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Reviewing nuclear structure properties of even-even Yb isotopes

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Abstract

The medium–to–heavy mass ytterbium isotopes ($_{70}Yb$) in the rare–earth mass region are known to be well–deformed nuclei, which can be populated to very high spin. Spectroscopic information becomes scarcer as the neutron number increases, impeding the understanding of nuclear structure in this mass region, where interesting phenomena, such as shape coexistence, have been predicted [1]. The lack of any experimental information on the structure of the neutron–rich ^{180}Yb isotope and the lifetime of the 2_1^+ state of ^{178}Yb have greatly motivated this study, which can offer useful information for the collective behavior of neutrons and protons, the evolution of shape and shape coexistence. A measurement was performed to investigate the population of excited states and a first measurement of the unknown 2_1^+ lifetime of ^{178}Yb by means of a two neutron–transfer reaction ^{176}Yb (^{18}O, ^{16}O) ^{178}Yb at energies 68-74 MeV using the ROSPHERE [2] array at IFIN–HH, Romania. From the theoretical point of view, in this work, energy levels, deformation parameters β_2, reduced transition probabilities $B(E2)$ and transition quadrupole moments Q for even–even Yb isotopes have been calculated using a Phenomenological Model, the Interacting Boson Model and various other theoretical models, including the recently developed proxy SU(3) model [3]. Along these lines, the results for the even-even $^{164-178}Yb$ isotopes are compared to available experimental data [4,5], serving as benchmarks for more detailed studies in the near future. An overall good agreement was found between available adopted data and theoretical predictions.

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