

Study of $\nu h_{11/2}$ Band in ^{127}Xe

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Introduction

The structure of odd-A xenon nuclei explicitly depends on the negative parity intruder $h_{11/2}$ orbitals, lying near the neutron Fermi surface. As a result, the strongly populated yrast $\nu h_{11/2}$ band were reported systematically in odd-A Xe isotopes [1–3]. Particularly, in ^{125}Xe , the alignment of the second pair of $h_{11/2}$ neutrons was reported at $\hbar\omega \sim 480$ keV in $\nu h_{11/2}$ band [3] along with the alignment of a pair of $h_{11/2}$ protons, beyond $27/2^-$ state [2]. In ^{129}Xe , the similar two sequences of E2 transitions were also observed above $23/2^-$. Authors suggested one of them due to two proton alignment and the other sequence of transitions was suggested to be associated with $\pi(g_{7/2})^2 \otimes \nu f_{7/2}$ configuration. Interestingly, the neutron pair alignment is not reported in ^{129}Xe , which is expected to

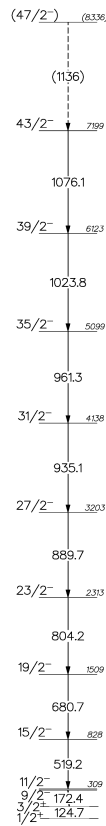


FIG. 1: Partial level scheme of ^{127}Xe deduced from this work

be seen at lower frequency compared to the proton alignment, as reported in the case of ^{125}Xe . The change in the structure of $\nu h_{11/2}$ band at high spin occurs between $N=71$ and 75 . For $N=73$, the states beyond $19/2^-$ were known with tentative spin and parity and no further structural information was available [4–6]. Therefore, in-beam γ -ray spectroscopy of ^{127}Xe has been carried out to infer the structure of this band at high spin.

Experimental Details

High spin states of ^{127}Xe have been populated via $^{122}\text{Sn}(^9\text{Be}, 4n\gamma)$ fusion-evaporation reaction at 48 MeV, at 15UD pelletron accelerator facility of the IUAC, New Delhi [7]. A 8.4 mg/cm^2 thick ^{122}Sn foil has been used as target. The de-exciting γ -rays were detected in fourteen clover detectors of INGA spectrometer [8]. CANDLE, a CAMAC based analogue data acquisition system has been used to record the valid events [9]. The offline data analysis was carried out using the computer codes INGAsort and RadWare [10, 11]. The spin of nuclear states were determined from R_{DCO} results [12].

Results

The important transitions belonging to $\nu h_{11/2}$ band are shown in 1023.8 keV energy gated spectrum [fig 2]. On the basis of the coincidence relationship and intensity distribution, the partial level scheme has been developed [fig 1]. The spin and parity of the high spin states have been confirmed in the present

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study. The values of R_{DCO} (with error) for eight transitions belonging to this band have been determined and listed in table I.

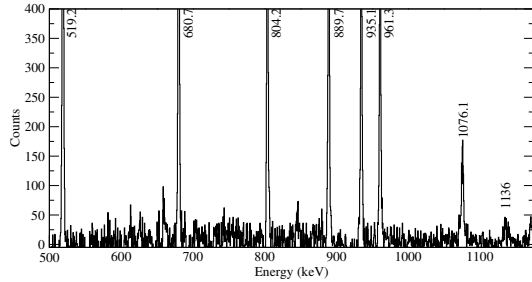


FIG. 2: Energy gate on 1023.8 keV γ -ray, showing the γ -rays of interest belonging to $\nu h_{11/2}$ band.

TABLE I: Energies of γ -rays and DCO ratios for levels of ^{127}Xe .

E_γ (keV)	R_{DCO}	Assigned multipolarity	$I_f \rightarrow I_i$
519.2	1.00 (1)	E2	$15/2^- \rightarrow 11/2^-$
680.7	0.99 (2)	E2	$19/2^- \rightarrow 15/2^-$
804.2	1.01 (2)	E2	$23/2^- \rightarrow 19/2^-$
889.7	0.98 (3)	E2	$27/2^- \rightarrow 23/2^-$
935.1	0.97 (4)	E2	$31/2^- \rightarrow 27/2^-$
961.3	0.94 (7)	E2	$35/2^- \rightarrow 31/2^-$
1023.8	0.92 (13)	E2	$39/2^- \rightarrow 35/2^-$
1076.1	0.92 (31)	E2	$43/2^- \rightarrow 39/2^-$

Discussions

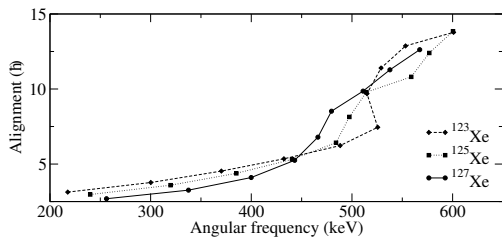


FIG. 3: Aligned angular momentum i_x as a function of frequency for $\nu h_{11/2}$ band in $^{123-127}\text{Xe}$.

The aligned angular momentum (i_x) relative to a reference has been calculated with Harris parameters, $\mathfrak{S}_0=16\hbar^2 \text{ MeV}^{-1}$ and

$\mathfrak{S}_1=7\hbar^4 \text{ MeV}^{-3}$, for yrast $\nu h_{11/2}$ band in $^{123-127}\text{Xe}$ [fig. 3]. The alignment plot of ^{127}Xe has been found similar to that of $^{123,125}\text{Xe}$. The alignment gain of $\sim 6\hbar$ is observed at $\hbar\omega \sim 440 \text{ keV}$ in ^{127}Xe , which may be caused by the alignment of the second pair of $h_{11/2}$ neutrons, as explained in case of ^{123}Xe at $\hbar\omega \sim 525 \text{ keV}$ [1] and ^{125}Xe at $\hbar\omega \sim 490 \text{ keV}$ [3]. The back-bending frequency shifted towards lower side with increasing A from 123 to 127. For the proton aligned band, data analysis is under process and results will be discussed during symposium.

Acknowledgments

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