Low-energy Excitations and Giant Resonances in Skin Nuclei.

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Low-energy excitations of different multipolarities are investigated theoretically in skin nuclei focusing on the possible relation of these modes to a neutron or proton skins. For this purpose a method incorporating the density functional theory and quasiparticle-phonon model is applied [1,2].

Studies of the structure of low-energy dipole and quadrupole states and corresponding neutron and proton transition densities indicate the presence of new modes of excitations that could be related to pygmy dipole and pygmy quadrupole modes of neutron or proton character depending on the charge asymmetry ratio N/Z of the nucleus. The nature of the pygmy resonances is found to be significantly different from the known giant resonances and scissors modes [2,3].

Furthermore, the unique character of the observed excitations is confirmed in quasiparticle-phonon model calculations of electric and magnetic dipole strength distributions in skin nuclei at different mass regions and compared to experimental data [4]. The investigations allow to decompose the dipole strength below the giant dipole resonance to elastic E1 component, related to skin oscillations and pygmy dipole resonance, and background component composed of elastic and inelastic E1 and M1 transitions, respectively.

The obtained information reveals new aspects in the isospin dynamics of the nucleus which might have important astrophysical consequences. Supported by BMBF project 06GI9109.

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