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Abstract

Time-Resolved Investigations and Biotechnological Applications of Plasmonic Nanostructures †

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Plasmonics exploits the collective motion of conduction electrons in metals (plasmons), thus enabling light to couple with nanoscale objects, with the consequent generation of a plenty of novel and unexpected optical effects and functionalities. Plasmonic nanostructures have been deeply studied in the last decade due to their crucial impact on several areas of nanoscience and nanotechnology. Their unrivalled capability to squeeze light well beyond its diffraction limit, leading to extremely confined and enhanced electromagnetic fields on the nanoscale at optical frequencies, is of great interest for the prospect of real-life applications, such as energy harvesting and photovoltaics, wave-guiding and lasing, optoelectronics, fluorescence emission enhancement, plasmon-assisted bio-interfaces and nanomedicine. In this framework, traditional studies of the resonant behavior of plasmonic nanoantennas rely on standard intensity detection schemes. Up to date, the temporal dynamics of plasmonic nanoantennas remains challenging. In the first part of the talk we will show that, by combining femtosecond time-domain spectroscopy and high-resolution confocal microscopy, it is possible to measure full time- and field-resolved response of single plasmonic nanoantennas [1]. In the second part of the talk, we will then show practical applications of plasmonic nanostructures to single-molecule detection [2–4], enhanced spectroscopy on single-cells [5–7], optical trapping [8,9], enhanced Raman scattering [10–12] and resonant energy transfer [13].

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