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Chiral basis for particle-rotor model for triaxial nuclei

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In the last decade nuclear chirality resulting from an orthogonal coupling of angular momentum vectors in triaxial nuclei has been a subject of numerous experimental and theoretical studies. Three perpendicular angular momenta can form two systems of the opposite handedness, the right-handed and the left-handed system; the time-reversal operator, which reverses orientation of each of the components, relates these two systems. The underlying mechanism for generating chiral geometry of angular momentum coupling emphasizes the interplay between single-particle and collective degrees of freedom in nuclear structure physics. In the simplest case of odd- odd nuclei, two out of three mutually orthogonal angular momenta are provided by the high-j valence proton and neutron quasiparticles, which are of particle and hole character as defined by the respective position of the Fermi level within a unique-parity sub-shell. The single-particle contribution to the total energy is minimised when the angular momenta of the particles and holes align along the short and the long axis of the core, respectively. The third angular momentum component is provided by the collective core rotation and aligns along the axis of the largest moment of inertia; this is the intermediate axis for irrotational flow-like moments of inertia for a triaxial body. This simple picture leads to prediction of distinct observables manifesting chirality in rotational structures, most notably to the doubling of states. All these effects can be demonstrated using particle-rotor model for triaxial nuclei, and are especially transparent when a newly developed chiral basis is used in calculations. The model, the basis, numerical results, and comparison to the data will be presented and discussed.

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