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FDTD calculations of the optical properties of nanostars F. HAO, C. NEHL, J. HAFNER, P. NORDLANDER, Department of Physics, Rice University, Houston TX 77251 — Using the Finite-Difference Time-Domain (FDTD) method, we calculate the near- and far-field properties of a gold nanostar. The nanostar is modeled as a solid core with protruding tips of prolate spheroidal shape. The shape of this nanostar agrees qualitatively with the shape inferred from an SEM picture. The calculated extinction spectra agree very well with the experimentally observed scattering spectra for different polarization angles of incident light. We show that the plasmon resonances of the nanostar can be viewed as resulting from hybridization of short wavelength primitive plasmons associated with the core and long wavelengths plasmons associated with the individual tips. Due to the asymmetric orientation of the tips, several nanostars plasmons can be observed for an arbitrary polarization of the incident light. The intensity of these plasmons resonances vary with polarization angle. The plasmon hybridization results in bonding and antibonding nanostar plasmons. The bonding plasmons are primarily composed of primitive tip plasmons but with a small but finite admixture of the core plasmons. The admixture of the core plasmon dramatically increases the cross section for excitation of the bonding plasmons and result in enormous local electric field enhancements compared to those for individual tips.

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