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Progress in the development of scanning ultrafast electron microscopy DING-SHYUE YANG, OMAR MOHAMMED, AHMED ZEWAIL, California Institute of Technology — In recent years, ultrafast electron microscopy (UEM) has been developed as a technique that enables time-dependent imaging of structural dynamics in the condensed phase. The central concept involves the usage of a femtosecond or nanosecond laser pulse to initiate dynamical changes in the specimen, and a second light pulse that generates an electron packet as the probe for detection. In UEM, the electron pulses are accelerated typically to 200 keV, and the microscope operates in the transmission mode. Here, we report the development of scanning ultrafast electron microscopy (SUEM) using a field-emission-source configuration, which is different from UEM's. Scanning of pulses is made with only one or a few electrons per pulse, thus achieving imaging still in ten(s) of seconds and without much of the space-charge effect between electrons. For imaging, the secondary electrons from surface structures are detected, as demonstrated here for material surfaces and biological specimens. By recording backscattered electrons, diffraction patterns from single crystals were also obtained. Scanning pulsed-electron microscopy with the acquired spatiotemporal resolutions, and its efficient heat-dissipation feature, is now poised to provide in-situ 4D imaging and with environmental capability.

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