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General Properties of Local Plasmons in Metal Nanostructures[1]

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— Local plasmon resonance in metal nanostructures offers the potential to concentrate electro-magnetic energies at nanoscale. Different designs of nanostructures have been proposed to achieve this goal. Here we investigate the general behavior of local plasmon resonances independent of specific structures. We study the local plasmon under quasi-static approximation given that nanostructure dimension is much smaller than optical wavelength.[1] We show that the plasmon resonance frequency depends on the fraction of plasmon energy residing in the metal through the real dielectric function of the metal. Further, at a given resonant frequency, the Q-factor of the resonance is determined only by the complex dielectric function of the metal material and does not depend on the nanostructure form or the dielectric environment. We will also discuss the effect of optical gain on the Q-factor of plasmon resonance.

[1] F. Wang and Y.R. Shen, Phys. Rev. Lett. **97**, 206806 (2006)

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