Semiclassical description of wobbling and chiral modes in triaxial nuclei

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Abstract. A time-dependent variational principle with an angular momentum coherent state playing the role of the variational state [1], is used to describe the dynamics associated to a triaxial rotor Hamiltonian with rigidly aligned high-j quasiparticles. Solving the variational principle with a stereographic parametrization of the coherent state, one obtains a classical energy function and a set of canonical equations of motion expressed in terms of the azimuth angle and a canonical conjugate coordinate related to the polar angle. The system's rotational dynamics is investigated through the evolution on total angular momentum of the canonical variables as well as spherical angles corresponding to distinct minima in the constant energy surface. The unique minimum energy conditions define phases with specific dynamical behaviour. The conditions are also spin-dependent and therefore a dynamical phase transition can occur. This effect is investigated for a single and two aligned single-particle spins. In the first case the transition is associated to the changing from transversal to tilted-axis wobbling, while in the later case to the smooth evolution from chiral vibration to static chirality. The discrete energy levels and corresponding wave-functions are obtained through a quantization procedure applied to the classical energy function. The formalism is used for the description of wobbling excitations in odd mass nuclei [2] and chiral doublet bands in odd-odd nuclei [3], with numerical applications to ^{135}Pr and ^{134}Pr nuclei

References

[1] A. A. Raduta, R. Budaca, and C. M. Raduta, Phys. Rev. C 76, 064309 (2007).
[2] R. Budaca, Phys. Rev. C 97, 024302 (2018).
[3] R. Budaca, Phys. Rev. C 98, 014303 (2018).