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**Ultrafast Electron Diffraction of Laser-Aligned $CF_3I$ Molecules** CHRISTOPHER HENSLEY, JIE YANG, MARTIN CENTURION, University of Nebraska - Lincoln — We present first experimental results of electron diffraction from non-adiabatically, laser-aligned molecules in the gas phase. Previous gas-phase diffraction studies have been successful in determining the structure of small molecules by comparing the data to theoretical models of the molecules. The random orientation of the molecules provides only 1D information (the interatomic distances), which makes it difficult to recover the structure of large molecules, or during conformational changes in the molecule where theoretical models cannot provide sufficient information. Using diffraction patterns from multiple projections of the aligned molecules it is possible to reconstruct the complete 3D structure of the symmetric top molecule ($CF_3I$). The alignment angle is adjusted by rotating the direction of the laser polarization. An aligned distribution is created using a femtosecond laser pulse that excites a rotational wave packet causing the molecules to align along the direction of laser polarization around 2 ps after interaction with the laser pulse. Both the electron packet and the intense alignment field are generated using a 300-fs pulse centered at 800 nm. Our results are in good agreement with the previous findings and theoretical models for $CF_3I$.

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