Optical Rectification in non-Centrosymmetric Plasmonic Nanostructures

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Abstract

The goal of this thesis is to investigate the forces produced on plasmonic nanoparticles and to manipulate them in order to produce realizable voltages from sunlight-intensity spectra. The objective is to design, fabricate, and characterize a photovoltaic plasmonic device that maximizes voltage production at normal light incidence. Control of the voltage at normal radiation incidence will be the focal point of this thesis.

The first section of this thesis explains the theory behind the generation of forces in plasmonic nanoparticles via electromagnetic fields. The magnitude and direction of such forces on plasmonic particles involve both linear and nonlinear responses that are dependent on a number of factors including an external magnetic field, which will be explored via magneto-optical responses.

The second section concerns nonspherical nanoparticles. Here, the orientation with respect to the incoming radiation becomes important, and orientation-dependent plasmon modes produce varying forces.

Finally, this thesis offers a template for how photoinduced voltages in plasmonic nanostructures result from these forces. Numerical simulations of the forces and voltages in such nanostructures will be performed as a preliminary investigation followed by fabrication methods of these nanostructures.