

Band structure of the ^{132}Xe nucleus above the $5^- \hbar$ state

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Introduction

The shape driving tendencies of the proton and neutron orbitals in the transitional nuclei ($A \sim 130$) leads to the multiple bands built on the particle-core rotational coupling, shape co-existence and multi-quasiparticle (qp) vibrational excitations. The nuclei ranging from the Xe to Nd have been studied and the above stated phenomena have already been observed in the intermediate and high spin structure of these nuclei [1–5]. In the previous studies of the ^{132}Xe nucleus [6], the yrast band have been studied upto spin $I = (10^+) \hbar$. The isomeric states were reported due to the two quasi-particle coupling at the spin $5^- [\pi(h_{11/2}, s_{1/2})]$, $7^- [\pi(h_{11/2}, d_{3/2})]$ and $(10^+) [\pi(h_{11/2})^2]$, respectively. In the recent study [7], the structure of the ^{132}Xe nucleus was extended above $I = (10^+) \hbar$ isomer upto spin $I = (16^+) \hbar$ using multi-fragment reaction and partial AGATA spectrometer.

In the present work, the ^{132}Xe nucleus have been studied and three bands above the $5^- \hbar$ state were observed. These bands are expected to be the negative parity bands, which were observed in the ^{134}Ba and ^{136}Ce nuclei, $N = 78$ isotones [3, 8].

Experimental Details

To populate the excited states of the ^{132}Xe nucleus, $^{130}\text{Te}(\alpha, 2n)^{132}\text{Xe}$ reaction was used at a beam energy of 28 MeV, provided by the Cyclotron at Variable Energy Cyclotron Centre (VECC), Kolkata. The target used was a composite target, made of two ^{130}Te targets placed together. The first target fact-

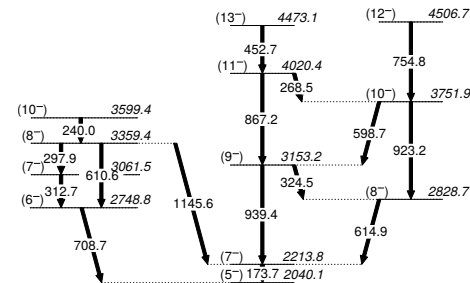


FIG. 1: Partial level scheme of ^{132}Xe nucleus above the $5^- \hbar$ state (Intensity of γ -ray transitions are not presented in this figure).

ing the beam had a thickness of 3 mg/cm^2 with the $530 \mu\text{g/cm}^2$ thick myler backing and the second target was 2 mg/cm^2 thick with the aluminized myler backing of $635 \mu\text{g/cm}^2$ thickness. The γ -rays de-exciting from the ^{132}Xe nucleus were detected using the Indian National Gamma Array (INGA), which at the time of experiment consisted of 6 Compton suppressed clover detectors, with 2 and 4 clovers placed at 125° and 90° with respect to the beam direction, respectively. The pulse processing and data acquisition system was based on 12-bit 250 MHz PIXIE16 digitizers, manufactured by XIA LLC (USA), based on firmware logic conceptualized by UGC-DAE CSR, Kolkata Centre [9]. Acquired listmode data was processed using the IUCPIX package [9], developed by UGC-DAE CSR, Kolkata Centre and analysed using the RADWARE software package [10].

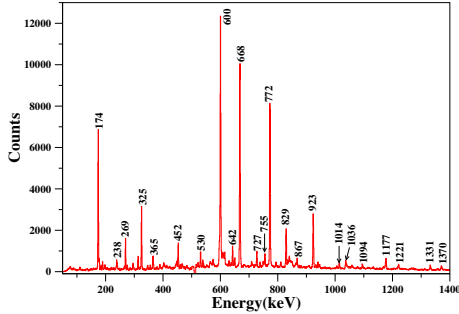


FIG. 2: Gated spectrum of 615 keV γ -ray transition.

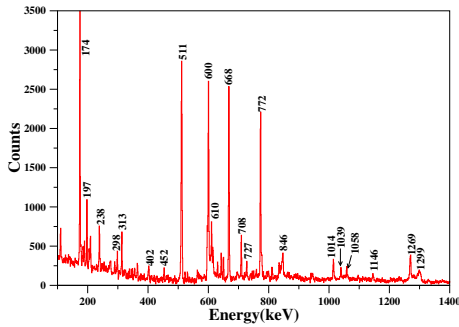


FIG. 3: Gated spectrum of 240 keV γ -ray transition.

Results and Discussion

In the present work, structure of the ^{132}Xe nucleus, above the spin $I = 5^- \hbar$ have been studied and the level scheme is extended upto $I = (13^-)\hbar$. Above the $5^- \hbar$ state, three band like structure are observed.

The 174-, 240-, 269-, 298-, 313-, 325-, 452-, 599-, 610-, 615-, 708-, 755-, 867-, 923-, 939- and 1146 keV γ -rays, consisting these bands are shown (see Fig. 1) in the gated spectrum of 615 keV (Fig. 2) and 240 keV (Fig. 3) γ -ray transitions. These bands are similar to the negative parity bands observed in the ^{134}Ba nucleus [8], as shown in Fig. 4.

Conclusion

The ^{132}Xe nucleus have been studied above the $5^- \hbar$ state and three negative parity bands upto spin $I = 13 \hbar$ have been observed. The R_{DCO} and polarization asymmetry measure-

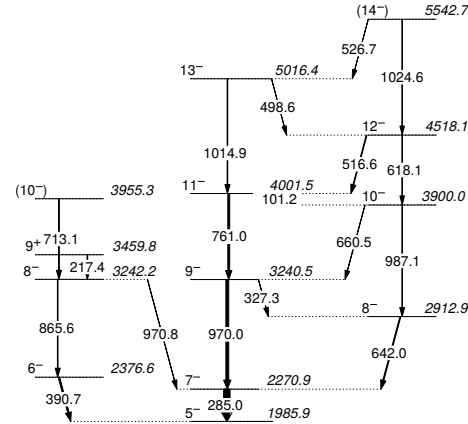


FIG. 4: Partial level scheme of ^{134}Ba nucleus above the $5^- \hbar$ state.

ments to confirm the spin and parity of these bands are in progress. The theoretical calculations to understand these bands are to be done in near future.

Acknowledgments

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