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Optical response function reconstruction of the femtosecond electronic dephasing of an individual plasmonic nanostructure KSENIYA S. DERYCKX, ALEXANDRIA ANDERSON, XIAOJI G. XU, University of Washington Departments of Chemistry and Physics, GÜNTER STEINMEYER, Max-Born-Institute for Nonlinear Optics, MARKUS B. RASCHKE, University of Washington Departments of Chemistry and Physics — The femtosecond (fs) temporal evolution of the optical polarization in a metal reflects the microscopic electron dynamics associated with carrier scattering and electron-phonon coupling. Conventional incoherent plasmonic light scattering with its lack of phase information provides an incomplete description of the material response and thus its underlying origin. We study the homogeneous electronic dephasing of a surface plasmon polariton excitation of an individual plasmonic nanostructure using sub-10 fs excitation pulses and symmetry-selective second-harmonic scattering. We reconstruct the full optical response function of the plasmon excitation with both amplitude and phase information without any model assumptions from the spectrogram analysis of a two-pulse interferometric autocorrelation measurement, an approach conceptually analogous to frequency resolved optical gating (FROG). Recovered (10±5) fs dephasing times are consistent with corresponding calculations within the Drude-Sommerfeld model.

Kseniya S. Deryckx
University of Washington Departments of Chemistry and Physics

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