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Capture of highly charged ions in a rare-earth permanent-magnet Penning trap NICHOLAS D. GUISE, NIST, SAMUEL M. BREWER, University of Maryland, JOSEPH N. TAN, NIST — Highly charged ions extracted from the NIST electron beam ion trap (EBIT) are captured and stored in a rare-earth Penning trap built around a cylindrical NdFeB permanent magnet. Ions of charge qe, emerging from the EBIT with typical energy $4.0q$ keV, are slowed electrostatically while entering the Penning trap, then captured by pulsing closed the Penning trap front endcap voltage at the time of arrival. Stored ions are later detected by pulsing open the back endcap to dump to a microchannel plate. In this first prototype trap,[1] species including Ne^{10+} and N^{7+} are confined with storage times of order 1 second, showing the potential of this setup for manipulation and spectroscopy of highly charged ions in a controlled environment. Such experiments will use a more elaborate apparatus that incorporates a two-magnet Penning trap for improved B-field homogeneity, a field-emission electron gun for in-trap loading of low-Z ions, and optical access for spectroscopy experiments on trapped ions. Possible applications include spectroscopic studies of one-electron ions in Rydberg states,[2] as well as highly charged ions of interest in atomic physics, metrology, and plasma diagnostics.

[1]S.M. Brewer and J.N. Tan, BAPS.2009.DAMOP.T1.107
[2]U.D. Jentschura, *et al.*, Phys. Rev. Lett. **100**, 160404 (2008)

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