Optical reponse and Electron Energy Loss Spectroscopy of plasmonic systems by discrete dipoles approximation

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Plasmonic systems are mainly studied by optical spectroscopy and electron energy loss spectroscopy (EELS). We show here that the discrete dipoles approximation (DDA) is an efficient tool for numerical simulations and for the interpretation of experimental data obtained with both techniques [1], including for the effect interaction with a substrate and the coupling between nanoparticles.

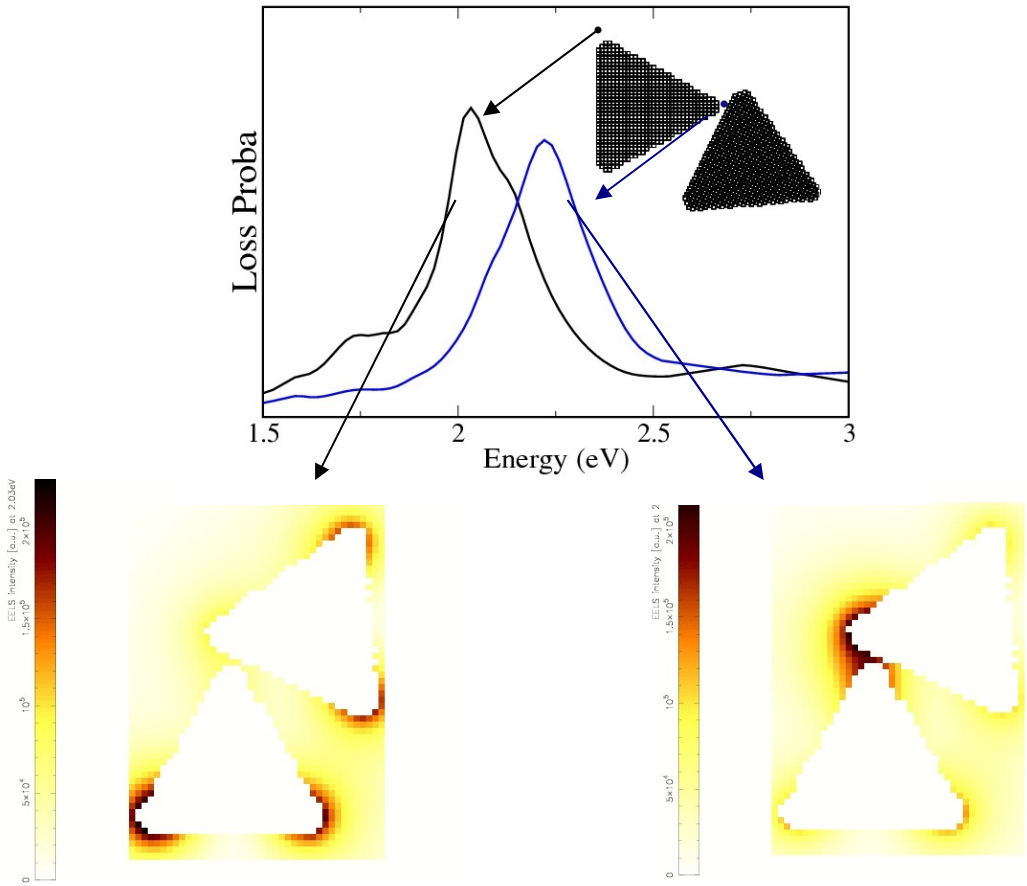
Silver nanoparticles with triangular shape have been extensively study experimentally in the last year. The experimental size and aspect ratio dependance of their optical and EELS response is well described by DDA [2]. These modes have a symmetric charge distribution and result from the strong coupling of the upper and lower surface of the triangle. In other the explain the experimental results, we also explored the limit of very small and very large aspect ratio of particules and we analyzed the retardation effect on the mode excitation probability. We have also simulated the effects of the coupling between nanoparticles, with the substrate and with the environment.

Coupling between nanoparticles can result in induced transparency or Fano resonances. We report here on this effect with the example of noble metal nanorods as experimentally studied in [3] and of nanotriangle mentionned above (see Figure)

References

[1] N. Geuquet, L. Henrard. Ultramicroscopy, **110**, 1075 (2010)
[2] J. Nelayah et al., NanoLett **10,** 902 (2010)
[3] N. Verellen et al., NanoLett **10**, 2080 (2010)

Figure



Caption :