

Shears Effect with PAC Core Rotation for Dipole Bands in ^{142}Gd and $^{130,132}\text{La}$

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The enhancement of M1 transitions in dipole bands (DB) can be explained semiclassically if the multi-quasiparticle configuration are separable into two components with different orientations of the angular momenta \mathbf{j}_1 and \mathbf{j}_2 with respect to the principal x- and z-axes. For transitional nuclei this so-called Shears mechanism [1] can be combined with the Principal Axis Cranking Cranking (PAC) coupling scheme where the vector \mathbf{R} is parallel to the x-axis and is referred to as the semiclassical SPAC model [2,3]. The total energy contains collective and quasiparticle contributions: $E(I, \theta_1, \theta_2) = C(I)R^2(I, \theta_1, \theta_2) + V_2 P_2(\theta_1 - \theta_2)$, where θ_1 and θ_2 are the angles between the x-axis and the vectors \mathbf{j}_1 , \mathbf{j}_2 respectively, and the collectivity parameter $C=1/2J$ is assumed as spin dependent. For each value of I , the angles θ_1 and θ_2 can be found by the minimization of the total energy E . The transition probabilities $B(M1)$ and $B(E2)$ can be expressed as functions of I . In case of dipole bands in ^{141}Eu [2], ^{142}Gd [3] and ^{139}Sm [4] the SPAC model reproduces the experimental data very well. In the present work new results of lifetime measurements for DB5 in ^{142}Gd [5] and for the yrast DB in ^{130}La [6] are described in the framework of the SPAC model. Results for energy structures and $B(M1)$ values are presented in Figs. 1, 2. In case of DB5 in ^{142}Gd results of Tilted Axes Cranking (TAC) calculations are also presented. In case of ^{130}La the results are compared with those for the yrast DB of ^{132}La [7]. For both nuclei the parameters of the calculations are the same, but for a reproduction of the high-spin regions a mixture of 2-qp and 4-qp structures was taken into account.

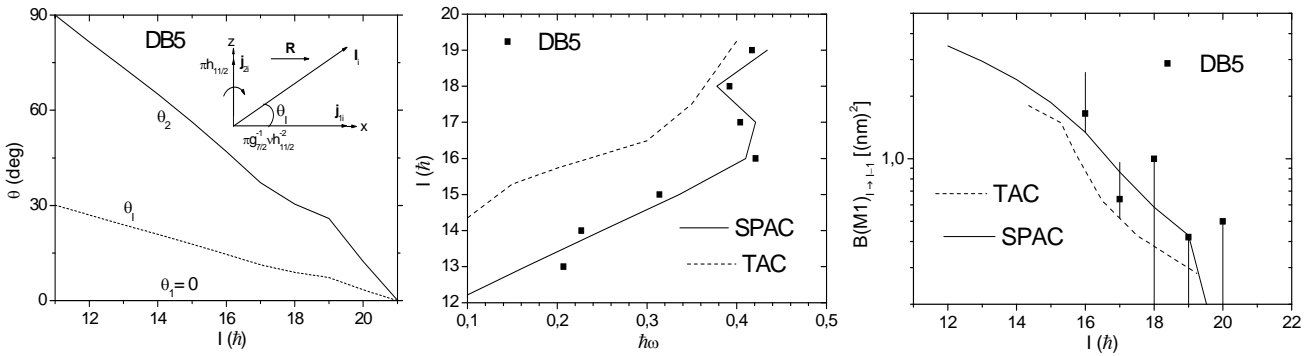


Fig. 1. Results for DB5 in ^{142}Gd . **Left:** Angles of vectors \mathbf{j}_1 , \mathbf{j}_2 and \mathbf{I} vs. spin. **Middle:** Experimental I vs. $\hbar\omega$ plots are compared with TAC and SPAC model calculations. **Right:** The corresponding $B(M1)$ values.

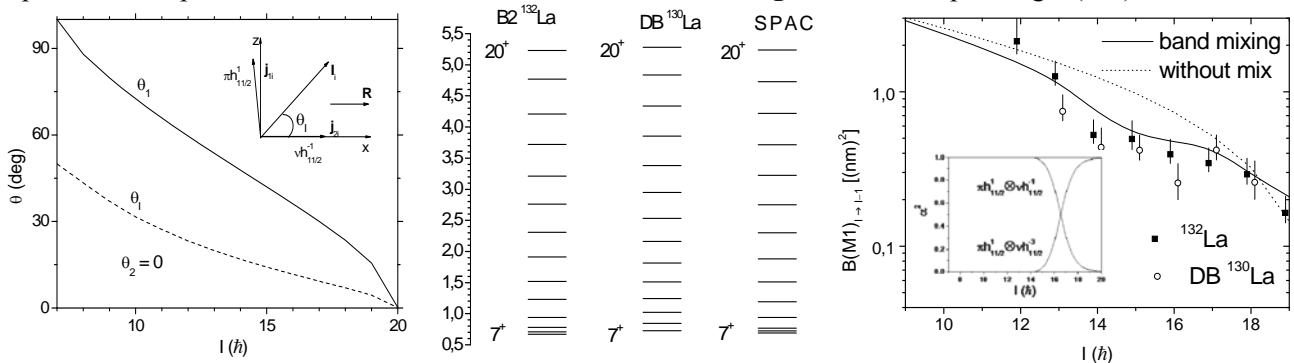


Fig. 2. Results for dipole bands in $^{130,132}\text{La}$. **Left:** the same as in Fig. 1. **Middle:** Experimental and calculated energies. **Right:** The corresponding $B(M1)$ values with and without 4-qp structure admixture.

References

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