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Dipole and Quadrupole Plasmon Resonances in Gold Nanoring Structures[1] LAROUSSE KHOSRAVI KHORASHAD, HUI ZHANG, Department of Physics and Astronomy, Ohio University, 45701, EVA-MARIA ROLLER, TIM LIEDL, Munich University, ALEXANDER O. GOVOROV, Department of Physics and Astronomy, Ohio University, 45701 — The quest for light manipulation in metallic nanostructures has grown greatly over the past decade to create novel optical devices for applications ranging from metamaterials and cloaking to optical sensing and plasmonic waveguides. Nanoring geometries, which are composed of metallic nanospheres, play an important role as the building blocks of plasmonic devices. We have shown that the plasmon resonance modes, which can be observed in absorption and scattering, not only depend on the dielectric function of the material, but also are strongly related to the size and shape of the structures and to the projection of the incident electromagnetic wave. By use of the finite element method, we have simulated ring geometries that are composed of different numbers of gold nanoparticles. The ring structures assembled experimentally have varying radii of nanoparticles and form symmetric and asymmetric geometries. This randomness in sizes and shapes influences the plasmonic spectrum of a ring, which consists of longitudinal and transverse plasmons and electric dipole and quadrupole modes. Moreover, the simulation predicts magnetic dipole radiation resulting from the circulation of current density.

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