Nuclear isomerism is mostly due to breaking of nucleon pairs and forming of large intrinsic angular momenta, which are usually called high-K isomers in deformed nuclei. For unstable nuclei, the isomers can have even longer lifetimes than their ground states. In the last 20 years, we have investigated many possible high-k isomeric states for different mass regions, calculating their excitation energies, deformations and analyzing isomeric mechanism, combining experimental works.

Recently, we are moving towards the calculations of the collective rotations of the isomeric states. 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 tracking calculations are also necessary to get self-consistent results.

In this talk, we will also show the new developments of cranking calculations based on the Woods-Saxon potential and 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 [1, 2]. 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.
