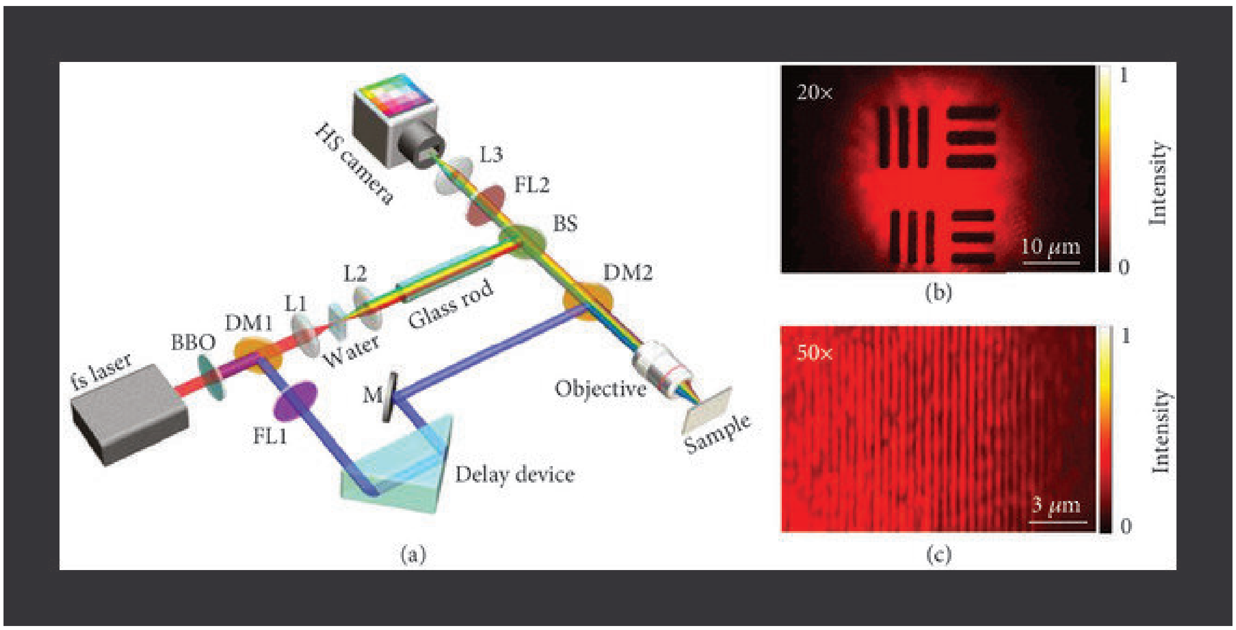
Visualization of the deforming atomic wavefunction with attosecond time-resolved photoelectron holography

December 15 2022



Configuration of CSMUP. (a) Experimental device of CSMUP. (b) Imaging a 1951 USAF resolution test target with a 20× objective. (c) Imaging a grating of 1200 lp/mm with a 50× objective. Credit: *Ultrafast Science* (2022). DOI: 10.34133/2022/9842716

Revealing the impulsive response of the bound electron to an electromagnetic field is of fundamentally importance for understanding various nonlinear processes of matter, and it is one of the ultimate goals of attosecond science.

However, it is still a very challenging task. Recently, a group from Huazhong University of Science and Technology demonstrated a new photoelectron spectroscopy for metrology of the attosecond response of the bound electron exposed to the intense XUV pulses.

In this work, they took advantage of the benefits of the attosecond temporal resolution of tunneling ionization and the subatomic spatial resolution of photoelectron holography. With this scheme, they successfully filmed an attosecond-scale movie of the impulsive response of the bound electron to an intense XUV pulse.

Their work not only revealed how the atomic stabilization is established in the intense laser field, but also established a novel photoelectron spectroscopy to time-resolved imaging of the ultrafast bound-state electron processes in intense laser fields. Extension of this method to more complex molecules is promising, and it will be an exciting aspect in the attosecond science.

The paper is published in the journal *Ultrafast Science*.

More information: Jintai Liang et al, Direct Visualization of Deforming Atomic Wavefunction in Ultraintense High-Frequency Laser Pulses, *Ultrafast Science* (2022). DOI: 10.34133/2022/9842716

Provided by Ultrafast Science