GEOMETRY DEPENDENCE OF SURFACE LATTICE RESONANCES IN PLASMONIC NANOPARTICLE ARRAYS

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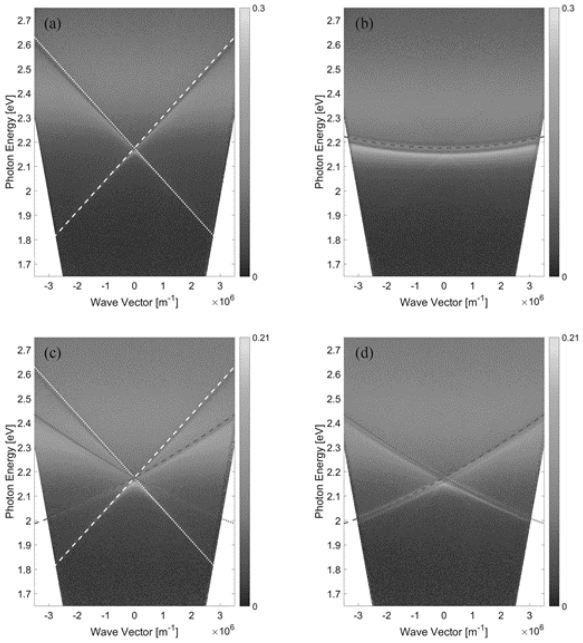
Metallic nanoparticle arrays support localized surface plasmon resonance (LSPR) and propagating surface lattice resonance (SLR). SLRs show angle dependent dispersions and much narrower linewidth compared with LSPRs on the individual particles. These features enable metallic nanoparticle arrays to tailor light in nanoscale.
In this work [1], we investigate systematically the SLRs supported by metallic nanoparticle arrays with different geometries. Experimental measurements show that while square, hexagonal, rectangular, honeycomb and Lieb lattice arrays have similar spectra near Γ-point, they have remarkably different SLRs dispersions. Furthermore, their dispersions are highly dependent on the polarization, as shown in Fig. 1. We present a general theoretical framework from which the various SLR modes of a given geometry can be straightforwardly obtained, by a simple comparison of the diffractive order (DO) vectors and orientation of the nanoparticle dipole given by the polarization of the incident field. Numerical simulations are performed to elucidate the field profiles of different modes, which show that the field distribution of the in-plane electric component is in phase along the DO vector.



[1] R. Guo, T. K. Hakala, and P. Törmä, arXiv:1611.04352, in review in Phys. Rev. B (2016).