Magnetic and Anti-magnetic rotational bands- Present Status

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Introduction

The phenomenon of magnetic and anti-magnetic rotation observed in nearly spherical nuclei was first proposed by Frauendorf [1, 2]. Magnetic Rotational (MR) bands have strongly enhanced magnetic dipole (M1) $\Delta I = 1$ transitions but comparatively weak electric quadrupole (E2) $\Delta I = 2$ transitions. On the other hand, in case Anti-Magnetic Rotational (AMR) bands, M1 transitions are absent and enhanced E2 transitions are observed. In this paper, we present complete survey of all the available MR and AMR bands, which will supersedes earlier compilations [3,4]. Some features such as regular, irregular bands, back-bending and signature splitting shown by MR and AMR bands are also pointed out.

Compilation overview

Magnetic Rotational bands

In the present study, we presented a recent picture of all the experimentally observed MR bands pertaining to mass region 58<A<206. In earlier compilation by Amita *et al*. [3], there were total 120 MR bands in 56 nuclei and another subsequent compilation [4] consisting of total 178 bands observed in 76 nuclides. Presently, we updated the earlier compilation by including 41 MR bands observed in 31 new nuclides. Additionally, 19 MR bands (already available in earlier compilation) have been extended to higher spins. So, in totality, we added 358 M1 and 196 E2 transitions in previous compilation [4]. The maximum number (total 55) of MR bands have been identified in Pb isotopes. Among all the 219 MR bands, total 160 MR bands are of regular nature whereas and 53 show irregular behavior, 14 bands exhibit signature splitting and 77 shows back-bending phenomenon.

Another important quantity which could be used to estimate the strength of the M1 transitions and also to extract nuclear structural information, is B(M1)/B(E2) ratios. We completed the present compilation by extracting B(M1)/B(E2) ratios for the bands where these are not listed in literature but could be deduced from available experimental data. In present study, we used following equation [4] to extract B(M1)/B(E2) ratios from experimental data:

$$\frac{B(M1)}{B(E2)} = \frac{0.6975 E_r^5(E2) I(M1)}{E_r^3(M1) I(E2)}$$

where, E_r is the gamma energy in keV, B(E1) and B(E2) are in e^2b and e^2b^2 respectively. We update earlier compilations by including the B(M1)/B(E2) ratios of 27 MR bands.

Anti-Magnetic Rotational bands

In present compilation, we also extracted AMR bands with their probable configuration assignments. Till date, 16 AMR bands have been observed in 12 different nuclides. The lightest and heaviest nuclides where AMR bands have been reported are ^{100}Pd and ^{144}Dy respectively. The maximum number (total 5) of AMR bands are observed in Cd and In isotopes. The detailed analysis of features exhibited by various experimentally observed AMR bands is in progress.

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References

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