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Chiral bands with rigid quasiparticle alignments

R. Budaca[1,2]

[1]"Horia Hulubei" National Institute for Physics and Nuclear Engineering, Str. Reactorului 30, RO-077125, POB-MG6 Bucharest-Măgurele, Romania
[2]Academy of Romanian Scientists, 54 Splaiul Independenţei, RO-050094, Bucharest, Romania

Abstract

A triaxial particle-rotor Hamiltonian describing a system of two high-j quasiparticles rigidly aligned to a triaxial collective core, is treated semiclassically within a time-dependent variational principle [1]. The resulting classical energy function is used to investigate the rotational dynamics of the system. It exhibits two minima starting from a critical angular momentum value which depends on the single-particle configuration and the triaxiality measure γ. The appearance of the two minima is attributed to the breaking of the chiral symmetry. Quantizing the energy function for a given angular momentum, one obtains a Schrödinger equation with a coordinate dependent effective mass for a symmetrical potential which changes from a single to a double well shape as the angular momentum passes the critical value. A single minimum chiral potential is associated to a chiral vibration, whereas a potential with two deep minima corresponds to a static chirality. The transition between the two phases is not sudden, being extended over few angular momentum states where the system undergoes a double-minimum chiral vibration including tunneling effects between the separate chiral potential wells. The energies of the chiral partner bands for a given angular momentum are then given by the lowest two eigenvalues. The results for a valence $h_{11/2}$ proton particle and a $h_{11/2}$ neutron hole alignments are investigated as a function of total angular momentum and the triaxiality measure. The experimental realization of the model is presented for the chiral doublet bands in ^{134}Pr.

References

[1] R. Budaca, *Phys. Rev. C* **98** (2018) 014303.