DAMOP12-2012-020009

Abstract for an Invited Paper
for the DAMOP12 Meeting of
the American Physical Society

**LeRoy Apker Award Lecture: Strong-field dissociation dynamics of $NO^{2+}$: A multiphoton electronic or vibrational excitation?**[1]

BETHANY JOCHIM[2], J. R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, KS 66506

A 3-D momentum imaging technique is employed to study intense ultrafast laser-induced dissociation of a metastable $NO^{2+}$ beam. We focus on $N^+ + O^+$ coincidences and explore possible dissociation pathways using estimates of the initial vibrational population and transition rates between the X $^2\Sigma^+$and A $^2\Pi$ states together with our measured kinetic energy release and angular distribution spectra. Our analysis suggests that lower intensity pulses ($<10^{15}$ W/cm$^2$) drive perpendicular transitions between these states. Higher intensity pulses ($\sim 10^{16}$ W/cm$^2$), on the other hand, yield a prominent contribution from molecules breaking parallel to the polarization. An intriguing possibility is that this feature is due to a two photon permanent dipole transition to the vibrational continuum of the X $^2\Sigma^+$ state, *i.e.*, a multiphoton vibrational excitation involving only the electronic ground state. The results of our time-dependent Schrödinger equation calculations comparing the probabilities of this type of pathway and competing electronic transitions will be presented.

[1]Supported by the Chemical Sciences, Geosciences and Biosciences Division, Office of Basic Energy Sciences, Office of Science, U.S. Department of Energy. BJ acknowledges NSF grant PHY-0851599, and EW and BJ acknowledge NSF grant PHY-0969687.

[2]Co-authors: M. Zohrabi, B. Gaire, U. Ablikim, K.D. Carnes, F. Anis, B.D. Esry, I. Ben-Itzhak, Kansas State University; E. Wells, Augustana College-Sioux Falls, SD; T. Uhlíková, Institute of Chemical Technology, Czech Republic.