Nuclear supersymmetry $SU(3) \subset SU(3) \otimes SU(2j+1)$

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Exact nuclear supersymmetry $O(6) \otimes U(4) \supset$ Spin (6) was recently suggested for a coupled boson-fermion system of the Interacting boson-fermion approximation.[1]

We have pointed out[2] that the appearance of this supersymmetry is independent of the IBFA approximation: the same supersymmetry appears in the equivalent SU(6) particle-quadrupole phonon coupling model (PTQM)[2].

Furthermore, in the framework of PTQM we have investigated possible approximate supersymmetries, by considering the overlap integrals of the calculated wave functions with the projected coherent states[2,3]. On this basis, we propose an approximate supersymmetry for the system of quadrupole phonons in the SU(3) limit, and of single-particle $|j\rangle$ coupled to the quadrupole phonons in the SU(3) limit. The corresponding phonon (labelled by B) and the fermion (labelled by F) chains of algebra lead to

$$U(6/2j+1) \supset SU^B(3) \otimes U^F(2j+1) \supset SU^B(3) \otimes SU^F(2j+1) \gtrsim$$
$$SU^B(3) \otimes SU^F(3) \supset SU^{BF}(3) \supset O^{BF}(3) \supset U^{BF}(2) \quad .$$

The approximation $SU^F(2j+1) \gtrsim SU^F(3)$, where $SU^F(3)$ algebra contains the generator $A_2^F = (c_j^+ c_j)_2$, is obtained by neglecting a term with A_3^F in the commutator $[A_2^F, A_2^F]$. Thus, the approximate supersymmetry energy relation appears:

$$E = \xi C^{BF}(\lambda,\mu) + \xi J(J+1) \ ,$$

where C denotes the eigenvalue of the Casimir operator of $SU^{BF}(3)$. The experimental verification of this approximate supersymmetry would be highly desirable.

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1) F.Iachello, Phys.Rev.Lett. 44 (1980)772
2) V.Paar, in Proceedings of Nuclear Physics Workshop, Trieste 1981, (North-Holland, Amsterdam, in print)
3) V.Paar, S.Brant and H.Kraljević, to be published