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Simulated Photoelectron-Based Imaging of Localized Surface Plasmons with Attosecond Resolution JAMES PRELL, LAUREN BORJA, ANDREY GANDMAN, DESIRE WHITMORE, DANIEL NEUMARK, STEPHEN LEONE, University of California, Berkeley — Simulations of proposed photoelectron streaking experiments in the presence of an oscillating plasmon field are presented. The results indicate that localized surface plasmon dephasing can be imaged with attosecond resolution using electron time-of-flight (TOF) or velocity map imaging (VMI) techniques. In the simulation, localized surface plasmons are excited in metal nanoparticles by a few-cycle infrared or visible laser pulse. Using time-delayed single, isolated attosecond x-ray pulses, electrons are photoemitted from the metallic nanoparticles and streaked by both the plasmon and laser electric fields. The effects of these two fields in the streaking spectra and images can be separated so that the temporal evolution of the plasmon electric field can be directly extracted. The plasmon electric field induces a broadening of the photoelectron speed distribution with an envelope directly proportional to that of the plasmon dipole moment. Plasmon-induced oscillation of the angular distribution in VMI is predicted to report the spatial distribution of the plasmon electric field for nanoparticles with high aspect ratios. The simulations indicate that these techniques can be used to map plasmon dynamics with unprecedented temporal resolution.

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