Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Observation of sub-doppler cooling via swept adiabatic transfer in Rb BAOCHEN WU, GRAHAM P. GREVE, JILA and Department of Physics, University of Colorado Boulder, JAMES K. THOMPSON, JILA, and Department of Physics, University of Colorado Boulder — Norcia et al (arXiv:1707.01944) recently demonstrated a novel cooling mechanism on narrow-linewidth optical transitions in Sr. Counter-propagating laser beams are swept in frequency in a sawtooth manner to cause adiabatic Landau-Zener transfers between an atom's ground state and excited state. Doppler shifts impose a time-ordering of the interactions with each laser beam such that the associated photon recoils oppose the atom's motion, leading to cooling. Here we expand the idea to artificial two-photon transitions in Rb. We are able to cool atoms from 42 uK to 6 uK over several sweeps, and we achieve a moderate amount of phase space density compression. Because the dynamics of the adiabatic transfer are crucial for understanding the cooling rate, we developed a generic model for assessing the feasibility of two-photon Landau-Zener transitions in the presence of free space scattering, and propose a dimensionless quality factor to quantify the maximum efficiency of the process. Both the experiment and theoretical modeling may find potential applications in cooling molecules or other systems that lack high-quality cycling transitions.

Baochen Wu
JILA and Department of Physics, University of Colorado Boulder

Date submitted: 26 Jan 2018 Electronic form version 1.4