

Abstract Submitted  
for the DAMOP13 Meeting of  
The American Physical Society

**Scheme for Launching and Observing Dynamics of Cold Atoms in Rydberg States** ANNE GOODSSELL, ERIK WEIDNER, MATTIAS FITZPATRICK, Middlebury College — We are assembling a source of laser-cooled Rb atoms that can be launched at slow, controlled velocities and excited into Rydberg states. We assess the feasibility of detecting the motion of cold Rydberg atoms around a macroscopic charged wire. The capture and ionization of cold ground-state atoms in a  $1/r$ -electric field has been observed previously [1], using a nanowire to ensure that captured atoms could move in free space at small radial distances before impacting the wire or field-ionizing near the surface. Using highly-excited atoms instead, we suggest that a macroscopic wire offers a robust system with magnified effects. The capture cross-section increases for incident atoms in high- $n$  states. For a 20-micron-diameter wire charged to +300 V, the critical impact parameter for atoms traveling at 2 m/s with  $n = 50$  is  $30 \mu\text{m}$ , 10 times larger than for ground-state atoms. We propose that aspects of this model can be realized experimentally. Using an estimated lifetime of 40 ns for the  $n = 50$  state, we calculate that excitation must occur at  $r=100 \mu\text{m}$ , significantly beyond the wire's surface. In this way, we are preparing to promote launched atoms into high- $n$  states and study their dynamics. [1] PRL 104, 133002 (2010).

Anne Goodsell  
Middlebury College

Date submitted: 29 Jan 2013

Electronic form version 1.4