Spintronic-plasmonic antenna metasurfaces for molecular sensing

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Hybrid platforms merging metallic antennas and materials with specific functionalities offer excellent technological opportunities for active plasmonics, as they provide large changes in their optical response, which can be activated by external stimuli. In this talk I will focus on the magnetic modulation of the optical response of spintronic metasurfaces composed of microantenna arrays fabricated out of giant magnetoresistance $Ni_{81}Fe_{19}$/Au multilayers [1,2]. In this case, the plasmonic response of the antenna, combined with the Magneto-Refractive Effect (MRE) of the multilayer, allows for low magnetic-field control of the modulation of the optical response in the mid-infrared. Moreover, the relative difference in optical transmission (MR signal) with (T_P) and without (T_{AP}) magnetic field shows the presence of molecules (PMMA deposition in Fig. 1). Our experimental and theoretical results suggest that these GMR plasmonic metasurfaces are excellent candidates to improve the molecular detection capabilities of traditional Surface-Enhanced Infrared Absorption (SEIRA) Spectroscopy platforms and develop a novel type of infrared sensing technique based on spintronic antennas [3].

References

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Figures

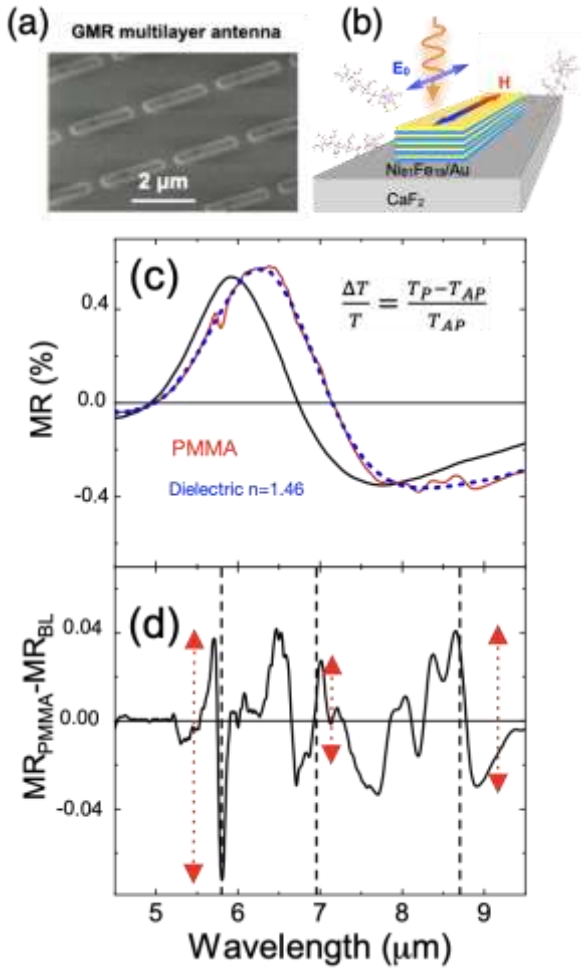

Figure 1: a) SEM image of the rod antenna array. b) Sketch of the GMR antenna structure, applied magnetic field and polarization of incident light. c) MR signal of the bare antenna array (black), covered with PMMA (red) and covered with a dielectric of n=1.46 (blue). d) Difference between the MR transmission spectra after PMMA deposition and the baseline spectrum. Red arrows show the contrast of vibrational features (dashed black) of PMMA.