Theoretical study of the magneto-optical activity in Au/Co/Au disks

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Abstract

Metal/dielectric/metal plasmonic nanodiscs present a rich optical behaviour with the appearance of a bonding and an anti-bonding configuration that result in an electric- and a magnetic-dipole, respectively [1]. Due to symmetry considerations, the coupling of each configuration with the incident light differs, and the modes show a bright (electric dipole) or a dark (magnetic one) nature. The insertion of a ferromagnetic component in the structure introduces magneto-optical (MO) activity, and the presence of the MO response in both modes has been recently established, as well as the influence of the position of the ferromagnetic component [2].
So far, no attention has been paid to the differences in the MO response attending to the magnetic- or electric-dipolar character of each mode, neither to the influence of the coupling between the two metallic disks.

In this presentation we will show a theoretical model based on coupled dipole method [3], where we study the system above by considering each disk as a single dipole particle with an oblate geometry (fig. 1). The electromagnetic properties of the disks are described by an effective dielectric tensor, which incorporates the properties of the material constituents: gold for the plasmonic material and a ferromagnetic metal (cobalt) for the magneto-optically active one.

We will analyze the optical and magneto-optical response of that simple system as a function of the degree of interaction between the two dipoles. We will also explore the effect that the amount of ferromagnetic material present in the magneto-optically active 'disk' (mainly losses) has on these responses.

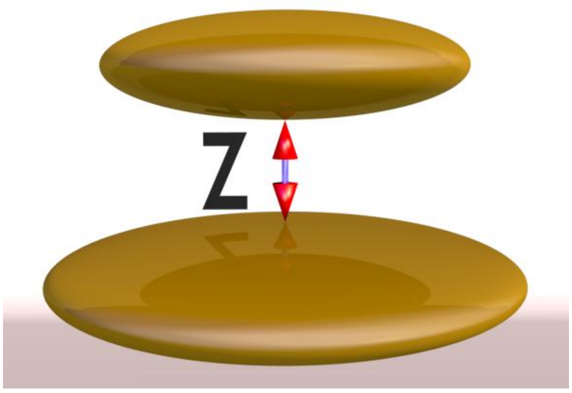

Fig. 1: Representation of the system modeled. Two gold disks separated a distance of *z*.

References

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