Prospects of precision measurements with thorium ions trapped inside Coulomb crystals of 40Ca+

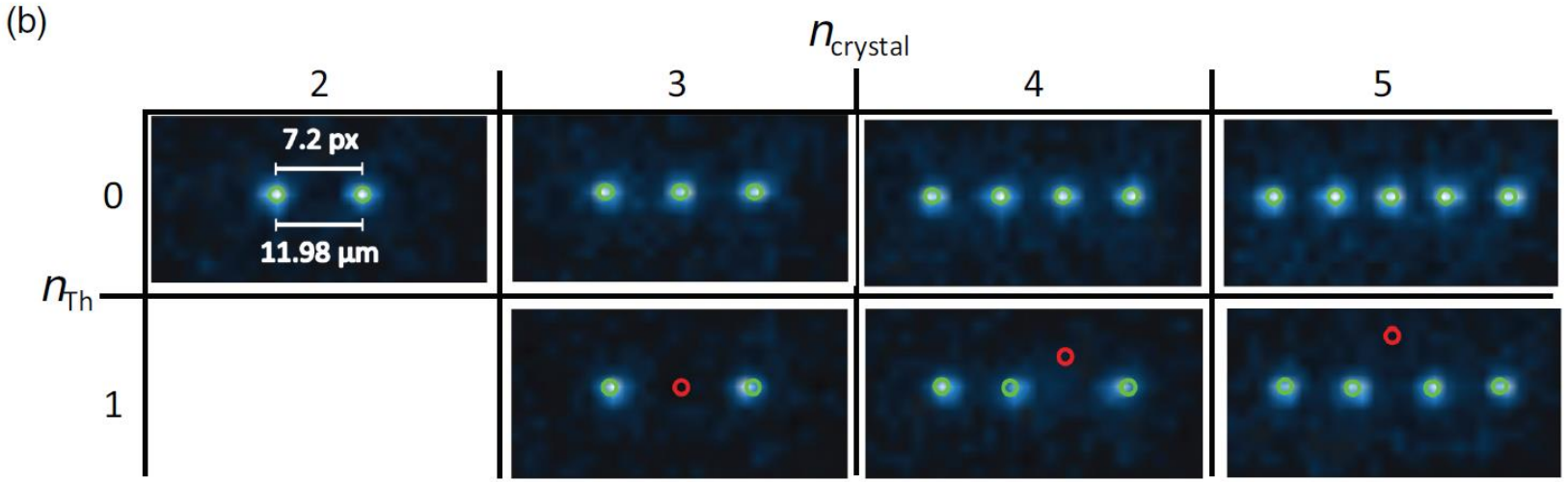
Anna Viatkina for TACTICa collaboration

FFK-2019, Tihany

Trapping And Cooling Thorium Ions with Calcium

(Mainz, Germany)

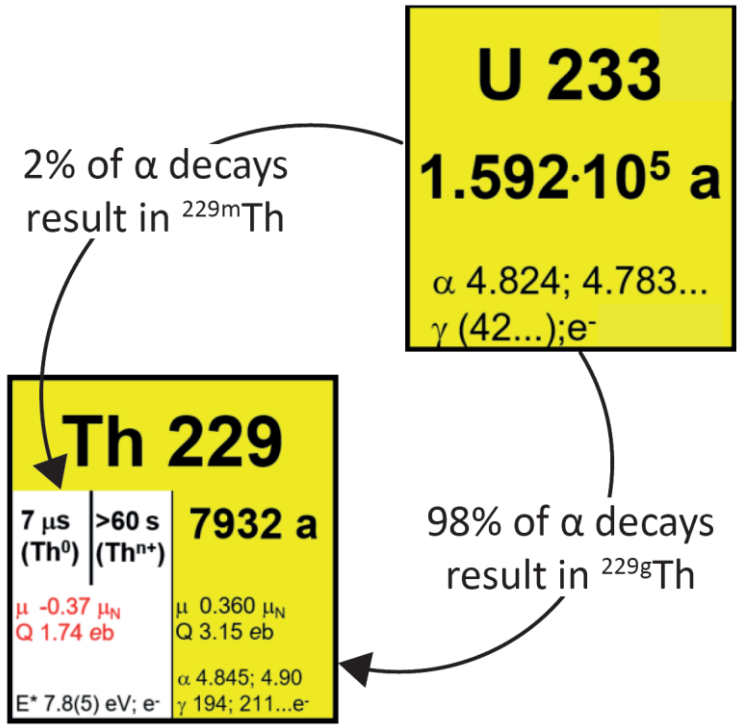
232 Th+ was trapped inside Paul trap, within Coulomb crystals of 40Ca+



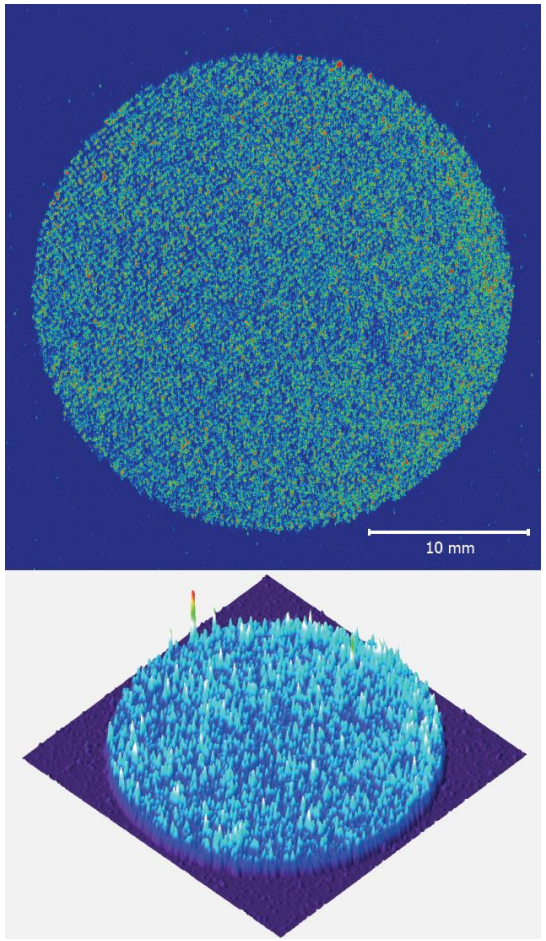
[K. Groot-Berning, F. Stopp, G. Jacob et al. Phys. Rev. A 99, 023420 (2019)]
[F. Stopp, K. Groot-Berning, G. Jacob et al. Hyp. Int. 240, 33 (2019)]

We want to trap 229(m)Th+ in the future.

Recoil source of 229(m)Th+ is being developed on the basis of 233U:



α decay of 233U produces 229(m)Th recoil ions in charge states up to 10+.



Autoradiographic image of Drop-on-Demand inkjet printing 233U source.

[R. Haas, S. Lohse et al. Nuc. Instr. Meth. Phys. Res. A 874, 47 (2017).]

Further plans

- Connect 229Th source with Paul trap.
- Single ion spectroscopy with 229Th and 229mTh.
- Quantum logic spectroscopy with 40Ca+ as a read-out of quantum states.

Theoretical proposals

- Determination of sensitivity of 229Th nuclear transition to the variation of fine structure constant α

[J. C. Berengut, V. A. Dzuba, V. V. Flambaum et al. Phys. Rev. Lett. 102, 210801 (2009)]

- Measurements of nuclear Schiff moment

[V. V. Flambaum Phys. Rev. C 99, 023420 (2019)]