Time-dependent density-functional calculation of nuclear response functions

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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. In addition to calculating properties of the nuclear ground states, systematic investigations for excited 2^+ states of even-even nuclei have been recently performed by a few groups using different methods and different functionals [1, 2].

For calculations of nuclear response, we have been developing several theoretical methods based on the time-dependent density functional theory; real-time methods[3, 4], quasiparticle random-phase approximation [5], finite amplitude method [6–13], and second RPA[14]. In this presentation, we will show our recent results on nuclear response and related topics, such as the giant resonances in deformed nuclei, low-lying dipole modes in neutron-rich and proton-rich nuclei, etc.

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