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Two proton radioactivity: status and perspectives

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Two-proton radioactivity is the latest nuclear decay mode discovered. It consists of the emission of a pair of protons from a nuclear ground state. According to the definition by V. Goldanskii who was the first to discuss this new type of radioactivity extensively, one-proton radioactivity is not allowed to be an open decay channel for two-proton radioactivity (2p) candidates.

In pioneering experiments at GANIL and GSI, this new radioactivity was discovered in 2002 and meanwhile 45Fe and 54Zn are established 2p emitters, with a possible third nucleus, 48Ni, for which one event was most likely observed. These results allowed a detailed comparison with the theoretical models available and showed that, at the level of precision of the experimental data and of the predictive power of the models, nice agreement was obtained.

The latest step in the investigation of 2p radioactivity was the use of time-projection chambers to study the decay dynamics via measurements of the individual proton energies and the relative proton-proton emission angle. A first experiment at GANIL and a high-statistics experiment performed at MSU on 45Fe allowed to gain first insides into the decay characteristics by comparison
with a three-body model. Meanwhile, 54Zn has also been studied with a TPC at GANIL.

The present talk will review the experimental results on ground-state two-proton radioactivity and compare these results with theoretical predictions. Future studies and the possible discovery of new 2p emitters will be discussed.

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