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Nuclear Collective Rotations on Excited Configurations

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Abstract

Nuclear rotational bands built on excited configurations provide rich information for nuclear structure studies. These bands are called sidebands, relative to the ground-state band which is built on the lowest-energy configuration. Theoretically, the calculations of sidebands are usually difficult due to the non-convergence problem of the numerical iteration of the cranking shell model in the case of the residual pairing interaction considered. But the cranking calculation with self-consistent pairing and deformation is a powerful tool to describe the collective rotations of nuclei. For sidebands, configuration-constrained tracking calculations are also necessary to get self-consistent results.

In this talk, we will show the recent developments of cranking calculations based on the Woods-Saxon potential or the Skyrme Hartree-Fock model. An important improvement is that we have incorporated a particle-number-conserved pairing into the total-Routhian-surface (TRS) calculation. The pairing method has the merit of the standard shell model, and can lead to a converged solution of the cranking calculation with pairing. The configuration-constrained TRS method gives a configuration-pairing-deformation self-consistent calculation for the collective rotation of an excited configuration. The calculated moments of inertia can well reproduce experiments. It is found that a self-consistent variable deformation is important to reproduce experimental observations and the pairing still plays an important role even in high seniority and high spin.