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The dipole polarizability of the doubly-magic nuclei

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The study of nuclear giant resonances has long been a subject of extensive theoretical and experimental research. Experimental data on giant resonances have allowed us to determine fundamental properties associated with the nuclear interaction in the nuclear medium. In particular, the study of the giant dipole resonances (GDR) is expected to provide information on the symmetry energy term of the nuclear equation of state. This information is very relevant for the modeling of neutron stars. The energy region studied in the GDR also covers the major part relevant to a determination of the nuclear electric dipole polarizability. The electric dipole polarizability is a particularly important observable, as it can be measured in finite nuclei and it provides important information on the neutron skin thickness that can be extracted.
The new spectroscopic studies of the GDR in neutron-rich nuclei stimulate a development of the nuclear models. One of the successful tools for describing the GDR is the random phase approximation (RPA) with the self-consistent mean-field derived by making use of the Skyrme effective nucleon-nucleon interaction. As an illustration, we study the properties of the electric dipole strength distributions of 16,28 O, 40,48,60 Ca, 56,68,78 Ni, 100,132,176 Sn and 208 Pb. The nuclear dipole polarizability is computed. Our results are in reasonable agreement with available experimental data. The correlations between the nuclear dipole polarizability and the neutron skin thickness are analyzed in a systematic way.

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