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Ultrafast Electron Diffraction from Aligned Molecules MARTIN CENTURION, University of Nebraska - Lincoln, PETER RECKENTHAELER, WERNER FUSS, SERGEI TRUSHIN, FERENC KRAUSZ, ERNST FILL, Max Planck Institute of Quantum Optics — Electron diffraction has been very successful for determining the structure of molecules in the gas phase, and also for investigating ultrafast conformational changes. However, due to the random orientation of the molecules in the gas phase only 1D information (the interatomic distances) can be extracted from the diffraction patterns, which limits the size of molecular structures that can be studied. Having a sample of aligned molecules would greatly increase the information encoded in the diffraction pattern and potentially allow for reconstructing the full 3D molecular structure. Here we show electron diffraction patterns recorded from a sample of transiently aligned molecules. In our experiments molecules were aligned selectively using photodissociation of C2F4I2 (1,2- diiodotetrafluoroethane). Molecules oriented parallel to the laser polarization have a higher probability for dissociation, which generates an anisotropic angular distribution. The diffraction pattern is captured by probing the sample with picosecond electron pulses shortly after dissociation—before molecular rotation causes the alignment to vanish. Our results clearly show that the diffraction pattern becomes anisotropic after dissociation.

Martin Centurion
University of Nebraska - Lincoln

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