Dyson representation and SU(6) symmetry for odd system

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Starting from the Dyson representation for odd system we get the approximate SU(6) particle-vibration interaction which consists of two terms, the dynamical interaction and the exchange term[1]:

$$H_{DYN} = \sum_{j_1 j_2} \Gamma_{j_1 j_2} \left[(c^+_{j_1} \tilde{c}_{j_2})_2 \, Q_2 \right]_0 ,$$

$$H_{EXC} = - \sum_{j_1 j_2 j_3} \Lambda_{j_1 j_2 j_3} : \left[(c^+_{j_1} \tilde{b})_{j_3} \; (\tilde{c}_{j_2} b^+)_{j_3} \right]_0 :$$

where

$$Q_{2\mu} = b^+_\mu \sqrt{N-\hat{N}} + \sqrt{N-\hat{N}}\, \tilde{b}_\mu + \chi (b^+ \tilde{b})_{2\mu}$$

$$\Gamma_{j_1 j_2} = \sqrt{5} \sum (u_{j_1} u_{j_2} - v_{j_1} v_{j_2}) \langle j_1 \| Y_2 \| j_2 \rangle$$

$$\Lambda_{j_1 j_2 j_3} = -\kappa_2 \rho \langle r^2 \rangle^2 \; (u_{j_3} v_{j_2} + v_{j_3} u_{j_2}) \frac{2(E_{j_3} + E_{j_2})}{(E_{j_2} + E_{j_2})^2 - (\hbar\omega)^2} \times$$

$$(u_{j_1} v_{j_3} + v_{j_1} v_{j_3}) \frac{1}{\sqrt{2j_3+1}} \langle j_3 \| Y_2 \| j_2 \rangle \langle j_3 \| Y_2 \| j_1 \rangle .$$

Here b^+_μ and c^+_{jm} are the creation operators of the quadrupole phonon and the quasiparticle state, respectively. Thus, IBFM[2] is merely a particular type of particle-quadrupole phonon coupling model.

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1) V.Paar and S.Brant, Phys.Lett. 105B (1981)81

2) F.Iachello and O.Scholten, Phys.Rev.Lett. 43 (1979)679