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Experiment at NIST to produce one-electron ions in circular Rydberg states JOSEPH TAN, NIST, SAMUEL BREWER, University of Maryland, NICHOLAS GUISE, NIST — Highly charged ions, including bare nuclei, produced in the NIST EBIT (electron beam ion trap) are extracted and captured in the simplest Penning trap that can be configured with a single neodymium (NdFeB) magnet.[1] Slowing and capture of bare nuclei is a step towards formation and study of one-electron ions within the well-controlled environment of a Penning or Paul trap. Detailed laser spectroscopy of hydrogen- like ions in circular Rydberg states would potentially provide a test of theory in a regime with completely negligible nuclear- size corrections.[2] Such a test is of particular interest in the wake of the large discrepancy in proton radius determinations that resulted from the muonic hydrogen Lamb-shift measurements.[3] We discuss some experiments with captured ions planned in a more elaborate apparatus configured with a two-neomagnet (NdFeB) Penning trap for better magnetic field homogeneity, an electron gun for in-trap loading of low-Z ions, and optical access for spectroscopy experiments with low-energy, highly-charged ions.

[1]N. Guise, S.M. Brewer and J.N. Tan, oral presentation at this meeting
[2]U.D. Jentschura, *et al.*, Phys. Rev. Lett. **100**, 160404 (2008).
[3]R. Pohl, *et al.*, Nature **466**, 213-218 (2010).

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