

Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Three-dimensional momentum imaging of dissociation in flight of metastable molecular ions¹ BETHANY JOCHIM, REID ERDWIEN, T. SEVERT, BEN BERRY, PEYMAN FEIZOLLAH, JYOTI RAJPUT, Y. MALAKAR, B. KADERIYA, W. L. PEARSON, K. D. CARNES, A. RUDENKO, I. BEN-ITZHAK, J. R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, KS 66506 — While fragmentation of molecular ions induced by ultrashort laser pulses or fast ions often proceeds on femtosecond timescales, the population of metastable states can lead to decay on much longer timescales, ranging from picoseconds to even seconds [1,2]. We examine in detail the unimolecular dissociation in flight of such long-lived metastable molecular ions, utilizing the cold target recoil ion momentum spectroscopy (COLTRIMS) technique. Via the example of deprotonation of metastable ethylene dications formed in intense femtosecond laser pulses, we demonstrate a method that allows retrieval of the lifetime(s) of the metastable states, as well as the 3-D momentum distributions of the dissociating fragments. Importantly, our approach is general and can be used to study other heteronuclear metastable molecules that undergo dissociation in flight.

[1] S. D. Price, *Int. J. Mass Spectro.* **260**, 1 (2007).

[2] D. Mathur, *Phys. Rep.* **391**, 1 (2004).

¹Supported by the Chemical Sciences, Geosciences, and Biosciences Division, Office of Basic Energy Sciences, Office of Science, U. S. Department of Energy.

Bethany Jochim
J. R. Macdonald Laboratory, Kansas State University

Date submitted: 06 Feb 2017

Electronic form version 1.4