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Shape fluctuations in transitional nuclei

Some nuclei in the transitional region exhibit shape coexistence and shape fluctuations (for example γ-soft) in low-lying energy spectra. To treat such shape fluctuations, quadrupole collective Hamiltonian approach based on energy density functionals (EDF) has often been employed [1]. However, in that approach, the collective inertial functions in the Hamiltonian is derived by the so-called cranking approximation, which neglects dynamical effects. Our goal is to construct the quadrupole collective Hamiltonian, especially to derive the collective inertial functions by the local quasiparticle random phase approximation (QRPA) that correctly includes dynamical effects [2]. Toward this goal, we have first developed an efficient computational framework to perform QRPA on β–γ deformation space based on Skyrme EDF with the finite amplitude method (FAM) that efficiently computes strength functions for multipole modes [3]. We have obtained the strength functions of isoscalar quadrupole modes of triaxial superfluid nuclei ^{110}Ru and ^{190}Pt within a reasonable computational cost [4]. Then, as a next step, we estimate collective inertial functions in the quadrupole collective Hamiltonian. To do this, we apply our Skyrme-QRPA to local Skyrme-QRPA on each $\beta - \gamma$ deformation to estimate collective inertial functions, rotational mass (moment of inertia) and vibrational mass. We find a significant enhancement of the inertial functions from those by the cranking approximation. This is due to dynamical effects derived from local QRPA calculations.

In this contribution, we will show strength functions of isoscalar quadrupole modes of selected triaxial superfluid nuclei. Then, we will discuss the property of mass inertial functions derived from the present local Skyrme-QRPA calculation for the case of a transitional nucleus ^{106}Pd.

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