

Abstract Submitted  
for the DAMOP12 Meeting of  
The American Physical Society

**Optical pulse-shaping for internal cooling of molecules**<sup>1</sup> CHIEN-YU LIEN, CHRIS SECK, SCOTT WILLIAMS, BRIAN ODOM, Northwestern University — We propose a scheme to use pulse-shaped femtosecond lasers to optically cool the internal degrees of freedom of molecular ions. Since this approach relies on cooling rotational and vibrational quanta by exciting an electronic transition, it is most straightforward for molecular ions with diagonal Frank-Condon-Factors. Compared with schemes that cool rotations by exciting vibrations, this approach achieves internal cooling on the orders-of-magnitude faster electronic decay timescale and is potentially applicable to apolar molecules. For  $\text{AlH}^+$ , a candidate species, a rate-equation simulation shows that rovibrational equilibrium should be achievable in 8  $\mu\text{s}$ . Progress towards the experimental realization of this scheme for rovibrational optical cooling  $\text{AlH}^+$ , including the molecular ion production technique, details of the optical pulse shaping, and the state readout scheme will be discussed.

<sup>1</sup>This work is supported by AFOSR and NSF.

Chien-Yu Lien  
Northwestern University

Date submitted: 27 Jan 2012

Electronic form version 1.4