Evidence of Rigid Triaxiality in Light Mo – Cd Nuclei

Rajesh Kumar[1] and S. Sharma[2*]
[1]Department of physics, Noida Institute of Engineering & Technology, Greater Noida- 201306, INDIA
[2] Panchwati Institute of Engineering & Technology, Meerut (U.P.) - 250001, INDIA
[*]Email: rajeshkr0673@yahoo.co.in , ssharma_phy@yahoo.co.uk

Introduction

The Rigid Triaxial rotar model is one of the longest standing and simplest description of nuclear structure. It was proposed by Davydov and Filippov [1] to explain the interband γ – g B(E2) ratios in the ground band of atomic nuclei. Bohr and Mottleson [2] had pointed earlier that at $\gamma_0 \geq 24^0$, nuclei are no longer to be considered deformed in the original sense and the nucleus is expected to take any shape, including triaxial. Earlier Gupta and Sharma [3] have been presented a review on interband B(E2) ratios in the rigid triaxial model to test the internal consistence of the rigid triaxial asymmetric rotar model (ARM) predictions and B(E2) ratios do have same relation with shape asymmetry parameter γ_0 . Mittal et al. [4] also presented earlier rigid triaxiality in neutron deficient Te – Sm nuclei for N<82.

Recently, most of the works concentrated on rigid triaxiality in γ-band [5,6,7] for medium and heavy mass even-even nuclei. The rigid triaxiality in g-band for light mass nuclei have not been studied sufficiently. In the present work we focus on rigid triaxiality in light Mo – Cd nuclei for N<66, to test whether asymmetry parameter γ_0 is related to the variation of N and Z.

Result and Discussion

There are various methods [1,3,4,8] to calculate γ_0. Davydov and Filippov [1] determined asymmetry parameter γ_0 from the ratio R_γ $(=E_{2\gamma}/E_{2g})$ is more relevant. We have calculated γ_0 from R_γ values using the equation.

$$\gamma_0 = \frac{1}{3}\sin^{-1}\left[\frac{9}{8}\left\{1-\left(\frac{R_\gamma - 1}{R_\gamma + 1}\right)^2\right\}\right]^{1/2}$$

These ratio R_γ are calculated using $E_{2\gamma}$ and E_{2g} values from the National Nuclear Data Centre, Brookhaven national laboratory [9]. The calculated γ_0 values for Mo – Cd nuclei studied here are listed in table 1.

Table 1: The values of asymmetry parameter γ_0.

N	Mo	Ru	Pd	Cd
50	28.29			
52	27.07	25.57		
54	27.66	26.78	25.13	
56	26.66	24.33	23.21	23.50
58	23.32	25.56	24.96	24.41
60	18.91	24.49	26.47	24.30
62	18.85	22.48	27.01	26.13
64	19.03	22.53	26.71	27.25
66			27.41	26.81

The present study concluded that:

(a) All these nuclei have $\gamma_0 > 18^0$, as determined from R_γ.
(b) From fig.1, for Mo nuclei the range of $\gamma_0 \approx 18^0$ to 28.3^0 and it is sensitive to R_γ which drops from 4.22 to 2.04, which indicates that a shapes transition from rotational to vibrational.
(c) From fig.1, for Ru, Pd and Cd nuclei the range of $\gamma_0 \approx 22^0$ to 27.4^0 and R_γ is less sensitive (R_γ= 2.10 – 2.93) to γ_0, which indicates that these nuclei are near the vibrational limit.

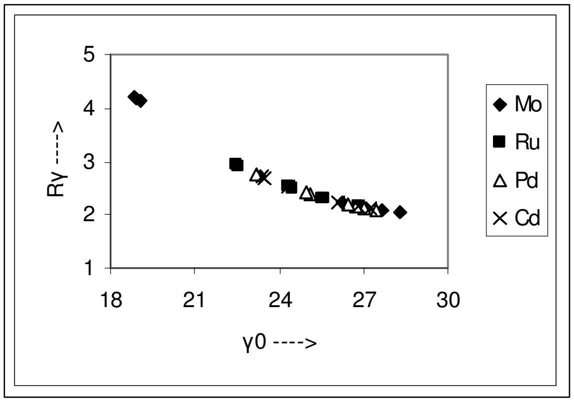

Fig. 1 Experimental data for R_γ ($=E_{2\gamma}/E_{2g}$) for even-even nuclei as a function of γ_0.

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