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Microscopic fission collective inertias for astrophysical applications

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Nuclear fission is one of the most important nuclear phenomena and arguably its most interesting astrophysical application is in the study of r-process nucleosynthesis. The theoretical description of fission is a challenging quantum many body problem and one such key challenge is the description of collective inertias along the fission path. In most of the fission calculations, the collective inertia is evaluated using cranking approximation which neglects the dynamical residual effects. Recently, a new method for the calculation of collective inertias using finite amplitude method - quasiparticle random phase approximation (FAM-QRPA) method was devoloped which also takes into account the consistent treatment of dynamical effects neglected in cranking approximation [1]. Work is in progress in developing FAM-QRPA approach using the finite range Gogny energy density functionals and axial symmetry preserving Hartree-Fock-Bogoliubov framework to compute collective inertias needed for fission calculations. The obtained results will be then used to compute new fission reaction rates relevant for r-process calculations. This work is supported by International Graduate School (IRTG 2891) Nuclear Photonics.

1. K. Washiyama, N. Hinohara, and T. Nakatsukasa, Phys. Rev. C 103, 014306 (2021)

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