First observation of proton emission from ^{117}La

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Recently we measured the proton radioactive decay of ^{117}La. A 310 MeV ^{58}Ni beam, delivered by the ALPI accelerator of the Legnaro National Laboratories, bombarded a 1 mg/cm^2 ^{64}Zn target producing ^{117}La after $p4n$ evaporation (with an expected cross section of $\sim$ 300 nb) from the compound nucleus.

The experimental setup used the RMS spectrometer to select specific M/q recoils and to focus them on the focal plane detector (a multiwire proportional counter MWPC). The mass selected recoils are allowed to pass through the MWPC and are then implanted in a 60 μm thick double sided silicon strip detector (DSSD) where they eventually decay.

The DSSD is located 1 m downstream the MWPC and is divided in 40 strips (1 mm wide) on both sides (x and y) resulting in 1600 cells of 1 mm^2 each. The detector thickness is such that the recoils are stopped in few μm, while typical ranges for α and p particles are of the order of 15 μm; this causes a detector geometrical efficiency of $\sim$ 60%. β particles are only partially degraded causing a low energy (up to $\sim$ 500 keV) background.

A 4 MHz clock is used to associate an absolute time to each event (either implantation or decay of a recoil). Separation between recoil implantation events and decay events in the DSSD is achieved requiring coincidence with the MWPC detector for the former ones and anticoincidence for the latter ones.

From the analysis of the time correlated implantation-decay events a clear peak at about 770 keV was observed. The time analysis gave a half-life of (20 $\pm$ 5) ms.

Calculated half-lives for ^{117}La ground state p-emission vary in a wide range (from μs to seconds) according to the ground state configuration and deformation. Our result corresponds to a ground-state deformation $\beta \geq 0.25$, in agreement with calculations of reference 1.

Reference

1) Möller and Nix, Atomic Data and Nuclear Data Tables 59(1995)185