Magneto-optical activity in interacting magnetoplasmonic nanodisks

Gaspar Armelles, Alfonso Cebollada, Fernando García, **Antonio García-Martín**, María Ujué González, and David Meneses.

IMM-Instituto de Microelectrónica de Madrid (CNM-CSIC), Isaac Newton 8, PTM, E-28760 Tres Cantos, Madrid, Spain

Nuno de Sousa

Departamento de Física de la Materia Condensada,

Universidad Autónoma de Madrid, 28049 Madrid, Spain

Luis S. Froufe-Pérez

Instituto de Estructura de la Materia, CSIC,

Serrano 121, 28006 Madrid, Spain

a.garcia.martin@csic.es

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[1]. Moreover, the insertion of a ferromagnetic component inside the structure introduces magneto-optical activity in the system. 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 our study on the influence that the dielectric spacer thickness has on the interaction between the disks, and as a consequence, on the optical and MO properties of such structures.

The structures consist 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, reducing the required magnetic field to achieve saturation in polar configuration.

It will be shown that these structures exhibit the expected magnetic and electric dipolar modes, both in the optical and MO spectra. The position of the magnetic-like mode strongly depends on the SiO2 thickness, while that of the electric like one remains basically unaltered.

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.

[1] A. Dmitriev, T. Pakizeh, M. Käll, and D.S. Sutherland, *Small* **3**, 294 (2007)
[2] J.C. Banthí *et al.*, *Adv. Mater.* **24**, OP36 (2012)