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ABSTRACT

Introduction of a new shell model method for nuclear level density

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For a microscopic description of NLD, one should solve the eigenvalue problem, H |Ψ> = E |Ψ>, to obtain all energy levels. To do so, one must abandon the conventional thinking for shell models, and develop methods by applying modern many-body techniques. In this talk, I will introduce a novel shell-model method for calculation of NLD in deformed nuclei. Our diagonalization yields a large ensemble of eigenstates of angular momentum and parity. We demonstrate that NLD as a statistical quantity depends sensitively on structure of deformed single-particle states. We take 164Dy, for which NLD has been studied extensively by the Oslo method, as the first example. By comparison with known experimental discrete levels, we show that while the pronounced step-wise structure in the low-energy NLD curve can be understood as the collective excitation and nucleon-pair breaking, the exponential growth of levels in the higher-energy NLD is described by combination of the broken-pair states. We discuss the formation mechanism and characteristic features of NLD for different energy regimes. In addition, the parity dependence and angular-momentum-dependence in NLD are discussed with a strong emphasis of the structure effect.

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