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Plasmons in Metallic Nanoparticles: Effect of Nanoparticle Shape
GARNETT BRYANT, NIST, Gaithersburg, MD, JAVIER AIZPURUA, Donositia International Physics Center, San Sebastian, Spain, JAVIER GARCIA DE ABAJO, Instituto de Optica, Madrid, Spain — Plasmonic oscillations of valence electrons determine the optical response of metallic nanoparticles. The energy and strength of these surface oscillations are a function of the size and shape of the nanoparticles. With the use of the boundary element method, we solve Maxwell's equations to calculate light scattering and surface modes in Au nanorods that are commonly used in field enhanced nanoantennas and scanned probe microscopies and spectroscopies. We calculate the near field and far field response of the nanorods to show how the shape of the nanorod determines its optical response. Although it is often assumed that the plasmon wavelength scales with the nanorod aspect ratio, we find that scaling with the aspect ratio does not apply. For small rod radii, the plasmon response blueshifts with increasing radii, as would be expected for scaling with the aspect ratio. However, the plasmon response still depends on both the rod length and radius and does not scale with the aspect ratio. For larger radii, the plasmon response redshifts with increasing radii, in contradiction to scaling with aspect ratio. We discuss the mechanisms that determine the shape dependence in these two regimes.

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