Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Coherent Control of Ultracold Collisions with Nonlinear Frequency Chirps: Experiment and Simulations J.A. PECHKIS, J.L. CARINI, C.E. ROGERS III, P.L. GOULD, Department of Physics, University of Connecticut, Storrs, CT 06269 — We report on measurements and simulations of ultracold collisions between Rb atoms induced by frequency-chirped laser light. Either positive or negative chirps, centered at a variable detuning below the atomic resonance, sweep over 1 GHz in 100 ns. If the light is resonant with an attractive atom-pair potential at some point during the 40 ns chirped pulse, the pair is excited, potentially resulting in trap loss. In previous work with linear chirps,[1] the negative chirp yielded a lower collisional loss rate β than the positive chirp at certain center detunings. We attribute this to the fact that the negative chirp follows the excited-state wavepacket trajectory and, thus, can de-excite the wavepacket, coherently blocking the collision. In the present work, we use nonlinear chirps, either concave-down or concave-up. For the negative chirp, we find a dependence on the details of the nonlinearity under conditions where coherent collision blocking occurs. In particular, the concave-down chirp yields a higher β than the linear and concave-up chirps, a trend supported by quantum mechanical simulations of the collision process. Our results indicate the importance of the shape of the frequency chirp on the excited-state wavepacket dynamics. This work is supported by DOE.

[1] M.J. Wright *et al.*, Phys. Rev. A **75** 051401(R) (2007)

J.A. Pechkis
Department of Physics, University of Connecticut, Storrs, CT 06269

Date submitted: 23 Jan 2009 Electronic form version 1.4