Signatures of Electromagnetic Hot Spots and Fano Interferences in Electron Energy-Loss and Cathodoluminescence Spectroscopies

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Electron energy-loss spectroscopy (EELS) performed in the scanning transmission electron microscope (STEM) offers a powerful means by which to study nanoscale light-matter interactions with sub-angstrom-scale spatial resolution. This technique is now being applied to probe surface-plasmon-supporting metal nanostructures, where a wealth of new information is being revealed that was previously unobtainable with standard optical techniques. These experiments provide an impetus for the implementation of theoretical methodologies capable of elucidating the differences between optically- and electronically-driven plasmons and their associated nanophotonic properties. In this talk, I will discuss our recent work in this area aimed at determining the signatures of electromagnetic hot spots, such as those responsible for single molecule surface-enhanced Raman scattering (SMSERS), in STEM/EELS based upon multiscale numerical simulations. I will also introduce a class of exotic interference features known as Fano resonances and predict, via simulations, their appearance in EELS and cathodoluminescence.