GROUND-STATE BANDS IN THE TRANSITIONAL PROTON EMITTERS ^{145,147}Tm*

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The excited states in the moderately deformed proton emitters ^{145,147}Tm were studied using the Recoil-Decay Tagging method. Prompt γ rays were detected in the GAMMASPHERE Ge array. The γ rays were tagged by proton decays observed in a Double-Sided Si Strip Detector placed at the focal plane of the Argonne Fragment Mass Analyzer. Excited states in ^{147}Tm have been studied previously using a modest Ge array [1]. Thanks to a much larger γ detection efficiency the ^{147}Tm ground-state band was significantly extended and the unfavored signature sequence was found. The ^{145}Tm ground state decays primarily to the 0^+ ground state in the daughter ^{144}Er. A branch to the 2^+ state has been observed recently [2]. The cross section for producing ^{145}Tm is only about 200 nb. The ^{145}Tm half-life is 3 μs. To avoid pileup of protons with implants fast delay-line amplifiers were developed. As a result, protons with decay times as short as 1 μs were observed. The ground-state band was clearly observed in ^{145}Tm. In addition, coincidences between the proton fine structure line and the $2^+ \rightarrow 0^+$ γ-ray transition in ^{144}Er were detected at the focal plane of the FMA. This is the first time that coincidences between proton decays and γ rays have been seen.

The calculated deformation changes rapidly from oblate in ^{147}Tm ($\beta_2 = -0.18$) to prolate in ^{145}Tm ($\beta_2 = 0.25$) [3]. On the other hand, the ^{145}Tm proton-decay rate and the branching ratio to the 2^+ state have been reproduced using the particle-vibrator model [4]. The decay rates in ^{147}Tm are consistent with the assumption of spherical shape. The dominant γ-ray sequences feeding the ground states in ^{147}Tm and ^{145}Tm have properties of decoupled $\pi h_{11/2}$ bands. The energies of the bottom $15/2^- \rightarrow 11/2^-$ transitions indicate lower deformation than the calculated one in both ^{145}Tm and ^{147}Tm. The $E(19/2^-)/E(15/2^-)$ ratio, equivalent to $E(4^+)/E(2^+)$ for the even-even core, is about 2.5, which is characteristic of a γ-soft rotor, greater than 2.2 for a typical harmonic vibrator, and well below the rotor value of 3.33. This suggest an alternative way of viewing the proton decay in ^{145,147}Tm as emission of the $h_{11/2}$ proton aligned with the angular momentum of the γ-soft deformed core.

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