THE COLLECTIVE MODES OF EXCITATION AND SOFTNESS OF ATOMIC NUCLEI

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S u m m a r y

A survey of the present phenomenological theory of collective excited states in non-spherical soft nuclei is present. The structure of nucleus excitation can be described in various ways. Within models based on the A.Bohr Hamiltonian, the excited states are considered as eigenfunctions of this Hamiltonian, while, within the interacting-boson model, the excited states are treated as ground-state excitations. However, many relations obtained within different approaches agree well with one another and are quite appropriate for revealing general regularities in the phenomenology of the nuclear structure. Rotational-vibrational excitations of non-axial even-even nuclei are investigated on the basis of the Bohr – Mottelson Hamiltonian with dynamical variables (Euler angles, β- and γ-coordinates). A nucleus is considered as a soft β- and γ-quadrupole deformable rotator. The character of excited states depends upon two parameters specifying the longitudinal and transversal deformability of the nuclear surface. In soft nuclei, rotations are not separated from vibrations. The above parameters are computed from the data concerning the energies of excited levels. The inclusion of nuclear surface γ-vibrations generates additional energy bands featuring their own sets of quantum numbers for both positive and negative parity states. The scheme of calculations of the energy and wave functions of excited states in the β- and γ-bands by using perturbation theory is suggested. The results of the identification of nuclear levels obtained within this model are present for nucleus ^{76}Se. The role of the choice of a collective model for the description of neutron-nucleus elastic and inelastic scattering are analyzed.