An Energy - B(E2) generalized vibrational rule for one-phonon multiplets in odd-A nuclei

V.Paar
Prirodoslovno-matematički fakultet, University of Zagreb, Zagreb, Yugoslavia

The rule is derived for the energies of one-phonon multiplet states and for the transition moments for the ground - state E2 transitions[1]. Selected leading diagrams with the particle-vibration interaction and nuclear anharmonicities have been included; these are not affected by the nuclear Ward identities. The asymptotic complementarity of corrections to the energies and transition moments is derived.

In the asymptotic limit ($j \gg \frac{1}{2}$) the following rule arises:

$$\frac{E(|j,12;I\rangle)}{\hbar\omega} = -\left(\frac{B(E2;|j,12;I\rangle \to |j\rangle)}{B(E2,2_1 \to 0_1)}\right)^{\frac{1}{2}} =$$

$$\lambda \begin{cases} -12/(2j)^2 - \xi & , I = j-2 \\ 12/(2j)+1(2\xi) & , I = j-1 \\ 1(2j) + \xi & , I = j \\ -12/(2j)+1(2\xi) & , I = j+1 \\ -12/(2j)^2 - \xi & , I = j+2 \end{cases}$$

$$= -\frac{1}{\sqrt{4\pi}} \frac{\hbar\omega}{|a|} \frac{\vartheta_{(j)}\, Q(2_1)}{(B(E2,2_1 \to 0_1))^{1/2}} ,$$

$$a = -\frac{1}{3}\sqrt{4\pi}\langle k\rangle \frac{(B(E2_1 2_1 \to 0_1))^{1/2}}{ZR_0^2} ,$$

$$\vartheta_{(j)} = \begin{cases} +1 & \text{if } |j\rangle \text{ is a particle - like state,} \\ -1 & \text{if } |j\rangle \text{ is a hole - like state.} \end{cases}$$

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1) V.Paar, Nucl.Phys. A351 (1981)1; Fizika 12 (1980)145