Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Study of the Efficiency of STIRAP[1] YUAN SUN, VLADISLAV ZAKHAROV, HAROLD METCALF, Physics, Stony Brook University, Stony Brook NY 11794-3800 — We measure the efficiency of the STIRAP process in exciting 2^3S metastable He atoms (He*) to Rydberg states. Atoms in a beam are excited to 3^3P by $\lambda = 389$ nm light (blue), and from there to Rydberg states by ~ 800 nm (red) light. The parallel laser beams are perpendicular to the atomic beam, arranged so that the atoms encounter the red light first (in counterintuitive order), partially overlapping with the blue. Although the lasers are CW, the atoms fly through their mm-size beams at $v \sim 1070$ m/s so they see μs pulses of light. The primary detection scheme uses a stainless steel detector (SSD) as a target from which He* can efficiently eject an electron. A bichromatic light beam at $\lambda = 1083$ nm exerts a strong transverse force on He* atoms that deflects them into the offset SSD, but Rydberg atoms are unaffected, thus allowing an absolute measure of the Rydberg atoms. A secondary detection method exploits the relative ease of ionizing Rydberg atoms by background blackbody radiation. The efficiency of Rydberg production is partly limited by the residual transverse velocity spread of the atomic beam, causing Doppler broadening. This will be partially remedied with an optical molasses for transverse cooling just before the STIRAP region.

[1]Supported by ONR.

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Date submitted: 31 Jan 2014 Electronic form version 1.4