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Photon-Induced Near Field Electron Microscopy: Theoretical and Experimental SANG TAE PARK, MILO LIN, AHMED ZEWAIL, California Institute of Technology — 4D electron microscopy utilizes a pulsed electron packet to image structural dynamics of nanomaterial, induced by an optical pulse, in real time. In the presence of nanostructures, electrons can directly interact with photons, and either gain or lose light quanta. This near field photon-electron interaction enables visualization of nanoscale particles and interfaces with enhanced contrast, and is termed photon-induced near field electron microscopy (PINEM). Here, we give an account of the theoretical and experimental results of PINEM. In particular, the time-dependent Schrödinger equation for electron packets in the nanostructure-scattered electromagnetic (near) field is solved to obtain the evolution of the incident electron packet into discrete momentum wavelets. The characteristic length and time scales of the halo of electron- photon coupling are discussed in the framework of Rayleigh and Mie scatterings, providing the dependence of the PINEM effect on size, polarization, material, and spatiotemporal localization.

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