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Multiple many-particle chiral systems described within the particle-rotor model

A nuclear chiral system is formed when the total angular momentum of the nucleus is aplanar, i.e. when it has significant projections along all three nuclear axes [1]. Most important for the identification of chiral bands is to establish a pair of ΔI = 1 bands that are near-degenerate in energy, but also in B(M1) and B(E2) transition probabilities [1]. Up to date, chiral candidates showing two- or multi-quasiparticle partner bands have been observed in several nuclei in A ~ 80, 100, 130 and 190 mass regions. It was suggested that multiple chiral partner bands (MXD) with the same two-quasiparticle nucleon configuration may exist in a single nucleus [1-3]. The first multiplet of chiral bands built on the same multi-quasiparticle configuration was observed in 103Rh [4]. Such a scenario was also considered recently for 194Tl [5].

In this work the multi-particle-plus-triaxial-rotor (MPR) [6] model calculations were performed for multiple chiral systems associated with the same multi-quasiparticle configurations in the 100, 130 and 190 mass regions described with a realistically large configuration space for the odd proton(s) and the odd neutron(s). The main objective was to study the properties of the excited chiral systems associated with the same nucleon configuration. In particular we were interested in whether the excited chiral systems might show better near-degeneracy than the yrast one.

Multiple chiral systems associated with many-particle nucleon configurations were found, but they may not necessarily form pairs of near-degenerate bands in an obvious way. Our calculations showed that in order to search for the best chiral symmetry, one needs to study not only the two lowest-energy bands, but also as many excited bands as possible. It is quite possible that the excited bands will couple into pairs with more similar geometry of the intrinsic angular momenta as a function of spin, and show closer intrinsic structure, than the two lowest-energy bands. It is also concluded that to couple chiral bands into pairs with a similar nature one needs to consider the projections of the angular momenta along the nuclear axes. Part of the results from this work has been published in Ref. [7]. The results from these calculations will be presented and discussed.

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[1] S. Frauendorf, J. Meng, Nucl. Phys. A 617, 131 (1997).
[2] Q.B. Chen et al., Phys. Rev. C 82, 067302 (2010).
[3] H. Zhang, Q. Chen, Chin. Phys. C 40, 024102 (2016).
[4] I. Kuti et al., Phys. Rev. Lett. 113, 032501 (2014).
[5] P.L. Masiteng et al., Eur. Phys. J. A 50, 119 (2014);P.L. Masiteng et al, Eur. Phys. J. A 52, 28 (2016).
[6] B.G. Carlsson, I. Ragnarsson, Phys. Rev. C 74, 044310(2006); B.G. Carlsson, Models for rotating nuclei - cranking and rotor plus particles coupling, PhD Thesis (Lund University, 2007) ISBN 978-91-628-73554; B.G. Carlsson, Int. J. Mod. Phys. E 16, 634 (2007).
[7] O. Shirinda and E.A. Lawrie, Acta Phys. Pol. B46, (2015) 683; O. Shirinda and E.A. Lawrie, Eur. Phys. J. A52, 344 (2016).

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