universität innsbruck

Innsbruck Physics Colloquium

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Highly Charged Ion Optical Clocks to Test Fundamental Physics

Highly charged ions (HCI) have many favorable properties for tests of fundamental physics and as potential next-generation optical atomic frequency standards [1]. However, up until recently the most accurate laser spectroscopy on any HCI was performed on the 17 Hz wide fine-structure transition in Ar13+ with 400 MHz resolution, lagging almost twelve orders of magnitude behind state-of-the-art optical clocks. We present the first coherent laser spectroscopy of an HCI using techniques developed in the context of quantum information processing with trapped ions. Results on sympathetic ground state cooling and quantum logic spectroscopy of the Ar13+ P1/2-P3/2 fine-structure transition at 441 nm will be presented, improving the precision of the observed line center by more than eight orders of magnitude [2]. This paves the way towards optical clocks based on highly charged ions with a high sensitivity to a change in fundamental constants and other tests of beyond standard model physics.

[1] M. G. Kozlov et al., Rev. Mod. Phys. 90, 045005 (2018).
[2] P. Micke et al., Nature 578 60-65 (2020).

Sympathetically cooled highly-charged ions.
Left: Ar13+ in a cloud of laser-cooled Be+ ions.
Right: Two-ion crystal of a Be+ and an Ar13+ ion.

Tuesday, 1.12.2020, at 17:15 h online (link t.b.a.)

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