Nanoplasmonic cavities, also known as optical nanoantennas, are efficient transducers from the far to the near field, harvesting light to the nanoscale. This talk will touch upon a variety of new concepts, including transformation optics design, non-local effects, direct imaging of ultra-confined modes, and new design geometries for broadband spectroscopies and nonlinear optics.

When metallic nanostructures come in close contact with each other, plasmon hybridization leads to the establishment of spatially highly confined optical fields, also known as electromagnetic hot spots. The mathematical framework of transformation optics has revolutionized our understanding of light localization on this deep sub-wavelength scale [1], demonstrating that cavities with structural singularities lead to a broadband light harvesting response. I will summarize our present understanding on how to exploit this framework for cavity design, highlighting both extensions towards practical structures, as well as fundamental physical limitations in performance due to non-local effects.

I will then discuss practical applications of nanoantennas for nonlinear optics and sensing, and photovoltaics. Here I focus on two novel approaches, log periodic optical antennas for broadband second harmonic generation and spectroscopy [2], and hybrid plasmonic-photonic cavities combining high spatial mode confinement with high quality factors typical of Fabry-Perot type resonators [3].

REFERENCES

