Proton drip-line studies at HRIBF*

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Abstract

A summary of proton radioactivity studies performed within last two years at the Holifield Radioactive Ion Beam Facility (HRIBF) at Oak Ridge will be given. Among the highlights, there is an identification of five new proton emitters, in the deformed (^{140}Ho and ^{141m}Ho) and spherical regions (^{145}Tm, ^{150m}Lu and ^{151m}Lu) of rare earth nuclei. The decay properties of five other proton emitters (^{113}Cs,^{146gs,m}Tm, ^{150gs}Lu and ^{151gs}Lu) have been remeasured with improved precision.

These exotic nuclei have been selected among the fusion–evaporation products by means of a Recoil Mass Spectrometer (RMS). They were detected at the final focus of the RMS with a Position Sensitive Avalanche Counter and Double-Sided Silicon Strip Detector optimized to observe very short-lived activities. The position, energy and time recorded for the recoil implation signals as well as for subsequent particle decay allowed to identify the activities.

For four new proton emitters having halflife at the microsecond range, namely ^{141m}Ho,^{145}Tm,^{150m}Lu and ^{151m}Lu, the proton branching ratio of 100% can be safely assigned. The ^{145}Tm halflife (3.5 μs) is the shortest ever measured for proton radioactivity. In the case of ^{140}Ho, the exotic (p,5n) reaction channel ($\approx$ 13 nanobarns) was used for the first time to identify new proton emitter.

The single-particle levels, shapes and the structure of the unbound proton emitting states deduced from measured properties will be discussed.

* Work supported by the U.S. Department of Energy.