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Nuclear giant resonances studied by a self-consistent Skyrme quasiparticle vibration coupling approach

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Nuclear giant resonances provide deep insight in understanding the structure of atomic nuclei as well as constraining the nuclear equation of state (EoS). The giant monopole resonance (GMR) and giant dipole resonance (GDR) provide effective constraints on nuclear incompressibility and symmetry energy slope parameter, respectively. The giant quadrupole resonance (GQR) gives useful information on nucleon effective mass. The quasiparticle random phase approximation (QRPA) model is the most commonly used microscopic model to study the giant resonances of atomic nuclei. However, due to the lack of higher-order many-body correlations beyond the mean field, the resonance width cannot be given, and serious problems are encountered when describing the GMR energies. In this talk, I will introduce how to solve the above problems by developing a self-consistent quasiparticle random phase approximation + quasiparticle vibration coupling model based on Skyrme density functional which considers higher-order many-body correlations. Furthermore, facing to various modes of nuclear giant resonances, the photonuclear reaction is only limited to the study of nuclear dipole excitations, so I will discuss new possibilities to excite different modes of nuclear giant resonances with vortex photons.

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