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Ultrafast Imaging of Isolated Molecules with Electron Diffraction¹

MARTIN CENTURION, University of Nebraska - Lincoln

Capturing molecular dynamics as they take place is essential for understanding and eventually controlling the outcome of chemical reactions. Ultrafast electron diffraction can be used to image the structure of isolated molecules with atomic resolution, however, until recently it was not possible to reach the femtosecond resolution needed to observe the nuclear motion. We have recently imaged a vibrational wavepacket in iodine with a resolution of 0.1 Å in space and 230 fs in time with electron diffraction, using the MeV electron source at SLAC National Laboratory. This result opens the door to imaging structural dynamics in more complex reactions. Work is currently ongoing in diffraction experiments to capture conformational changes in molecules and also towards improving the temporal and spatial resolution.

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