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SU*(3) limit of the Interacting Boson Model and its relation to the realistic shell model

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In the neutron-proton interacting boson model (IBM-2) [1], the SU*(3) limit appears, which has a triaxial nature. It was first clarified by A.E.L. Dieperink and R. Bijker [2] with group theory and with coherent state analysis. This triaxiality has been also suggested from the correspondence between shape variables (β, γ) and SU(3) irrep label (λ, μ) by Ref. [3]. Moreover, the SU*(3) limit corresponds to one of the corners in IBM-2's extended symmetry triangle, where quantum phase transition lines (surfaces) and quantum critical points between spherical and triaxial shapes have been reported in Refs [4,5].

Here, we investigate the ground state and the excited state properties of the SU*(3) limit with angular momentum projected coherent state beyond mean field picture. We will discuss the relationship between intrinsic pictures and group theory, and will clarify the characteristics of the SU*(3) limit.

IBM-2 has given us various useful concepts to understand interacting nucleon systems. However, it is limited in the quantitative description because complex dynamics of fermion pairs are treated by boson approximation. The IBM concepts should be reinvestigated within the realistic shell model with the help of modern computational many-body methods.

Recently, we found a shell-model counterpart of the IBM-2 extended symmetry triangle by large-scale shell model calculation. Here we use the angular momentum projected Generator Coordinate Method (GCM) based on the Hartree-Fock-Bogoliubov (HFB) states with the realistic shell model (PMMU) interaction [6]. We will report it.

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