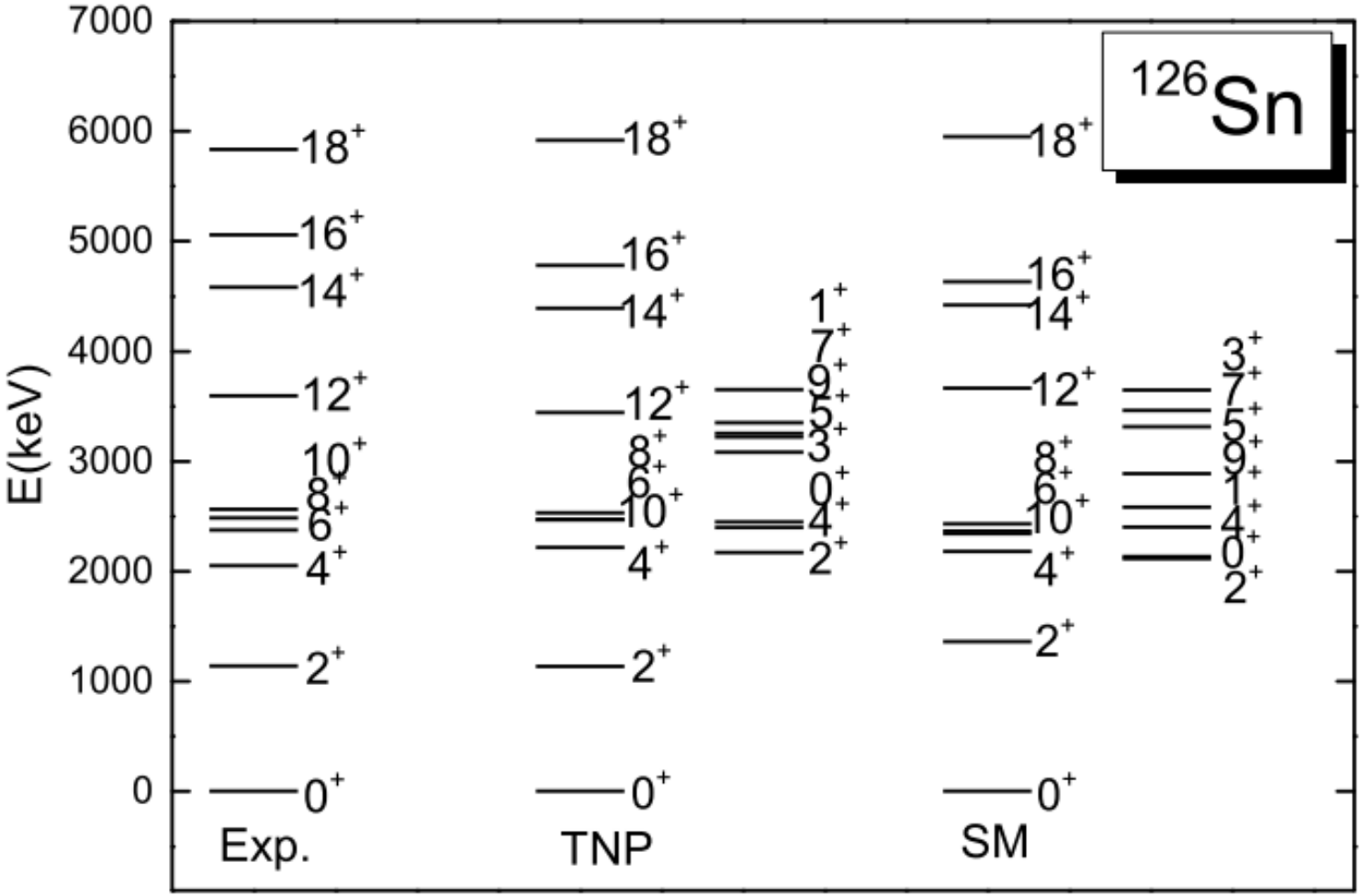


PTSM结果取自于 Phys. Rev. C, 94, 024301

Solid shell model foundation



Conclusion

1. The mechanism of the yrast band can be explained as band crossing between the ground-state band and the S band constructed from the neutrons alignment in h11/2 orbit.

2. The non-collective congurations may be crucial in describing the yrast states in even-even $^{124\text{-}128}$Sn in the SD-pair shell model.

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Thank you !