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Systematic study of electric dipole excitations with fully self-consistent Skyrme HF+RPA from light to medium-mass deformed nuclei

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Radioactive isotope facilities of the new generation enable us to access unexplored territories of unstable nuclei with large neutron excess. Theoretical studies and predictions of properties of unknown nuclei are important subjects in nuclear structure physics. In order to clarify peculiarities of these exotic nuclei, we need systematic calculations across the entire nuclear chart. The nuclear density-functional approach provides a promising tool for this purpose. So far, the ground-state properties of even-even nuclei have been investigated with use of the Hartree-Fock-Bogoliubov calculation. Systematic investigations for excited 2^+ states have been recently done with a few groups using different methods and different functionals

We have carried out systematic calculations of the electric dipole modes of excitation up to Ni isotopes in the self-consistent Skyrme-Hartree-Fock (SHF) plus RPA approach. We solve the equations in the three-dimensional Cartesian-coordinate-mesh representation without any spatial symmetries. The fully self-consistent RPA are realized using an iterative method we have recently developed; the finite amplitude method (FAM). The method allows us to treat both spherical and deformed nuclei on an equal footing and simultaneously to avoid explicit evaluations of complex residual fields. We will show systematics of the centroid energies, widths, and deformation splitting of the giant dipole resonances, in comparison with experiments. We also discuss variations of the low-lying dipole mode in neutron-rich and proton-rich nuclei.

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