Int. Workshop "Shapes and Dynamics of Atomic Nuclei: Contemporary Aspects"
ed. Nikolay Minkov, Heron Press, Sofia 2017

Introduction of fermion degrees of freedom in IVBM for the description of spectra of odd nuclei

V. P. Garistov[1], **A. I. Georgieva**[2]

[1]Institute of Nuclear Research and Nuclear Energy,
Bulgarian Academy of Sciences, 1784 Sofia, Bulgaria
[2]Institute of Solid State Physics, Bulgarian Academy of Sciences,
1784 Sofia, Bulgaria

Abstract

The description of odd-mass nuclei requires the introduction of fermion degrees of freedom, which are coupled to the neighboring even-even nuclei used as a core.

A very accurate results for the energy spectra of the even- even nuclei have been obtained in the application of one of the dynamical symmetries:
$Sp(12,R) \supset U(6) \supset U(3) \otimes U(2) \supset O(3) \otimes (U(1) \otimes U(1))$
of the Interacting Vector Boson Model (IVBM). Here, a new development of the model is employed, which is based on a new physically more appropriate correspondence of the experimentally observed states and the basis for this chain.

We introduce the fermion degree of freedom trough the angular momentum $I = 1/2$ for the single fermion coupled to the angular momentum L of the states of the ground and octupole bands of the core $\mathbf{J} = \mathbf{L} + \mathbf{I}$. The results are illustrated by the comparison of the theory with the experimental spectra of the ground and octupole bands ot the even-even nuclei ^{236}U and ^{238}Pu and the collective bands build on them in the odd ^{237}U and ^{239}Pu which are very long.

From an algebraic point of view, this can be presented as an extension of the dynamical symmetry group $Sp(12,R)$ of the IVBM to the orthosymplectic group $OSp(2\Omega/12,R)$, which contains the direct product of $SO^F(2\Omega)$ of the fermion degrees of freedom and the boson part $Sp^B(12,R)$ describing the even-even system. The approach can be extended for the description of the spectra of odd-odd nuclei as well.