Plasmon nano-optics for Biosciences: Sensing, Trapping and hyperthermia

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Summary
In this talk, we describe our recent advances in the engineering of both the optical and thermal properties of plasmonic nanosystems and discuss their respective applications to biosciences.

Introduction

Metallic nanostructures (MN) supporting localized surface plasmon (LSP) resonances have the potential to act as efficient point-like sources of both light and heat, opening plenty of new science and applications in areas ranging from integrated optics to biomedicine. Both the optical and photothermal properties of MN can be engineered through a suitable design of their geometrical parameters, environment and illumination conditions.

Discussion

In the first part of this presentation we discuss how proper plasmon mode engineering in ensembles of electromagnetically coupled nanostructures [1] can benefit to biosensing and optical trapping. In the context of sensing, we show that shaping the sensing volume to dimensions commensurable with the target molecules to detect enables to strongly enhance the sensing sensitivity [2]. As for optical trapping, we demonstrate that plasmonic hot spots can be used to create efficient nano-optical tweezers able to trap nano-objects, including biological systems, upon moderate laser intensities [3,4].

In the second part of the talk, we discuss both theoretically and experimentally the general physical rules for optimizing heat generation in plasmonic nanostructures [5]. We then discuss the applications of functionalized point-like heat sources to the stimulation of intra cellular processes and cancer cell destruction.

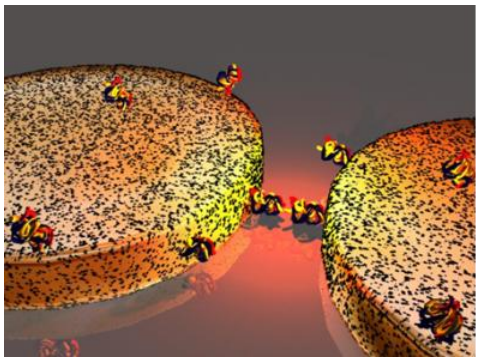

Fig1: Artistic view of enhanced sensitivity sensing in an array of gold dimers.

References

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