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Multiply-ionized Atoms at Low Energy for Precise Measurements[1] SHANNON FOGWELL HOOGERHEIDE, JOSEPH N. TAN, NIST - Natl Inst of Stds & Tech — Recent work at NIST introduced a new system for the slowing, capture and manipulation of multiply-ionized atoms in a controlled environment suitable for precision measurements. As a demonstration of its potentials, we have measured the lifetimes of metastable states in krypton and argon (gases), and are now extending this technique to metals such as iron. Work is also underway on a table-top apparatus that incorporates a miniature electron-beam ion trap (EBIT) coupled to a cryo-cooled, compact Penning trap to enable spectroscopic studies of interest for atomic physics, astrophysics, and metrology. This apparatus will allow charge exchange between laser-excited Rydberg rubidium atoms and isolated bare nuclei, opening the way for precision spectroscopy of one-electron ions in Rydberg states using optical frequency comb technology. Earlier theoretical work at NIST has shown that such measurements would provide a new determination of the Rydberg constant that was independent of the proton radius. Such a measurement could help resolve the proton-radius puzzle. Additional applications could include the study of very-long-lived atomic states proposed for new atomic frequency standards or laboratory studies of potential time variation of the fine structure constant.

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Shannon Fogwell Hoogerheide
NIST - Natl Inst of Stds & Tech

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