Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Diffraction using laser-driven broadband electron wave packets JUNLIANG XU, COSMIN I. BLAGA, KAIKAI ZHANG, YU HANG LAI, Department of Physics, The Ohio State University, C.D. LIN, Department of Physics, Kansas State University, TERRY A. MILLER, Department of Chemistry, The Ohio State University, PIERRE AGOSTINI, LOUIS F. DIMAURO, Department of Physics, The Ohio State University — Directly monitoring atomic motion during a molecular transformation with atomic-scale spatio-temporal resolution is a frontier of ultrafast optical science and physical chemistry. Here we provide the foundation for a new imaging method, fixed-angle broadband laser-induced electron scattering, based on structural retrieval by direct one-dimensional Fourier transform of a photoelectron energy distribution observed along the polarization direction of an intense ultrafast light pulse. The approach exploits the scattering of a broadband wave packet created by strong-field tunnel ionization to self-interrogate the molecular structure with picometer spatial resolution and bond specificity. With its inherent femtosecond resolution, combining our technique with molecular alignment can, in principle, provide the basis for time-resolved tomography for multi-dimensional transient structural determination.

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Date submitted: 30 Jan 2015 Electronic form version 1.4