DSAM Lifetime Studies for Gd – Nd nuclei with EUROBALL and AFRODITE

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With EUROBALL IV at IReS Strasbourg a lifetime experiment using the Doppler-shift attenuation method (DSAM) has been carried out [1], which allowed to determine the $B(E2)$ values of quadrupole bands in ^{142,143}Gd. These nuclei were produced in ^{114}Sn(^{32}S,2pxn) reaction channels at a beam energy of 160 MeV. As target a selfsupporting metallic ^{114}Sn foil of 8 mg/cm^2 thickness with an enrichment of 71.1% was used. To investigate lifetimes of quadrupole bands in ^{134}Nd a DSAM experiment was carried out with the γ-detector array AFRODITE at iThemba LABS, South Africa. This nucleus was produced in a ^{114}Cd(^{28}Si,α4n) reaction at a beam energy of 155 MeV. As target a selfsupporting metallic ^{114}Cd foil of 13 mg/cm^2 thickness with an enrichment of 99.1% was used. Four CLOVER detectors each were mounted under 45° and 135°, respectively, in the AFRODITE array. In total, lifetimes for 15 members of quadrupole bands in ^{142}Gd, 10 members of the quadrupole band in ^{143}Gd and 6 members of the ground band in ^{134}Nd have been obtained.

For the interpretation of the $(+,0)_1$ band in ^{142}Gd [2], calculations in the cranked Nilsson-Strutinsky (CNS) model have been carried out. Triaxial shapes with well-developed potential energy minima were obtained. For angular momenta around $I = 20$ minima are seen for rotations around each principal axis, but at $I = 30$ only the minimum at $\gamma = -75°$, corresponding to a rotation around the longest principal axis (the axis with the smallest $\mathcal{J}_{rig}$) remains. The $(+,0)_1$ band has at such spins a $\pi h^4_{11/2} \otimes \nu h^{-2}_{11/2}$ configuration. The present lifetime results support the conclusion that a rotation around the longest principal axis occurs (cf. fig. 1). This is to our knowledge the first case when experimental features support this suggestion.

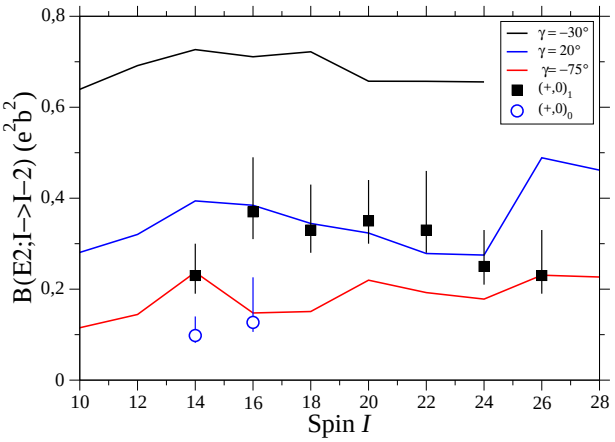

Figure 1: *Comparison of experimental $B(E2)$ values for bands in ^{142}Gd with results of cranked Nilsson-Strutinsky model calculations.*

[1] E.O. Podsvirova *et al.*, Eur. Phys. J. **A 21**, 1 (2004).
[2] R.M. Lieder *et al.*, Eur. Phys. J. **A 13**, 297 (2002).