The Study of Closed-Shell Proton-Emitter ^{155}Ta

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Proton radioactivity provides a unique probe of nuclear structure far from stability and for odd-Z elements it is expected to be the decay mode that determines the limit of observability for neutron deficient nuclei. Establishing these boundaries of observability and identifying the nuclear structure at these limits is a long-standing challenge in nuclear physics. The closed neutron-shell nuclide ^{155}Ta is expected to be the most nearly spherical proton emitter and therefore a benchmark for theoretical models of this decay mode [1,2]. However, conflicting results have been reported when producing this proton emitter directly [3] and as the daughter of ^{159}Re α decays [4]. Additional interest in this nuclide comes from the possibility of a microsecond multiparticle isomer in ^{155}Ta that is analogous to those seen in its lighter isotones [5].

The aim of this work is to confirm the nature of the proton radioactivity of ^{155}Ta and to search for a possible isomeric state. The experiment was performed at the University of Jyväskylä in Finland. The ^{155}Ta nuclei were produced by fusion-evaporation reactions induced by a ^{58}Ni beam bombarding a ^{102}Pd target. The evaporation residues were separated in flight using the Mass Analysing Recoil Apparatus (MARA) [6] and implanted into a double-sided silicon strip detector (DSSD), which was used to measure proton and alpha decays. The DSSD was surrounded by an array of germanium detectors to allow isomer gamma decays to be observed. The latest results from the analysis of these data will be presented.

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