Application of 3D-cranking model to even-even systems with triaxiality

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With the development in the tilted-axis cranking model, interesting rotational motions are recently suggested: magnetic rotation produced by anisotropy of electric current or magnetic moment, tilted rotation created by breaking the signature symmetry, and chiral rotation as a result of triaxial deformation and chiral symmetry breaking [1, 2]. In particular, study of nuclear chirality attracts much interest. The original model for the chiral configuration is based on the presence of particle, hole, and rotor whose angular momentum vectors point at the directions along different principal axes of triaxially deformed core. From this reason, odd-odd systems, e.g., an even-even core plus a proton particle and a neutron hole, are more suitable to realize the chiral rotation.

Nevertheless, even in even-even systems, there is a possibility of an emergence of nuclear chirality, if Cooper pairs are broken simultaneously both for protons and neutrons. Rotation-aligned states with multi-quasiparticles can be natural candidates for the chiral states in even-even systems if triaxial deformation is accompanied.

We have developed a method based on the theories of Kerman-Onishi [3] and Onishi-Horibata [4, 5] so as to investigate three-dimensional rotations (including chiral rotations) from a microscopic, self-consistent, and quantum mechanical approach [6]. With this method (3D-cranked HFB), we attempt to find chiral solutions in a fully self-consistent treatment in shape and pairing. The analyses will be presented for ^{136}Nd and ^{134}Ce.

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