Ultrastable clock transitions in highly charged ions

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Highly charged ions (HCIs) are insensitive to external perturbations and attractive for developing ultrastable clocks. In this contribution [1], we present a set of HCI clock candidates with quality factors and polarizabilities many orders of magnitude larger and smaller, respectively, than those in state-of-the-art clocks. Their transition energies could scale up to the XUV and soft-x-ray region, thus enable the development of clocks based on shorter wavelengths. Furthermore, as the metastable clock states have energies higher than their corresponding ground states, HCIs in such states bear heavier masses that could be detected via mass spectrometry [2, 3]. We also show that these HCI clock states can be coherently excited via currently available lasers [4]. The high-precision laser spectroscopy of these clock transitions will significantly enrich the detection of a hypothetical fine-structure constant variation, the search for new physics via spectroscopic methods, and the test of nuclear theories.

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[1] C. Lyu *et al*., in preparation.
[2] K. Kromer, C. Lyu *et al*., in preparation.
[3] R. X. Schüssler *et al*., Nature **581**, (2020) 42.
[4] C. Lyu *et al*., Phys. Rev. Lett. **125**, (2020) 093201.