Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Dynamic Orientation of OCS Induced by Intense THz Pulses[1]
KISRA EGODAPITIYA, SHA LI, R.R. JONES, University of Virginia — We have used intense, picosecond THz pulses to dynamically orient OCS molecules. Rotationally cooled molecules in a pulsed super-sonic expansion enter a time of flight mass spectrometer where they are exposed to a 50 fs, 780 nm "pre-alignment" pulse. This pulse coherently broadens the rotational probability distribution within each molecule, creating a rotational wavepacket which undergoes initial alignment along the laser polarization axis. After one-quarter of the fundamental rotational period, approximately 20 ps after the pre-alignment pulse, the molecules have rotated out of alignment and are maximally misaligned. At this time they are exposed to an intense THz pulse generated by tilted-pulse-front optical rectification of a 100 fs 780 nm laser pulse in Li:NiO_3. The THz field drives transitions between rotational states of opposite parity, creating a rotational wavepacket that exhibits periodic head vs. tail orientation along the THz polarization direction. The time-dependent orientation is probed by detecting the up vs. down asymmetry in the S^{3+} ion fragments released during the Coulomb explosion of the OCS molecules in an intense 40 fs, 780 nm pulse. Substantial orientation is observed at a delay of one-half the fundamental rotational period after the THz pulse.

[1]This work was supported by the DOE Office of Science, Basic Energy Sciences, Chemical Sciences, Geosciences, and Biosciences Division.

Kisra Egodapitiya
University of Virginia

Date submitted: 25 Jan 2013 Electronic form version 1.4