Re-examination of Dipole Bands in ^{104}Ag

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Introduction

The phenomenon of Magnetic Rotation (MR) has been established as a novel mechanism of generating angular momentum in weakly deformed systems. The decreasing trend of the B(M1) value and the B(M1)/B(E2) ratio is one of the identifying characteristics of the MR phenomenon and is established from the lifetime measurements of the levels constituting the band of interest. The theoretical interpretation of the MR phenomenon is provided within the framework of the Tilted Axis Cranking (TAC) [1] model. Subsequent to the maiden observation in the neutron deficient Pb isotopes, MR bands have been identified in a wide range of nuclei in different (A$\sim$ 140, A$\sim$100) mass regions. In A$\sim$100 nuclei, the MR structures have been established in Ag, In, Cd and Sb isotopes. The ^{104}Ag nucleus has previously been studied by Datta *et al.* [2] and two MR bands have been identified based on lifetime measurements using Doppler Shift Attenuation Method (DSAM). In the present work, a re-examination of the MR bands in ^{104}Ag in the light of new DSAM measurements, have been carried out. The lifetime measurements have been extended to higher levels in one of the bands, in quest of any change in the structure or termination therein.

Experimental Details

High-spin states in the ^{104}Ag nucleus have been populated using the reaction ^{76}Ge(^{32}S,p3n)^{104}Ag at E_{lab} = 110 MeV. The beam has been provided by the Pelletron LINAC Facility at TIFR, Mumbai. The target was 500 $\mu g/cm^2$ of isotopically enriched ^{76}Ge backed by 26 mg/cm^2 gold with a 11 $\mu g/cm^2$ layer of aluminum between the target and the backing, to prevent migration of the former into the latter. The Indian National Gamma Array (INGA), stationed at TIFR [3], has been used as the detection system.

Data Analysis and Results

The acquired data have been sorted into angle dependent matrices for lifetime analysis. Spectra have been generated with gates on 333, 346, 444 keV transitions and summed for lineshape analysis of the 481, 508, 520, 572 and 628 keV transitions in ^{104}Ag, using the modified LINESHAPE package [4, 5] that accepts stopping powers calculated by the SRIM software. The conventional least square fitting of the calculated shape to the experimental shape has been undertaken. The procedure have been carried out for transitions 481, 508, 520, 572 and 628 keV, in a cascade, simultaneously for three angles. Initially, the level lifetime (τ), the side feeding (τ_{SF}) time,

the linear background coefficients, the normalization factors have all been used as the least square fitting parameters. Eventually, after having obtained the best fit for each transition, all the parameters except τ and τ_{SF} have been fixed and the transitions have been subjected to a global fit to obtain the final values of the lifetime and the corresponding side feeding time. A representative fit has been illustrated in Fig. 1 while the resulting lifetimes of the levels are recorded in Table 1. It is noteworthy to mention that owing to the lineshape being analyzed in spectra with gates on transitions below the transitions of interest, the side-feeding contributions could not be eliminated. It is understood that the principal uncertainties in the lifetime analysis results from that on the stopping powers and are typically $\sim$ 10%. The same uncertainty directly impacts the extracted lifetimes and has been primarily assigned to the results. Details of the error analysis shall be presented subsequently. The $B(M1)$ values extracted from the present work has been recorded in Table 1 and compared to that reported by Datta *et al.* in Fig. 2. The $B(M1)$ values from this investigation are lower than the previous findings but exhibits the same decreasing trend that characterises the MR phenomenon.

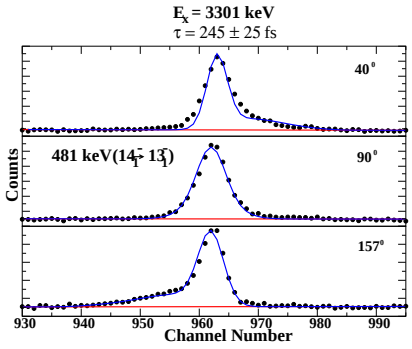

FIG. 1: Lineshape fit of the Doppler shape observed for the 481 keV transition in the ^{104}Ag nucleus.

Efforts are in progress to carry out the analysis with gates on transitions above the transitions of interest, so as to eliminate the side feeding contributions. Analysis of the level lifetimes of the second MR band in ^{104}Ag, as reported by Datta *et al.* [2], are in progress. These results are expected to provide an insight on the termination of the MR bands in the in ^{104}Ag nucleus.

TABLE I: Level lifetimes (τ) and side feeding times (τ_{SF}) obtained for levels (excitation energy E_x and spin-partity J^π) in one of the MR bands in ^{104}Ag and the corresponding $B(M1)$ values.

E$_x$ (MeV)	J$^\pi$	E$_\gamma$ (MeV)	τ (ps)	τ_{SF} (ps)	B(M1)
3.301	14$^-$	0.481	0.245 $\pm$ 0.025	0.48	0.77
3.809	15$^-$	0.508	0.216 $\pm$ 0.022	0.88	0.70
4.329	16$^-$	0.520	0.216 $\pm$ 0.022	0.32	0.69
4.901	17$^-$	0.572	0.209 $\pm$ 0.021	0.44	0.55
5.529	18$^-$	0.628	$\leq$0.606		0.26

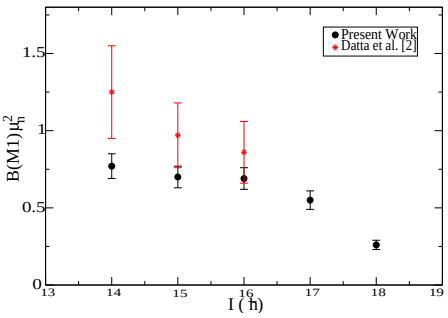

FIG. 2: B(M1) values of the MR band in ^{104}Ag determined from the present work in comparison to that reported by Datta *et al.*

This work is supported by UGC-DAE CSR under CRS Grant and we acknowledge CSR for this support. We also acknowledge the help and support from the BARC-TIFR Pelletron-LINAC Group and INGA Collaboration.

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