A pygmy quadrupole resonance in the stable Sn isotopes

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An extensive experimental study of the recently predicted pygmy quadrupole resonance (PQR) in the stable even-even Sn isotopes [1] will be presented. In this study, $(\alpha, \alpha'\gamma)$ and (γ, γ') experiments were performed on ^{124}Sn [2] as well as lifetime measurements in ^{112,114}Sn using the recently established $(p, p'\gamma)$ Doppler-shift attenuation (DSA) coincidence technique [3]. In all experiments, $J^\pi = 2^+$ states below an excitation energy of 5 MeV were populated. The $E2$ strength integrated over the full transition densities could be extracted from the (γ, γ') and the $(p, p'\gamma)$ DSA experiments, while the $(\alpha, \alpha'\gamma)$ experiment at the chosen kinematics strongly favors the excitation of surface modes because of the strong α-particle absorption in the nuclear interior. The excitation of such modes is in accordance with the quadrupole-type oscillation of the neutron skin predicted by a microscopic approach based on self-consistent density functional theory and the quasiparticle-phonon model (QPM). The newly determined γ-decay branching ratios hint at a non-statistical character of the $E2$ strength, as it has also been recently pointed out for the case of the pygmy dipole resonance (PDR). This allows us to distinguish between PQR-type and multiphonon excitations and, consequently, supports the recent first experimental indications of a PQR in ^{124}Sn [2, 4].

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