Contribution ID: **285** Type: **Invited talk in the parallel session**

Dark matter searches with atomic and nuclear clocks

Thursday 8 July 2021 17:00 (30 minutes)

The extraordinary advances in quantum control of matter and light have been transformative for precision measurements enabling probes of the most basic laws of Nature to gain fundamental understanding of the physical Universe. The development of atomic clocks with systematic uncertainties in the 10^{-18} range enables searches for the variation of fundamental constants, dark matter, and violations of Lorentz invariance. I will discuss recent advances in theory of clocks based on highly-charged ions (HCIs) including the detailed investigation of optical clocks based on Cf^{15+} and Cf^{17+} [1]. Development of a broadly applicable approach based on a parallel (MPI) configuration interaction code that drastically increases the ability to predict the properties of complex atoms accurately is also discussed. We recently used this approach to evaluate the electronic bridge process in $^{229}Th^{35+}$ for a laser excitation of a nuclear transition [2]. I will also report a release of the new online portal for high-precision atomic data and computation [3] and discuss future efforts in adding HCI data.

[1] S. G. Porsev, U. I. Safronova, M. S. Safronova, P. O. Schmidt, A. I. Bondarev, M. G. Kozlov, I. I. Tupitsyn, Phys. Rev. A 102, 012802 (2020).
[2] S. G. Porsev, C. Cheung, M. S. Safronova, arXiv:2105.00512, submitted to Quantum Science and Technology (2021).
[3] Parinaz Barakhshan, Adam Marrs, Bindiya Arora, Rudolf Eigenmann, Marianna S. Safronova, Portal for High-Precision Atomic Data and Computation (version 1.0). University of Delaware, Newark, DE, USA. URL: https://www.udel.edu/atom.

Author: SAFRONOVA, Marianna (University of Delaware)

Presenter: SAFRONOVA, Marianna (University of Delaware)

Session Classification: Variation of the Fundamental Constants, Tests of the Fundamental Symmetries and Probes of the Dark Sector

Track Classification: Precision Tests: Variation of the fundamental constants, tests of the fundamental symmetries and probes of the dark sector