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## A novel method for in-trap nuclear decay spectroscopy and level lifetime measurement using a double Penning trap

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MLL-Trap is a double Penning-Trap for high precision mass measurement of exotic nuclei, built and commissioned off-line at the Maier-Leibnitz Laboratory in Garching, Germany [1] and currently installed at the ALTO facility at IPN in Orsay. A new double trap geometry is being studied, in which the central electrode of the second trap has been replaced by an arrangement of four silicon strip detectors [2]. An ion cloud stored in a Penning Trap is indeed an ideal source for decay spectroscopy, since it is very well localized and backing free. Moreover, the ion bunch can be purified from contaminants and in the case of alpha emitters, the strong magnetic field spatially separates the alpha particles and coincident conversion electrons, allowing a clean spectroscopy of both. Such a setup enables direct in-situ observation of decaying very heavy alpha emitters.

In addition, once coupled with a position-sensitive electron detector, this spectroscopic trap will allow for indirect measurement of lifetimes of first excited states or  $0^+$  states in the region of heavy and super heavy nuclei, via a recoil-distance measurement [2]. Measuring the lifetime of the  $2^+$  level in very-heavy even-even nuclei can lead to the derivation of the corresponding quadrupole moment and gives insight into its deformation and degree of collectivity. Also, the lifetime measurement of a low-lying  $0^+$  state could allow to quantify the shape mixing with the ground state.

Simulations performed with SIMION8.1 confirm the feasibility of the method, while the expected uncertainties are still being investigated. Candidate nuclei for both offline and on-line commissioning at ALTO have been identified.

[1] V.S. Kolhinen et al., NIM A 600 (2009) 391-397

[2] C. Weber et al., IJMS 349-350 (2013) 270-276

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