Optical Response of Metal Nanoparticle Chains

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The excitation of surface plasmon on metal nanoparticles is interesting to many researchers because of its variety of applications. By arranging nanoparticles in different ways, many interesting properties can be observed [1]. For metal nanoparticle chains, there is a red (blue) shift on the plasmon resonant frequency for longitudinal (transverse) excitation. Numerical and experimental results on this splitting of plasmon resonant frequency for Ag nanoparticle chains with diameters around 10 nm are compared by Sweatlock et al. recently [2]. They used finite integration techniques (which may contains artifacts) for the numerical calculations [2]. Here, we present the results calculated by the multiple scattering theory (MST) and the ways to understand the results using simple models.

MST calculations are performed on the extinction of finite silver nanosphere chains embedded in glass matrix. The transmission and reflection of an infinite 2D arrays of silver nanospheres are also calculated to understand the interaction between nanoparticle chains. The results are in agreement with recent experiments. The splitting of plasmon-resonance modes associated with different polarizations of the incident light is further understood by employing simple models. Results on the effect of order and disorder in nanoparticle chains are also presented.

REFERENCES

1. Kreibig, U. and M. Vollmer, *Optical Properties of Metal Clusters*, Springer, Berlin, 1995.
2. Sweatlock, L. A., S. A. Maier, H. A. Atwater, J. J. Penninkhof, and A. Polman, *Phys. Rev. B*, Vol. 71, 235408, 2005.