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Size- and intensity-dependent photoelectron spectra from gas-phase gold nanoparticles irradiated by intense femtosecond laser pulses[1]

J. POWELL, S.J. ROBATJAZI, V. MAKHIJA, A. VAJDI, X. LI, Y. MALAKAR, W.L. PEARSON, A. RUDENKO, J.R Macdonald Laboratory, Kansas State University, C. SORENSEN, Department of Physics, Kansas State University, J. STIERLE, Max Planck Institute for Quantum Optics, M.F. KLING, Ludwig-MaximiliansUniversity Munich — Nanoparticles bridge the gap between atomic/molecular and bulk matter offering unique opportunities to study light interactions with complex systems, in particular, near-field enhancements and excitation of plasmons. Here we report on a systematic study of photoelectron emission from isolated gold nanoparticles irradiated by 800 nm, 25 fs laser pulses at 10-50 TW/cm^2 peak intensities. A combination of an aerodynamic lens nanoparticle injector, high-energy velocity-map imaging spectrometer and a high-speed, single-shot camera is employed to record shot by shot photoelectron emission patterns from individual particles. By sorting the recorded images according to the number of emitted electrons, we select the events from the regions of particular laser intensities within the laser focus, thus, essentially avoiding focal volume averaging. Using this approach, we study the intensity- and size-dependence of photoelectron energy and angular distributions for particle sizes ranging from 5 nm to 400 nm.

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