SHEARS EFFECT AND PAC CORE ROTATION FOR M1 BANDS IN ^{142}Gd, ^{141}Eu AND ^{132}La

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The enhancement of M1 transitions can be explained semiclassically if the multi-quasiparticle can be divided into two components with different orientation of the angular momenta $\mathbf{j_1}$ and $\mathbf{j_2}$ with respect to the principal axes x and z. For weakly deformed nuclei the collective rotation has been included into this model in the framework of the uniform rotation coupling scheme (SURC), in which the collective rotation vector **R** and **I** are parallel to each other [1]. For transitional nuclei the shears mechanism can be combined with the PAC coupling scheme where the vector **R** is parallel to x and can be referred to as SPAC semiclassical model. The total energy contains collective and quasiparticle contributions: $E(I,\theta_1,\theta_2) = C(I)R^2(I,\theta_1,\theta_2) + V_2P_2(\theta_1-\theta_2)$, where $C(I) = (2J)^{-1}$, P_2 is a Legendre polynomial, θ_1 and θ_2 are the angles between the x-axis and the vectors $\mathbf{j_1}$, $\mathbf{j_2}$ respectively and R is determined geometrically. For each value of I the angles θ_1 and θ_2 can be found by the minimization of the total energy E. Subsequently, the transition probabilities B(M1) and B(E2) can be expressed as functions of I. Unlike SURC the SPAC coupling can be realized in two symmetrical initial orientations of $\mathbf{j_2}$ – "normal" and "inverse" and can generate three different dipole bands: "normal", "inverse clockwise " (ICW) and "inverse counterclockwise" (Fig. 1 left). In case of the 4 and 3-quasiparticle dipole bands in ^{142}Gd and ^{141}Eu "inverse" bands are energetically favored as compare to the "normal" bands and the SPAC model describes well the experimental data including the backbending regions [2]. In the case of ^{132}La three dipole bands with simple 2-qp structure have been identified and level lifetimes were measured [3]. The interpretation of two from these bands as a chiral pair cannot explain particularly the large difference in the B(M1) and B(E2) spin dependencies. In the framework of SPAC these three bands can be described as corresponded to the same structure but for different symmetries mentioned above (Fig. 1).

[1] R.M. Clark and A.O. Macchiavelli, Ann. Rev. Nucl. Part. Sci. **50** (2000) 1
[2] R.M. Lieder, A.A. Pasternak, E.O. Podsvirova, *The Labyrinth in Nucl. Str.*, AIP (2004) 238
[3] E. Grodner *et al.*, Int. Journal of Modern Physics **E** (2004)

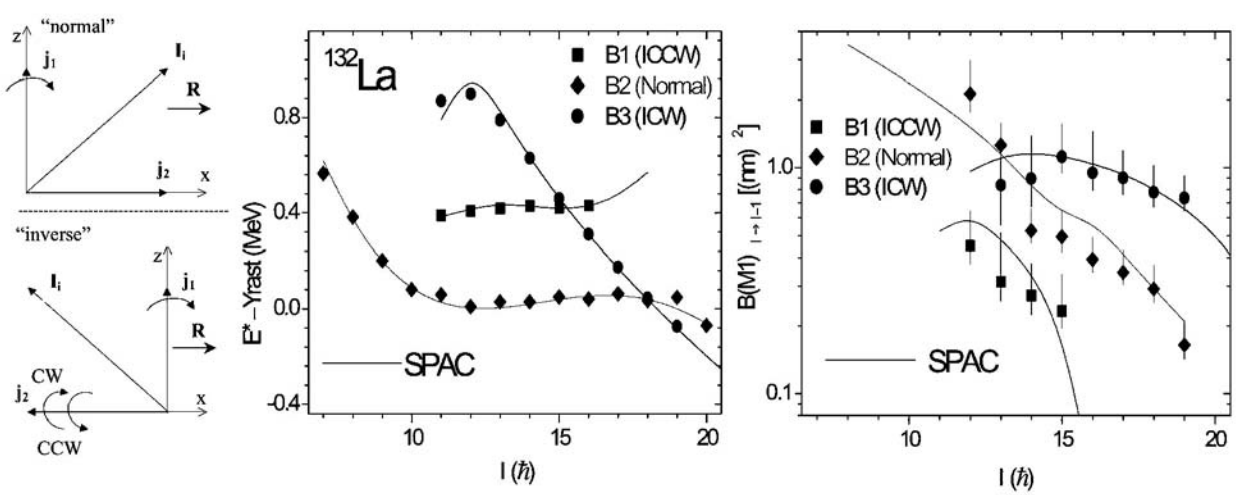

Figure 1. **Left:** Two symmetrical initial orientations of $\mathbf{j_2}$ generating three bands. **Middle: C**alculated and experimental energies of the dipole bands in ^{132}La. **Right**: corresponding B(M1) values