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Laser-induced electron diffraction for dynamic imaging of molecules[1]

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Electron diffraction is the well-established tool for probing the structure of gas-phase molecules near the equilibrium geometry. To study chemical dynamics ultrashort electron pulses below a few tens of femtoseconds are needed. Laser-induced electron diffraction (LIED) is a method where molecules can be probed with femtosecond temporal resolution and sub-angstrom spatial resolution. In LIED, molecules are exposed to an intense femtosecond laser pulse. The electrons that have been previously removed by the laser field can be driven back later to rescatter with the parent molecular ion. Using diffraction images from large-angle backscattered events, sub-angstrom spatial resolution can be achieved with tens to hundreds eV electrons. Recent LIED experimental results showing bond breaking in molecules will be illustrated [1] . Practical issues related to the retrieval of diffraction images from LIED on aligned molecules [2] and possibilities of real-time imaging of dissociating molecules using LIED will be presented. [1]B. Wolter et al, Science 354,308 (2016). [2]Chao Yu et al, Scientific Rept. 5, 15753 (2015). This work is performed in collaboration with Anh Thu Le (Kansas State University) and the experimental group of Jens Biegert (ICFO, Barcelona).

[1]US Department of Energy