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Low- and medium-spin level structures of neutron-rich 98Zr nucleus: Competition between single particle and collective modes of excitations

Neutron-rich nuclei in the mass region A˜100 exhibit large variety of interesting nuclear structure phenomena. The nuclei having neutron number N ≤ 58 has a nearly spherical ground state, but they undergo a rapid shape transition from nearly spherical to well-deformed prolate deformation as N = 60 is approached. This abrupt shape change was correctly described by largescale Monte Carlo shell model (MCSM) calculations which pointed out the proton-neutron interaction between π(1/) and ν(1/) orbitals. Lying in the intermediate position between the spherical 96Zr and the deformed 100Zr, it is expected that the level structure of 98Zr should exhibit the multifaceted excitation features arising out due to the strong competition between single particle and collective behaviors.

As these neutron rich nuclei are difficult to populate through conventional fusion evaporation reaction, the previous investigations on these nuclei were mostly carried out using the spontaneous fission (SF) data from 252Cf and 248Cm radioactive sources. The present study attempts an investigation of nuclear structure phenomena associated with the 98Zr nucleus, in the low- and medium spin regimes, incorporating the new spectroscopic results obtained from an experiment employing thermal neutron induced fission of 235U. The experiment was performed at the PF1B line of the high-flux reactor facility at the Institut Laue-Langevin (ILL), Grenoble, France. The γ- rays from the 98Zr nucleus and its complimentary fragment nuclei were detected by an array consisting of eight EXOGAM large clovers, six large single-cryatal coaxial detectors and two unsuppressed clovers from ILL. Evidence of shape-coexistence phenomenon with all its complexities and consequences, and possibilities of other exotic modes of excitations in this nucleus will be presented.

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