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Muonic X-rays for the precise measurement of the nuclear charge radius of 226Ra

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The charge radius of a nucleus is one of its defining parameters and of inherent importance for the understanding and the calculation of its interactions. For elements heavier than Z=83, where no stable isotopes exist, only few nuclear charge radii have been measured. These measurements are of paramount importance to complement the measurements of relative difference in mean-square radii along the isotopic chain available from the optical spectroscopy.
Muonic atoms have been used to extract the most accurate nuclear charge radii based on the detection of the X-ray emitted in the muonic cascades. Most stable and a few unstable isotopes have been investigated with muonic atom spectroscopy techniques. However, experiments with muonic atoms have been limited by low muon rates, poor beam quality and large muon stop volumes, but also by available detector technology for this environment. While beam intensities and quality have been improved in recent years, still no higher multiplicity spectroscopy of muonic cascades has been performed.
A new research project recently started at the Paul Scherrer Institut aims to exploit the potential of high-resolution muonic X-rays spectroscopy for the precise determination of nuclear charge radii of radioactive isotopes and other nuclear ground state properties. The first experimental goal is the measurement of the charge radius of 226Ra, which is one of the missing parameters for the measurement of atomic parity violation in radium. Status and perspectives of the project will be presented.

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