Optics and Magneto-optics in 2D Magnetoplasmonic Crystals

Musorin A.I., Chetvertukhin A.V., Grunin A.A., Ezhov A.A., Dolgova T.V., Fedyanin A.A.
Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia
e-mail: `fedyanin@nanolab.phys.msu.ru`

Uchida H.
Tohoku Institute of Technology, Sendai, Japan

Inoue M.
Toyohashi University of Technologu, Toyohashi, Japan

The use of periodic nanostructured materials due to plasmonic, photonic and other resonant effects allows one to enhance magneto-optical response in various spectral regions [1, 2]. Periodic nanostructuring of magnetoplasmonic crystals allows one to control excitation and propagation of surface plasmon-polaritons (SPP). 2D-periodicity provides the opportunity of spectral tuning of the phase-matching conditions via superposition of two vectors of the reciprocal lattice at various azimuthal angles. There are structures where simultaneous excitation of two intersecting magnetoplasmons can be achieved forming a standing plasmonic wave that leads to formation of plasmonic band gap [3]. In this work, the transversal magneto-optical Kerr effect (TKE) is studied in two-dimensional magnetoplasmonic crystals. Resonant enhancement of the Kerr effect is observed and can be attributed to the resonant excitation and the interaction between magnetoplasmonic modes, waveguide modes and effects that are emerging when diffraction maxima lays into the plane of structure.

The sample is 2D square lattice of Au disks placed on 1-mm-thick quartz substrate. 100-nm-thick Bi:YIG layer covers the structure. The sample is characterized by an atomic force microscopy (Fig.1).

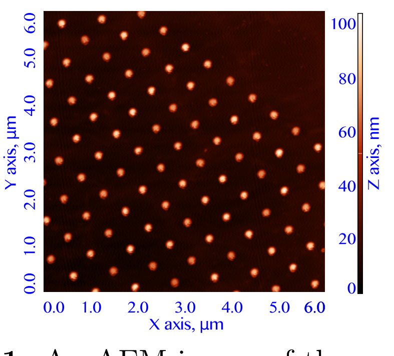

Fig. 1: An AFM-image of the sample.

The period of the lattice is 600 nm. The Au disks height is about 60 nm and their diameters are about 100 nm. According to vibrating sample magnetometry measurements the saturation field is 1 kOe.

Optical and magneto-optical spectra of the sample were measured at different azimuthal angles and polarizations. There is a distinct correlation between the spectral positions of plasmonic resonances and the resonances in TKE spectra.

References

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