Abstract Submitted for the DAMOP06 Meeting of The American Physical Society

Experimental Progress Toward Multiple Adiabatic Rapid Passage Sequences¹ X. MIAO, E. WERTZ², M. G. COHEN, H. METCALF, Stony Brook University, NY 11794-3800 USA — Multiple repetitions of adiabatic rapid passage (ARP) sweeps with counterpropagating light beams can enable huge optical forces on atoms³. The repetition rate of the ARP sweeps $\omega_s \gg \gamma$ results in a force $\hbar k \omega_s / \pi \gg \hbar k \gamma / 2 \equiv F_{rad}$ where $1/\gamma \equiv \tau$ is the excited state lifetime and F_{rad} is the ordinary radiative force. This is because each pair of ARP-induced inversions can coherently transfer momentum $\pm 2\hbar k$ between the light beams, and thus $\mp 2\hbar k$ to the atoms. In developing instruments for such experiments on the $2^{3}S_{1} \rightarrow 2^{3}P_{2}$ transition at $\lambda = 1083$ nm in He, we exploit recent developments in the optical communications industry. We use commercial phase and intensity modulators of the LiNbO₃ waveguide type having V_{π} as low as 6 V and thus requiring relatively low rf power for the modulation. Synchronized driving of the two modulators can produce the necessary multiple ARP sequences of 10 ns chirped pulses that span several GHz, as needed for the experiment³. We are also developing optical methods for characterizing these pulses.

¹Supported by ONR and ARO
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³T. Lu, X. Miao, and H. Metcalf, Phys., Rev. A 71 061405(R) (2005)

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Date submitted: 25 Jan 2006

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