High Spin Spectroscopy and Shape Coexistence in ^{73}As Nucleus.

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Nuclear spectroscopy at high-spins in the f-p-g shell nuclei around mass region A~70-80 assume significance as they provide ideal ground for coexistence of various nuclear shapes in the same nucleus [1]. Such shape coexistence is resulted from the complex interplay single-particle excitations and collective degrees of freedom. The total energy surface calculations[2] for the neutron-deficient nuclei in this region exhibit either more than one minimum with small barrier between them or they are gamma soft in nature. Thus the coexistence of prolate and oblate shapes at low-spins is to be understood and it would be interesting to see how these structures compete with each other at higher angular momentum.

High spin structure has been studied for several even-A nuclei in this region, where as very limited studies were reported for odd-A nuclei. In odd-A nuclei, occupation of different available states by the odd particle will result in different nuclear structures. In these nuclei, negative parity bands are generally strongly coupled bands built on $f_{5/2}$ or $p_{3/2}$ Nilsson orbital where as positive parity bands generated by $g_{9/2}$ orbital will have different structures; either strongly coupled or decoupled bands depending on the nucleon number and nuclear deformation.

Arsenic isotopes in A~70-80 region provide excellent ground for study the interplay of single-particle and collective degrees of freedom as both neutron and proton numbers for these nuclei lie at mid-shell. Odd-A isotopes of As with A=67, 69, 71 and 73 [3,4] have been studied upto I=33/2, 33/2, 37/2 and 25/2 respectively. Shape coexistence has been established for the heavier N=40 isotones i.e. 74Se, 75Br and 76Kr. This study is aimed to elaborate the nuclear structure of ^{73}As, N=40, nucleus to high-spins and to explore the shape coexistence and high spin structure. For this nucleus, only low-spin structure was known [4] from (α,2n) reaction.

In the present experiment, ^{73}As nucleus was populated using the fusion-evaporation reaction ^{64}Ni(^{12}C,p2n)^{73}As. Beam of ^{12}C ions with energy 55MeV and beam current of 1pnA was provided by 15UD/16MV Pelletron accelerator at IUAC, New Delhi. The target used was 1.5mg/cm^2 thickness with 7mg/cm^2 Au backing. Gamma Detector Array (GDA) [5] used consists of 12 Compton suppressed HpGe detectors positioned four each at 51, 98 and 144 degrees with respect to the beam direction.

Two fold gamma coincidence events were recorded event-by-event employing the data acquisition system CANDLE [6]. A total of more than 130 million γ–γ events were recorded in the experiment. About 20% of them correspond to the nucleus of present interest i.e. ^{73}As. The measured γ–γ coincidence events are histogrammed into a two-dimensional *4k* x *4k* matrix using INGASORT [7] with a dispersion of 1kev/channel. This matrix was the primary data set used for construction of the level scheme.

Positive parity band, built on 6 μs isomeric 9/2+ level at 428 keV, was known upto (25/2+) level at 4083 keV [4] consists of four E2 transitions in a sequence. This band is extended up to (33/2+) level at 7426 keV by adding two new transitions of energy 1622 and 1721 keV. Negative parity band was known upto (17/2-) level at 2848 keV [4] consists of two E2 sequences. This band is extended upto (37/2-) level at 8787 keV. A sequence of four weak ΔI=1 transitions interconnecting these two E2 sequences in the negative parity band were also identified between (9/2-) and (19/2-) levels. In addition several non-band transitions were also identified and placed in the level scheme. Preliminary level scheme is presented in the Figure-1 shows only the main band structure.

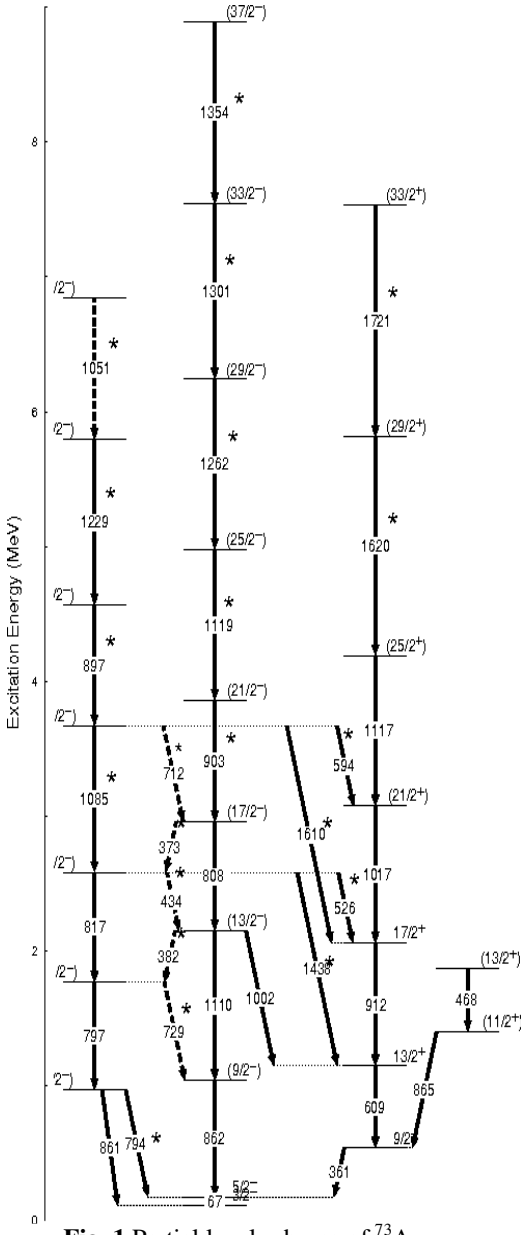

Fig. 1 Partial level scheme of ^{73}As

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