Structure of ^{169}W nucleus

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Introduction and Motivation

The very neutron-deficient nuclei in the mass 170 region are expected to be rather soft with respect to β and γ vibration and the polarizing effect of the last nucleon becomes very important. In recent years evidence for stable triaxial shape has been investigated and established in several odd-A Lu nuclei in the form of wobbling bands [1]. TSD bands have also been observed in Hf isotopes but wobbling nature has not been confirmed. So far no experimental evidence for such bands have been found in odd-odd nuclei.

The rotational bands of a number of nuclei in this mass region exhibit various features like multiquasiparticle excitation based on both low and high K values, signature splitting, band inversion etc [2].

The present experiment has been performed to look for the connecting transitions, extend the already observed bands to higher spins and try to observe the wobbling motion if possible.

Experimental Details

An experiment has been performed at the IUAC New Delhi to investigate the structure of neutron deficient nuclei in the mass 170 region. A ^{141}Pr target of thickness 1.8 mg/cm^2 with a gold backing of 6.8 mg/cm^2 was bombarded with a 155 MeV ^{32}S beam obtained from IUAC Pelletron. The beam current was 0.6 pnA on the target. The two-fold coincidence data were detected in the list mode using the INGA array comprising of 13 Compton suppressed clover detectors. For data aquistion the electronics comprising of the IUAC Clover modules [3] and software CANDLE [4] were used. The data analysis is being performed with the program INGASORT [5]

Preliminary Results

From the preliminary analysis it is evident that the isotopes populated with considerable yield are ^{169}Re, ^{168,169}W and ^{168}Re with a relatively small population. This is in conformity with the PACE4 calculation (Fig.1). The sum spectrum generated by putting gates on the 209, 368, 487, 576 and 631 keV transitions of the yrast positive-parity band [6] in ^{169}W is shown in Fig.2a. Also included in the figure are the spectra generated by adding the 415 and 465 keV transitions belonging to the (-,+1/2) band (band 1, Ref. [6]). As evident from the figure the present coincidence data are in conformity with the earlier results [6]. From the figure it is

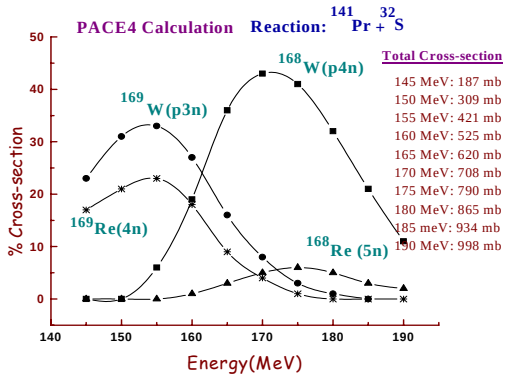

Fig.1. Results from PACE4 calculation

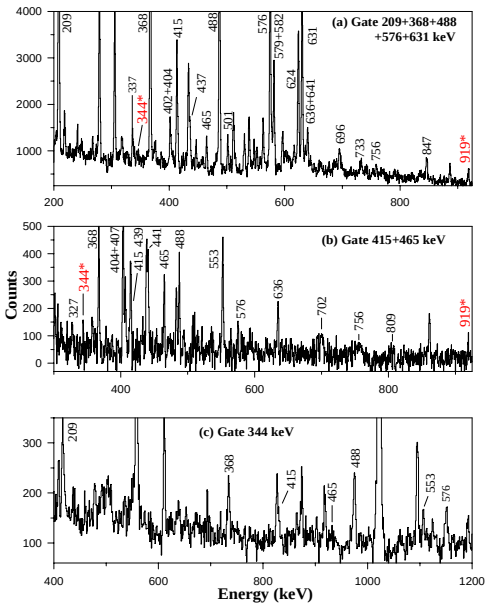

Fig.2: Gated spectra obtained in the present experiment (see text below).

evident that the two bands are strongly interconnected.

The absolute energy values of the reported bands [Ref.6] are not known. Even the relative positions of the two bands were not established as the connecting transitions between the two bands were not observed. The gated spectra obtained in the present experiment (Fig.2 a and b) shows two new transitions at 344 and 919 keV which possibly connect the $(29/2^-)$ state (band 1, Ref. [6]) with the $29/2^+$ and $25/2^+$ states of the yrast band respectively (Fig.3). To establish the present observation the spectra obtained by gating the new 344 keV line has been shown in Fig 2c. The gate clearly shows the various transitions belonging two both bands (Fig. 3). It is to be noted that the 919 keV gate (not shown) shows lines upto 488 keV further confirming the placement of the two new lines. The relative intensities for the 465, 553 and 636 keV lines normalized with respect to the 415 keV gamma-ray belonging to band 1 (Fig.3) obtained in 209 keV gate of the yrast positive-parity band is in agreement with the corresponding values obtained in the gate generated by adding the 439 and 442 keV transitions belonging to band 1 (Fig.3) giving additional support to our result. These two new transitions 344 and 919 keV may fix the relative positions of the two bands.

Further data analysis is in progress. DCO and DSAM analysis shall be performed to measure the spin-parity and lifetimes of the excited levels wherever possible.

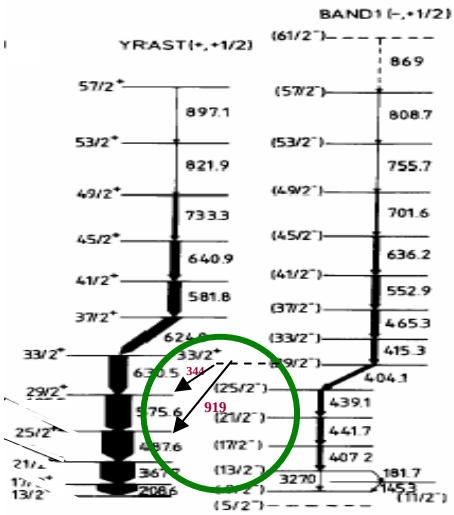

Fig.3: The partial level scheme showing the new transitions at 344 and 919 keV connecting the (+,+1/2) and (-, +1/2) bands.

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