

# Search for New Physics with Atoms and Molecules

M. S. Safronova<sup>1</sup>

<sup>1</sup>*Department of Physics and Astronomy, University of Delaware, Newark, Delaware 19716, USA*

<sup>1</sup>*Joint Quantum Institute, NIST and the University of Maryland, College Park, Maryland 20899, USA*

Presenting Author: msafrono@udel.edu

Recent advances in both experimental and theoretical atomic, molecular, and optical physics provide remarkable new opportunities for precision measurements and tests of fundamental physics, including searches for permanent electric-dipole moments, parity violation studies, searches for variation of fundamental constants, gravity studies, tests of local Lorentz invariance, search for dark matter and many others. I will give a brief introduction to this subject and review the role of theory. The main part of the talk will focus on the search for the variation of the fine-structure constant  $\alpha$  [1] and tests of local Lorentz invariance [2], including recent highly-charged ion proposals.

## References

- [1] *Highly-charged ions for atomic clocks, quantum information, and search for  $\alpha$ -variation*, 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).
- [2] *A Michelson-Morley Test of Lorentz Symmetry for Electrons*, T. Pruttivarasin, M. Ramm, S. G. Porsev, I. I. Tupitsyn, M. Safronova, M. A. Hohensee, and H. Häffner, Nature **517**, 592 (2015).