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Title: Ultrahigh-Throughput Single-Particle Hyperspectral Imaging of Plasmonic Nanoparticles

Abstract: Plasmonic nanoparticles (NPs) have become increasingly useful in recent years for their roles in nanomedicine, cellular biology, energy storage and conversion, photocatalysis, and more. At the single-particle level, NPs have heterogeneous physical and chemical properties which are not resolvable in ensemble measurements. We have developed an ultrahigh-throughput spectroscopy-microscopy system for characterization of NPs at the single-particle level using phasor analysis. This method enables quantification of spectral and spatial information on large numbers of NPs using a single snapshot with high temporal resolution and localization precision (sub-5 nm). Our method is characterized using the localized surface plasmonic resonance (SPR) scattering spectra of gold nanospheres (AuNSs) of many different sizes. Comparing to the conventional optical grating method which suffers low efficiency in characterization due to spectral interference caused by nearby nanoparticles, our phasor approach enables high-throughput analysis of single-particle SPR properties in high particle density. We see up to 10-fold greater efficiency in single-particle characterization using the spectra phasor approach when compared to a conventional optical grating method.