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# Magneto-optical activity in resonant magnetoplasmonic structures

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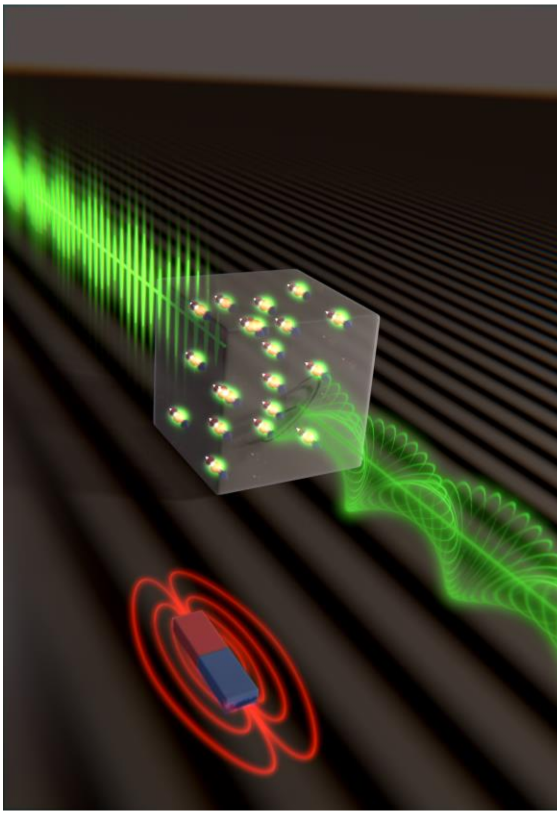
Metal-dielectric plasmonic nanodisks show a rich optical behaviour with the appearance of two modes of magnetic and electric dipolar character due to the interaction between the disks. These modes couple to the incident light in a different way, giving rise to regions with low and high optical extinction, respectively. Moreover, the insertion of a ferromagnetic component inside the structure introduces magneto-optical activity in the system (a comprehensive review can be found in [1]). As a consequence, metal-dielectric magnetoplasmonic nanodisks exhibit a rich optical and MO spectral phenomenology. It has previously been shown that, in Au/Co/Au nanodisks where a SiO2 layer is inserted, it is possible to obtain nanodisk configurations for which low optical absorption and large MO activity occur at the same spectral range. This is basically achieved by an adequate positioning of the dielectric component within the structure [2].

Here we present an overview of the influence that the interaction between the disks exerts on the optical and MO properties of such structures [3,4].

We will use a very simple, analytical, model to illustrate these effects. In fact, we will show that most of the physics behind can be understood using a classical mechanical model. The main results given by this model will then be contrasted with experiments and rigorous calculations of actual systems consisting of a pure Au nanodisk separated by a SiO2 spacer from a MO component constituted by a 4nmAu/2nmCo multilayer nanodisk, which exhibits perpendicular magnetic anisotropy.



As the SiO2 thickness is increased, the strength of the MO activity of the magnetic-like dipolar mode increases much more strongly than the corresponding extinction peak. On the other hand, the MO activity of the electric-like mode decreases as the SiO2 thickness increases, while the corresponding extinction peak remains nearly unaffected.

We will extend our analysis to inverse structure: a magnetoplasmonic antidot lattice. In that case the antidot structure couples with the propagating plasmon resonance, giving rise to a plethora of phenomena, such as the "super-transmission" (see a review in) [5]. The enhancement of the magneto-optical response in purely ferromagnetic systems has been extensively studied [6] in the reflected field. We will present our latest results on antidot structures made of combinations of noble metals and ferromagnetic metals.

### References

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[6] G. Ctistis et al., Nano Lett. 9, 1 (2009)