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Charge exchange and spectroscopy with isolated highly-charged ions NICHOLAS D. GUISE, National Institute of Standards and Technology (NIST), SAMUEL M. BREWER, University of Maryland, JOSEPH N. TAN, NIST — Compact ion traps can be useful in facilitating the study and manipulation of highly charged ions isolated in a controlled environment. Various ions of interest, including bare nuclei, are produced in the NIST electron beam ion trap (EBIT), extracted through a beamline that selects a single charge/mass species, then captured in a compact permanent magnet Penning trap[1] or RF trap. The isolated ions are detected optically or by ejection to a fast time-of-flight microchannel plate detector. In this room-temperature apparatus, demonstrated ion storage lifetimes exceed one second for species including Ne^{10+} and Ar^{13+}, sufficiently long to measure certain metastable lifetimes via fluorescence detection,[2] and to observe charge-exchange processes between trapped ions and residual background gas. A beam of Rydberg rubidium atoms, under development, may enable production of hydrogenlike ions in circular Rydberg states, via charge exchange with trapped bare nuclei; such one-electron ions are attractive for tests of theory and fundamental metrology.[3] Other applications include spectroscopic studies of trapped highly charged ions relevant to atomic physics, astrophysics, and plasmas.

[1]J.N. Tan, S.M. Brewer, and N.D. Guise, at this meeting (poster).
[2]S.M. Brewer, N.D. Guise, and J.N. Tan, at this meeting.
[3]U.D. Jentschura, *et al.*, Phys. Rev. Lett. **100**, 160404 (2008).

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