Simulating Composite Materials with Giant Anisotropy

JUSTIN ELSER, Oregon State University, EVGENII NARIMANOV, Princeton University, VIKTOR PODOLSKY, Oregon State University — We study the optical properties of a novel class of composite materials based on plasmonic nanostructures embedded into a dielectric host. Due to the phenomena of plasmon resonance, the plasmonic inclusions have a dramatic effect on the effective dielectric constant of the system even when the concentration of inclusion is small. We develop a numerical technique to simulate these structures, and compare the numerical results to the generalized Maxwell-Garnett predictions. We demonstrate that in contrast to most bulk media where the difference between the values of dielectric constant in different directions is of the order of a few percent, the effective anisotropy of the proposed structures can exceed 100%. Proposed applications include polarizers, reflectors, high-energy-density nano-waveguides, and the recently discovered non-magnetic low-loss left-handed media.