Systematic calculation of photoresponse with the Skyrme functional

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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 becoming more and more important subjects in nuclear physics. In order to find new features and useful concepts for these exotic nuclei, it is desired to perform systematic calculations for nuclei across the entire nuclear chart. The nuclear density-functional approach provides a promising tool for this purpose. Systematic investigations for the ground-state properties [1] and excited 2^+ states [2] of even-even nuclei have been recently performed by a few groups using different methods and different functionals.

We have carried out systematic calculations for the electric dipole modes of excitation up to Ni isotopes in the fully self-consistent Skyrme-Hartree-Fock (SHF) plus random-phase-approximation (RPA) approach in the three-dimensional coordinate-space representation [3]. The fully self-consistent calculation for deformed nuclei is achieved using the finite amplitude method (FAM), which we have recently developed [4]. The method allows us to avoid explicit evaluation of complex residual fields. We solve the FAM equations in the three-dimensional Cartesian-coordinate-mesh representation without any spatial symmetries. Recently, we have also developed a quasi-particle-RPA verison of the FAM [5] and the canonical-basis formulation of the time-dependent Hartree-Fock-Bogoliubov theory [5] to take into account the pairing correlations.

A part of our result is shown in the Fig. 1, for $E1$ strength distribution up to Ca isotopes. We will show systematics of the centroid energies, widths, and deformation splitting of the giant dipole resonances, low-lying dipole modes in neutron-rich and proton-rich nuclei, in comparison with experiments.

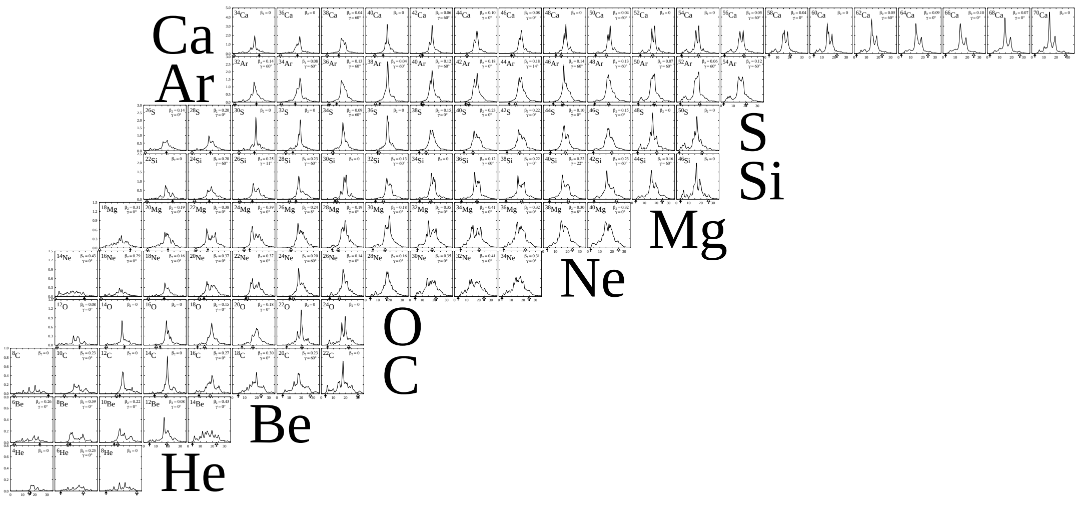

FIG. 1: Calculated $E1$ strength distributions for even-even nuclei from He to Ca isotopes.

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