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Resonant Nanoantennas for Long-Wavelength Spectroscopy

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Optical nanoantennas are nano-fabricated devices able to convert free-space optical radiation into localized energy. Due to this, they can be used to enhance the electromagnetic field and to localize it on a scale well beyond the diffraction limit. Nanoantennas have thus become key elements for single-molecule spectroscopy, nano-imaging and extreme nonlinear optics [1-3]. Our aim is to exploit these concepts in the long-wavelength region (mid-infrared –MIR, and terahertz –THz) of the electromagnetic spectrum.
I will present a summary of the results we have recently obtained [4-6] regarding arrays of planar THz nanoantennas as well as gold MIR nanocones. In particular, the resonance tunability of these structures, their near- and far-field response, and their field enhancement capabilities will be shown. Finally, a practical demonstration of the use of these nanoplasmonic structures for enhanced spectroscopy of nano-objects will be given.

References
[1] P. Bharadwaj et al., Chem. Sci. 2, 136-140 (2011); [2] F. De Angelis et al., Nature Nanotech. 5, 67-72 (2010); [3] S. Kim et al., Nature 453, 757-760 (2008); [4] L. Razzari et al., Opt Express 19, 26088-26094 (2011); [5] L. Razzari et al., Plasmonics 8, 133 (2013); [6] S. Tuccio et al., Opt. Lett. 39, 571 (2014).

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