Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Preparation for Acceleration and Deceleration of Cold Rydberg Atoms in the Field of a Charged Wire ANNE GOODSELL, POOMIRAT NAWARAT[1], W. COLLEEN HARPER[2], Middlebury College — We are preparing for experiments using cold Rydberg atoms in linear Stark states. We cool and launch Rb atoms at 2-12 m/s toward a charged wire with a cylindrically-symmetric electric field. The cold cloud will be illuminated in mid-flight to promote atoms into the desired Rydberg state (e.g. n = 33-40). With a three-photon sequence we will access nf states and the nearby manifolds (parabolic quantum number $0 \leq n_1 \leq (n-4)$) with linear Stark shifts. This requires specific detuning of the the excitation laser, which allows us to selectively compare states that are strongly accelerated to states that are strongly decelerated. With the wire at +10 V, atoms launched at 10 m/s, and excitation near 750 μm from the wire, the displacement during the Rydberg lifetime (e.g. n =35, τ = 30 μs) will be 200-300 μm farther for extreme attracted states (n_1 = 0) than for extreme repelled states (n_1 = 31). Detection will occur by spatially-dependent field ionization. Observations of atoms with zero angular momentum around the wire can be extended to atoms with nonzero angular momentum and also to study the dynamics of Rydberg atoms with a quadratic Stark shift, building on previous work with ground-state atoms [1].

[1] PRL 104, 133002 (2010).

[1](current address: Rensselaer Polytechnic Institute, Troy, NY)
[2](current address: Epic Corporation, Madison, WI)

Anne Goodsell
Middlebury College

Date submitted: 30 Jan 2015 Electronic form version 1.4