Description of isoscalar multipole giant resonances within the particle-hole dispersive optical model

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A continuing interest in experimental and theoretical studies of the isoscalar multipole giant resonances (ISMPGRs), in particular, the compression modes of nuclear excitations, is explained by the possibility of determining the nuclear-matter incompressibility coefficient. In this work, we present a description of the mentioned giant resonances in closed shell medium-heavy nuclei. Calculations performed within the particle-hole dispersive optical model (PHDOM) [1], provide the description of properties of each GR, including the energy-averaged strength function, double and one-body projected transition densities and partial probabilities of direct one-nucleon decay. All the model parameters (related to a mean field and Landau-Migdal particle-hole interaction) are taken from independent data. Only the parameters related to the imaginary part of the energy-averaged particle-hole self-energy term, responsible for the spreading effect, are adjusted to describe within the model the total width of the considered giant resonance. An example of the application of the above-described approach for the isoscalar giant monopole resonance in ^{208}Pb is given in Refs. [2]. In the present work, we extend such a description for ISMPGRs with multipolarity $L \leq 3$. Overtones of the isoscalar monopole and quadrupole giant resonances are also considered. Calculation results obtained for Zr, Sn and Pb are compared with the available experimental data. In particular, the unique data on the direct one-nucleon decay of the isoscalar dipole giant resonance [3] are considered. Possibilities to use the one-body projected transition density for describing inelastic α-scattering accompanied by excitation of isoscalar giant multipole resonances are also discussed.

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