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A cryogenic Paul trap setup for the determination of the ionic radiative lifetime of $^{229m}Th^{3+}$

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The exceptionally low energy of the isomeric first excited nuclear state of ^{229}Th, which has recently been constrained to 8.28±0.17 eV (i.e. λ=149.7±3.1 nm) [1], allows for direct laser excitation with current technology. This offers the unique opportunity to develop a nuclear clock capable of competing or even outperforming existing atomic clocks. One of the next steps towards the realization of such a clock is the determination of the ^{229}Th isomer's ionic lifetime (theoretically expected to range between $10^3 - 10^4$ seconds) via hyperfine spectroscopy. In order to achieve the required long ion storage time, a cryogenic Paul-trap with a corresponding mass-selective ion guide system has been set up at LMU Munich. The talk will present this new experimental platform.

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[1] B. Seiferle et al., Nature 573, 243 (2019).

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