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High Spin Strcture of ^{66}Zn

Indu Bala[1, *], R. P. Singh[1], S. Murlithar[1], S. S. Bhattacharjee[1], R. K. Gurjar[1], M. K. Raju[2], S. Saha[3], J. Sethi[3], T. Trivedi[4], and R. Palit[3]
[1] *Inter University Accelerator Centre, New Delhi, India*
[2] *Nuclear Physics Department, Andhra University, Visakhapatnam 530003, India*
[3] *Tata Institute of Fundamental Research, Mumbai, India and*
[4] *Guru Ghasidas Vishwavidyalaya, Bilaspur*

1. Introduction

In-beam γ-ray studies of nuclei in the mass region A = 60-80 excited by heavy-ion induced nuclear reactions have revealed a variety of excitation modes in these nuclei, which so far cannot be explained in a single theoretical nuclear model. Starting from ^{56}Ni as a closed core one sees from systematics how deformation increases in adding proton and/or neutron pairs. Describing the collective phenomena to nuclei around mass A = 70 was to identify it for the less deformed Zn isotopes with vibrational modes which for the heavier, more deformed nuclei Se and Kr converts into a rotational description. Even when introducing these physical interpretations it was clear that these approaches describe only half of the truth because, in detail, one could reproduce the spectra neither with an harmonic vibrator nor with a pure symmetric rotor but had to introduce anharmonicities, triaxial shapes and shape coexistence [1].

It is commonly accepted that information about high spin states of nuclie is important for assertaining various degree of freedom of motion. As a rule an orbital of high angular momentum j in the vicinity of Fermi level of nucleus contributes strongly to the configuration of these states [2]. In the mass region of A$\geq$60 one expects that $1g_{9/2}$ orbital plays a significant role among the degree of freedom excited in the states of high angular momentum. The aim of present investigation is to provide additional information on excited states of ^{66}Zn nucleus. Earlier work done in this nucleus is mostly by light beams (alpha or proton) with few Ge(Li) detectors. The only heavy ion induced reaction for ^{66}Zn is from ^{55}Mn(^{14}N,2pnγ)^{66}Zn with two Ge(Li) detectors [1]. Also the 3^- state has got differenet viewpoints from different authors, some has explained it as single particle level and some are quoting it as collective octupole state. The question on nature of negative states whether they are pure collective with the 3^- state as band head or of single-particle character with collective bands built upon the 5^-, 6^- and 7^- states, we hope to investigate these aspects.

2. Experiment Details

The excited states in ^{66}Zn is populated through $^{56}Fe(^{12}C$, 2p) ^{66}Zn reaction at beam energy of 62MeV. A thick iron foil was used as target for the reaction. The 62 MeV ^{12}C beam was provided by 14 UD BARC-TIFR Pelletron Accelerator facility. The de-exciting γ-rays were detected by the Indian National Gamma Array (INGA), at TIFR consisting of 15 clover detectors. The detectors were placed at 157°(three), 140°(two), 115°(two), 90°(four), 65°(two) and 40°(two) with respect to the beam direction. The front face of clover detectors were about 25 cm far from target. The list mode data was taken in double (γ-γ) and higher folds by using digital data acquisition system based on Pixie-16 modules by XIA LLC [3]. The energy calibration and efficiency was carried out by ^{132}Ba and ^{152}Eu source data. Symmatric , Asymmteric and polarisation matrices were made by marcoes

*indu.phy@gmail.com

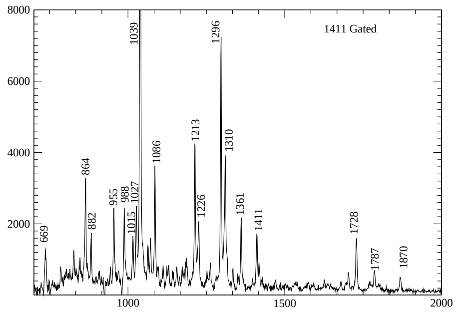

FIG. 1: Spectrum gated by 1411 keV of ^{66}Zn .

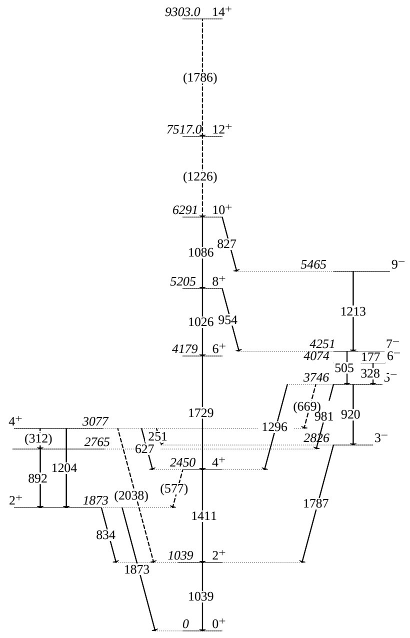

FIG. 2: Partial level Scheme of ^{66}Zn deduced from this work.

program and furthar analysis was done by RADWARE[4] and CANDLE.

3. Result & Discussion

All the previously reported gamma lines are confirmed in our data. The positive parity band gamma lines are also cross-checked with DCO and Polarisation matrices to confirm their multipolarity. The high intensity negative parity gamma lines are also confirmed from the data. But most of other lines at higher spin as well as in side bands are either not reported or reported as tentative lines, which we are analysing the data to confirm their postion and multipolarity. Some of new lines are aslo shown in figure 1. The time window is set 100 ns to make matrices. To confirm the placement of gamma lines we have made γ-γ-γ-cube from the 2d.dmp file, and we are able to see some of week lines also in double gated spectrum. Further analysis is in progress. we will present the full details in the symposium.

4. Acknowledgments

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