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Molecular structures studied using laser induced electron diffraction YUNFEI LIN, Department of Chemistry, Wayne State University, Detroit, MI, 48202, SUK KYOUNG LEE, LU YAN, WEN LI — In a strong laser field, the field ionized electrons from molecules can be returned to the parent molecules by the laser field. These electrons are then scattered off their parent ions. Such phenomena can be used to study molecular structures like the conventional electron diffraction technique, with much better temporal resolution (a few femtoseconds). In this study, we demonstrated its capability to retrieve static structures of molecules using a simple experimental setup. We obtained electron diffraction patterns from spatially aligned oxygen, nitrogen and carbon dioxide in a strong laser field with intensity around $7*10^{13}$ W cm^{-2}. Excellent energy and angular resolutions were achieved by using velocity map imaging detection of electron momentum. The analysis shows that in order to extract the structure information, two kinds of interferences have to be considered: in the first kind, the electrons are ionized and scattered from the same atom; in the second kind, they are ionized from one atom but scattered off another atom in the molecule. We were able to account for the main features in the diffraction patterns of all three molecules and thus obtained the internuclear distances. In the future, we will apply this technique to retrieve structures of polyatomics and also plan to study molecular dynamics exploiting its superb temporal resolution.

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