Cranked Relativistic Mean Field Description of Superdeformed Bands in ^{83}Sr

A.V. Afanasjev [a], J. König , and P. Ring
[a] Nuclear Research Center, Latvian Academy of Sciences, LV-2169, Salaspils, Latvia

Cranked Relativistic Mean Field (CRMF) theory is used to describe the superdeformed band recently observed in the $A \sim 80$ mass region and tentatively assigned to the nucleus ^{83}Sr. The calculated kinematic and dynamic moments of inertia, $J^{(1)}$ and $J^{(2)}$, are compared with experimental data and reasonable agreement is observed. Because the assignment of observed superdeformed band to other nuclei such as ^{83}Y and ^{80}Rb cannot be ruled out completely, the calculated dynamic moments of inertia for the lowest superdeformed solutions in these nuclei are compared with experimental data. While, for the case of ^{83}Y, the theoretical values of $J^{(2)}$ are close to the experimental ones, the results of calculations for ^{80}Rb indicate a crossing between neutron orbitals with the main oscillator quantum numbers N=3 and N=5 at a cranking frequency $\Omega_x \sim 1.3$ MeV.

Dynamical Shells in 3D Cranking

R. R. Hilton and J. Meng

High spin physics has been the subject of much interest in nuclear structure over an extended period of time. In an attempt to gain understanding of certain features of a system in states of high angular momentum we investigate a transparent model which allows us the possibility of complete mathematical and physical insight. A method, originally used to obtain the minimum energy configuration in the case of fermions contained within a one body potential of deformed oscillator form, simulating a self-consistent solution and which can be expressed as analytic functions of the number of particles in the system alone, is being generalized and developed for the case of a system rotating about an arbitrary axis.

Projected Shell Model and High-Spin Spectroscopy

K. Hara

Most of nuclei in the nuclear chart are deformed except for those in the vicinity of the magic numbers. It is difficult to treat such nuclei within the framework of the standard (spherical) shell model. On the other hand, the necessity for a proper quantum mechanical treatment of high-spin states has been steadily growing ever since modern experimental techniques made it possible to measure the fine details of the high-spin states of heavy nuclei. The present article reviews an approach based on the angular momentum projection technique which was initiated in the late seventies for the purpose of carrying out shell model configuration mixing calculations efficiently. A large number of examples is presented with an emphasis on the physical interpretation of the numerical results. Computing time for the whole spectrum up to spin ~ 40 of an axially symmetric rare-earth nucleus takes only few minutes on a mainframe showing the efficiency of the method. Most of the present calculations were carried out on a workstation but computation on a modern PC also presents no problem, so that one can enjoy a genuine quantum mechanical analysis of high-spin data using a facility available everywhere.

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