FIRST OBSERVATION OF YRAST BAND IN ODD-ODD N=91 ^{162}Lu NUCLEUS

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High spin states in ^{162}Lu have been populated in the ^{147}Sm(^{19}F,4nγ) ^{162}Lu reaction. A 7.3 mg/cm^2 self-supporting samarium target enriched to 98% in ^{147}Sm was bombarded by the ^{19}F beam from HI-13 Tandem accelarator, CIAE, Beijing. Standard γ-ray in-beam spectroscopic techniques were used including 7 high purity germanium with BGO anti-Compton shields and one planar detectors. The assignment of γ-rays to ^{162}Lu nucleus was obtained from Kx-γ coincidence and the excitation functions measured at 85, 90, 95 and 100 MeV beam energies. A band structure with crossover transitions was established, for the first time, from γ-γ coincidence data.

Based on the fact that the levels of the aligned band with the $\pi[h_{11/2}]$ $\nu[i_{13/2}]$ particle configuration are predominantly populated in the (HI,xn) reactions and form the yrast levels in the light Eu, Tb, Ho and Tm isotopes [1-4] even at low rotational frequencies, it is natural to assume the same particle configuration and negative parity to the yrast band observed in the ^{162}Lu nucleus.

The transitions from the band head to the ground state are very complex due to the high level intensity in the low excitation energy, it was impossible for us to build the connection in the level scheme between the band head and the ground state of ^{162}Lu, thus our measurements do not give, in principle, a definite spin assignment to the energy levels. However, by using the fundamental property of additivity role of the aligned angular momentum in the Cranked Shell Model (CSM) theory[5], we have determined the spin values of the energy levels. E2 transition energies for the two consecutive cascades (even and odd spin sequences) are coherent systematically for the odd-odd nuclei in the light rare-earth region, moreover, the favoured signature (α=0) corresponds to the larger alignment than that for the unfavoured signature (α=1). These two arguments support our spin assignments to the levels of yrast band in ^{162}Lu. A sudden increase of aligned angular momentum at ħω=0.36 MeV indicates the possible BC crossing of the second neutron pair at this rotational frequency.

The energy levels of ^{162}Lu yrast band shows a clear signature inversion at lower rotational frequencies (before bandbending) and the signature crossing at I0=20 ħ. By comparing the zigzag staggering of signature splitting in energy for both ^{160}Tm and ^{162}Lu nuclei, one can find that the two nuclei have the same zigzag phase, the amplitude of the staggering for ^{162}Lu is larger than that for ^{160}Tm. This phenomenon could be understood under the consideration of the fact that the even-even core ^{160}Yb of the ^{162}Lu nucleus has a smaller β deformation with respect to ^{158}Er. The γ positive triaxiality leads to the observed signature inversion in energy [6].

It is noted that the zigzag phase of signature splitting in energy is just opposite to the prediction given by K.Hara[7]. But the spin assignment is model dependent in this work, so it becomes more important to determine the spin value to the yrast levels in ^{162}Lu experimentally.

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