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Optical Properties of 2D hexagonal arrays of gold nanoshells FEI LE, HUI WANG, NAOMI HALAS, PETER NORDLANDER, Rice University — Using periodic boundary conditions, we employ the Finite Difference Time Domain method to calculate the optical properties of a two dimensional close-packed array of gold nanoshells for different polarizations under normal incidence. The calculated extinction spectrum agrees very well with experimental data. We show that compared with an individual nanoshell or a nanoshell trimer, the nanoshell array shows a significantly red shifted dipolar resonance while the quadrupolar peak remains at almost the same wavelength for all structures. The local field enhancement of the nanoshell array is a factor of 10 higher than that of an individual nanoshell. The calculated Surface Enhanced Raman Spectroscopy (SERS) efficiency of the close-packed array is around three orders of magnitude higher than that for an individual nanoshell. The largest efficiencies occur for incident wavelengths around six microns in the infrared. The 2D hexagonal array of gold nanoshells is therefore highly suitable as a substrate for both SERS and Surface Enhanced Infrared Absorption (SEIRA) applications.

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