Advanced Optical and Magneto-Optical Characterization of Nano- and Mesostructured Materials

The interaction of light with matter provides with a powerful tool to characterize the properties of materials. A conspicuous example is that of magneto-optical materials, in which the polarization of light is modified by external magnetic fields or by the magnetic state of the samples. In the case of magneto-optic systems, such cross link between light and magnetism might provide the basis of potentially novel devices for data control in optical communications, as well as in optical data storage. Additionally, other phenomena, like ferroelectricity, can give way to a modification of the polarization of light that can be exploited to characterize such systems. In any case, most materials of technological interest have to be structured at small scales, usually on the scale of tens of nanometers to a few microns.

We propose to make use of the enormous potential of light-matter interaction to achieve advanced optical/magneto-optical characterization of nano- and meso- structured materials. One of the aims is to carry out magneto-optical spectroscopy of materials with tailored spectral response to have enhanced magneto-optic activity at targeted light frequencies between the near infrared up to the ultraviolet. For that purpose, complex nanostructured materials cleverly designed to have a particular magneto-optical response will be analyzed, including magneto photonic crystals and magneto-plasmonic devices. We also propose to perform domain imaging of magnetic and ferroelectric structures with submicron resolution, under electric field stimuli.

The successful candidate will be trained in different optical and magneto-optical characterization techniques, comprising high-resolution domain imaging with confocal microscopy, optical transmission/reflectance, Faraday/Kerr rotation/ellipticity and magnetic circular/linear dichroism, all of the measured at near infrared, visible and ultraviolet frequencies.

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