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Attomicroscopy: single isolated attosecond electron pulse MOHAMMED HASSAN, Department of Physics, University of Arizona, Tucson, Arizona 85721, USA — In the last decades, the development of Ultrafast Electron Diffraction (UED) and Microscopy (UEM) have enabled the imaging of atomic motion in real time and space. These table-top tools opened the door for a vast range of imaging applications in different areas of science. In UEM, the typical temporal resolution spans between few tens of picoseconds to several hundreds of femtoseconds. This resolution is insufficient to resolve the faster transient dynamics of matter lasting few tens to hundreds of femtoseconds. Here, we break the temporal resolution limits in UEM (16 times enhancement) and demonstrate the generation of intense 30-fs electron pulses by temporal optical gating approach. This technique is based on the electron-photon interaction occurs only in the presence of the laser pulse. Then, we present the feasibility of using, our recent demonstrated, optical half-cycle laser pulse (FWHM=380 as) to provide an attosecond gating window and generate a single isolated "gated" attosecond electron pulse to establish the Attomicroscopy camera. Ultimately, this attosecond camera will have the desired resolution to image the electron motion in action.

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