

Proxy-SU(3) Symmetry in Superheavy Nuclei

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Abstract

Superheavy and hyperheavy nuclei are one of the frontiers of nuclear structure nowadays, while also for many actinides rather limited experimental information exists. Therefore, theoretical methods providing parameter-independent predictions for these nuclei are of particular interest. Such a method is the proxy-SU(3) approximation to the shell model [1], which has been adequately tested against experimental data in medium-mass and heavy nuclei up to the rare-earth region, and it has been found to provide reliable, parameter-independent predictions for the collective deformation variables β and γ [1]. Within the proxy-SU(3) approach, the SU(3) symmetry of the three-dimensional harmonic oscillator, which is destroyed beyond the sd shell by the strong spin–orbit interaction, is restored through a unitary transformation [2]. For each nucleus, the most symmetric irreducible representation (irrep) allowed by the Pauli principle and the short-range nature of the nucleon–nucleon interaction, called the highest-weight (hw) irrep in mathematical language, is found to suffice [3], except in cases in which the hw irrep turns out to be completely symmetric, so that the next highest weight (nhw) irrep has also to be included [4]. The hw and nhw irreps, as well as of the corresponding parameter-free predictions for the deformation variables β and γ , for actinides and superheavy nuclei ranging from $Z = 82$, $N = 82$ to $Z = 126$, $N = 258$ have been recently calculated [5] and applied to the study of the prolate-to-oblate shape transition, mirror symmetries, and the evolution of the collective variables along the valley of stability [5].

References

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