Magneto-optically active plasmonic structures

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Wednesday 23rd October, 16:00, seminar room 3.20, Faculty of Physics (third floor)

The control of light propagation in the visible and near-infrared domain using resonant systems such as plasmonic excitations or optical nanoantennas has been a matter of intense research during the last decades. The possibility to create and manipulate nanostructured materials encouraged the exploration of new strategies to control the electromagnetic properties without the need to modify the physical structure, i.e. by means of an external agent. A possible approach is combining magnetic responsive materials (magneto-opticaly active) and resonant materials (e.g. metals exhibiting plasmonic modes), where it is feasible to control the optical properties with magnetic fields in connection to the excitation of plasmonic resonances [1] (magnetoplasmonics).

These nanostructures can involve localized resonances or nano-antenna modes, or extended resonances such as surface plasmon polaritons SPP in thin continuous or perforated films.

Here I will review the fundamental aspects behind magneto-optically active resonant nanostructures and then show that they can be employed in a wide variety of systems and ranges of the electromagnetic spectrum.

I will specifically show that these structures:

(i) can be used to modulate the propagation wavevector of SPPs [2], which allows the development of label free sensors with enhanced capabilities [3-5]
(ii) give rise to enhanced values of the magneto-optical response in isolated or interacting entities as well as perforated films, either metallic or dielectric, but always in connection with a strong localization of the electromagnetic field [6-8]
(iii) can be used to actively control thermal emission and the radiative heat transfer between objects in the near and far field [9-10]

References

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