Contribution ID: **61** Type: **Hot Topic Talk**

Towards optical clocks based on highly charged ions for precision tests of fundamental physics and improved frequency standards

Tuesday, 26 September 2023 17:00 (20 minutes)

Optical clocks based on highly charged ions (HCIs) offer several promising avenues for the study of physics beyond the standard model. Among these are searches for time variation of the fine structure constant, $\dot{\alpha}/\alpha$, ultralight scalar dark matter, and tests of quantum electrodynamics (QED) [1]. Due to level crossings occurring in high charge states, narrow linewidth optically accessible transitions with a high sensitivity to $\dot{\alpha}/\alpha$ are predicted in systems such as Pr^{10+} [2]. We plan to create HCIs, including Pr^{10+}, in a compact electron beam ion trap (EBIT) and then transfer them to a cryogenic radiofrequency (rf) Paul trap where quantum-logic spectroscopy (QLS) will be performed. In this talk, I will present an update on HCI production in the newly developed CSU EBIT and recent results on precision spectroscopy on $^{9}Be^{+}$ in our first-generation room temperature rf trap. In addition, I will present an update on the development of a Ba^{4+} quantum-logic clock for use as an improved optical frequency standard [3] and a recently established dark optical fiber link between CSU and the NIST-WWV clock ensemble located in Fort Collins, CO.

References

[1] M. G. Kozlov, M. S. Safronova, J. R. Crespo Lopez-Urrutia, and P. O. Schmidt, Rev. Mod. Phys. **90**, 045005 (2018).

[2] M. S. Safronova, V. A. Dzuba, V. V. Flambaum, U. I. Safronova, S. G. Porsev, and M. G. Kozlov, Phys. Rev. Lett. **113**, 030801 (2014).

[3] K. Beloy, V. A. Dzuba, and S. M. Brewer, Phys. Rev. Lett. **125**, 173002 (2020).

Primary author: BREWER, Samuel (Colorado State University)

Presenter: BREWER, Samuel (Colorado State University)

Session Classification: Tuesday Hot Topics