Plasmonic antenna hybrids for active control of the optical response

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Hybrid platforms merging metallic nanoantennas and materials with specific functionalities, such as phase-change or spintronic properties, offer excellent technological opportunities for active plasmonics, as they provide large changes in their optical response, which can be activated by external stimuli. In the first part of the talk I will present our recent study of fast, nanoscale optical switching of an IMT phase-transition material, such as VO_2, driven by a single Au nanoantenna in its proximity [1]. The VO_2-single antenna hybrid is the first step to understand more complex building blocks formed by antenna arrays grown on VO_2 films [2], and allows for selecting the nanoscale active volume through a resonant pumping arrangement. This system is of paramount technological interest, as it represents the smallest possible switching unit. In the second part I will focus on the magnetic modulation of the optical response of spintronic metasurfaces composed of microantenna arrays (rods or slits), fabricated out of giant magnetoresistance $Ni_{81}Fe_{19}$/Au multilayers [3]. 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 mid-infrared [3]. Moreover, our study suggests that these GMR plasmonic metasurfaces are excellent candidates to improve the molecule detection capabilities of traditional Surface-Enhanced Infrared Absorption (SEIRA) Spectroscopy platforms and develop a novel type of infrared sensing technique based on spintronic antennas. [4,5].

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