Excited states of ^{129}Xe

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The importance of the occupancy of Nilsson intruder orbit $h_{11/2}$ by the valence particles for the triaxial-shaped nuclei, has been studied by observing many properties of nuclei. In one such study, a systematic comparison of the experimentally observed yrast bands of even-odd nuclei $^{123, 125, 127, 129}$Xe [1] was done along with the theoretical analysis. However, in this experimental work, the level schemes were limited to only low spin states because of the utilization of low mass projectiles α, ^{3}He. In our earlier work [2], we observed two new excited bands in ^{129}Xe and extended the yrast band to higher spins than known earlier [1].

Here we present our investigation of the observed yrast and excited bands in ^{129}Xe populated by the heavy-ion fusion reaction ^{124}Sn(^{11}B, p5n)^{129}Xe. An isotopically enriched (99.9%) self-supporting ^{124}Sn target of thickness 2.2 mg/cm^2 was utilized. The experiment was performed at the Linac accelerator facility at the Tata Institute of Fundamental Research (TIFR), Mumbai, India. The experimental set-up, called the Indian National Gamma Array (INGA), consisted of 21 Compton suppressed clover HPGe detectors. Two of these detectors were placed at 23º, three at 40º, three at 65º, four at 90º, three at 140º, three at 115º and three at 157º with respect to the beam direction. The triple-gamma coincidence data were collected in the event-by-event mode.

The data analysis was carried out using the computer program RADWARE. The data were calibrated using the radioactive source ^{152}Eu and the background was subtracted. With the energy of the gamma transitions E_γ, a three-dimensional cube (E_γ *vs.* E_γ *vs.* E_γ) and a two-dimensional matrix (E_γ *vs.* E_γ) were constructed. The projected spectra with single-gamma gate on the matrix, suffered from the contaminant gamma-peaks from the neighboring nuclei. While the projected spectra with double-gamma gates on the cube were clean, the new gamma peaks were found to have weak intensity. To enhance the intensity of the peaks, we added the projected spectra corresponding to few double-gamma gates. Our notation for the double-gamma gate is gamma1/gamma2, where gamma1 and gamma2 denote the energy, in keV, of the gates corresponding to the two gamma transitions.

Fig. 1 (a) shows the sum of the projected spectra with gates 576/587, 576/752, 587/981 and 787/981. The new gamma transitions 981 keV, 576 keV, 787 keV and 903 keV constituting a new band (Band 4), were identified. Fig. 1 (b) shows the sum of the projected spectra with gates 587/746, 587/406, 406/746, 894/746 and 406/752. A weak 673 keV transition decaying from the known energy state of Band 2, was identified. In Fig. 2, the labels ** and * denote the new transitions obtained in the present work and in our earlier work [2], respectively. Further data analysis is in progress. The assignment of spin-parity and the theoretical analysis will be presented.

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References

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Fig. 1

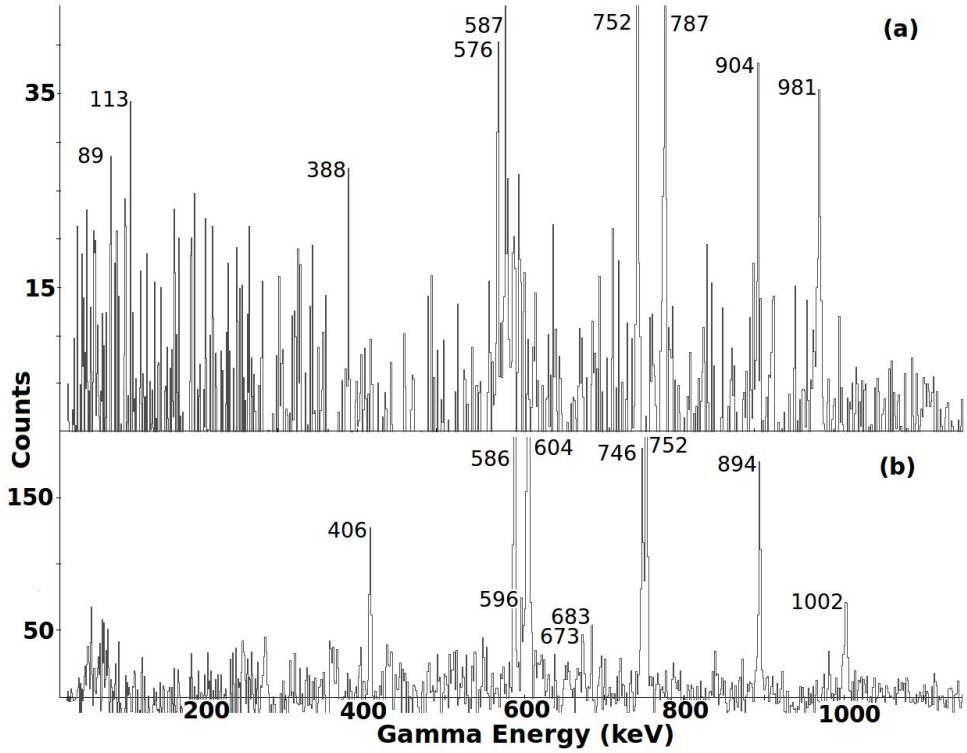
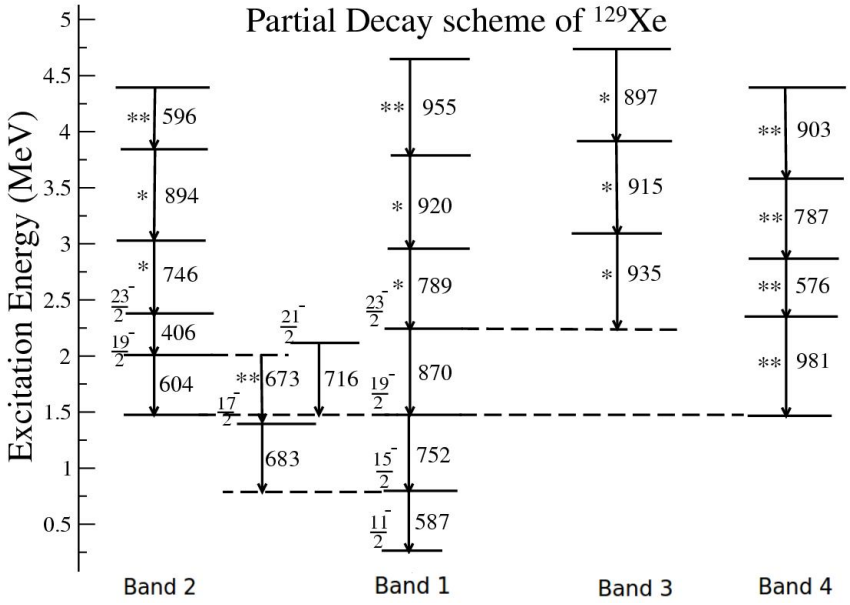

(a)
(b)
Counts
Gamma Energy (keV)
35
15
150
50
200
400
600
800
1000
113
89
388
587
576
752
787
904
981
586
604
746
752
894
406
596
683
673
1002

Fig. 2


Partial Decay scheme of ^{129}Xe
Excitation Energy (MeV)
Band 2
Band 1
Band 3
Band 4
** 596
* 894
* 746
406
604
** 673
716
683
** 955
* 920
* 789
870
752
587
* 897
* 915
* 935
** 903
** 787
** 576
** 981