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Muonic X-ray measurements with radioactive elements

Muonic X-rays are an excellent tool to measure the nuclear charge radius, the radii of almost all stable nuclei have been measured with this method. More challenging are radioactive nuclei due to the amount of material needed to stop negative muons produces at accelerator facilities. At the Paul Scherrer Institute we have developed a novel method, stopping the muons is a gaseous hydrogen-deuterium mixture. Initially muonic hydrogen is formed, then the muon transfers to deuterium. Due to a minimum in the scattering cross section, this muonic deuterium quickly reaches the target chambers walls, where the muons transfer a higher Z element. A layer as thin as a few nanometers of the element of interest is sufficient to produce the muonic atoms with a efficiency of O(10%). We aim to measure the muonic X-rays in 226Ra. The charge radius derived from this data will serve as a crucial input for an upcoming atomic parity violation experiment with a single trapped radium atom.

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