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Two-proton Radioactivity - A Nuclear Structure Tool Beyond the Drip Line

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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 19Mg, 45Fe, 48Ni and 54Zn are established 2p emitters. 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 insights into the decay characteristics by comparison with a three-body model. Meanwhile 54Zn has also been studied with a TPC at GANIL and 2p radioactivity was confirmed for 48Ni at MSU.
In a recent experiment at the BigRIPS separator of RIKEN, a new 2p emitter, 67Kr, was discovered and its basic decay characteristics have been established, whereas two other 2p radioactivity candidates, 59Ge and 63Se, have been shown to decay by beta decay. The decay characteristics of 67Kr are in disagreement with established models and might be a hint for a different decay mode.
The talk will quickly review the experimental status and present in more detail the new results. Future studies of new 2p emitters will also be discussed.

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