Remo Proietti Zaccaria, J Phys Chem Biophys 2014, 4:5
http://dx.doi.org/10.4172/2161-0398.S1.006

OMICS Group Conferences
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2nd International Conference and Exhibition on
Lasers, Optics & Photonics
September 08-10, 2014 Hilton Philadelphia Airport, USA

From superhydrophobicity for SERS/TERS-like applications to hot-electrons based nanoscopy (to say nothing of the adiabaticity)

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Plasmonics is the research field explaining the coupling of photons with free electrons. We shall illustrate the fundamental role played by plasmonics in three specific devices chosen for their peculiar characteristics. In fact, the analyzed structures are dedicated to different kinds of applications, involving Transmission Electron Spectroscopy, Raman measurement and AFM-like nanoscopy. In particular,

1. After introducing the fundamental concept of adiabaticity, we shall show how it can be realized in an actual three-dimensional device. In particular, the properties of nanometric-ended metallic cones will be exploited for background-free TERS-like applications, named SPEERS (Surface Plasmon Polaritons Enhanced Raman Scattering).
2. Superhydrophobic nanostructures for single/few molecules detection will be illustrated. The working principle is based on the possibility of beating the diffusion limit owing to the superhydrophobicity mechanism. In fact, it will be shown that Raman spectrum can be collected, in short time, from samples having concentrations down to atto-molar.
3. Finally, we shall introduce a new kind of nanoscopy based on the combination of plasmonics and hot electrons. In particular, we will show that by means of an adiabatic metallic concentrator, under the appropriate conditions, it is possible to obtain hot electrons production, to the extent of realizing an extremely localized "current reading". The result is the possibility of reproducing the topological/material characteristics of the investigated substrate. A comparison with standard AFM analysis will be shown.

Biography

Remo Proietti Zaccaria has completed his PhD in 2003 from the Polytechnic University of Turin. After that, he spent few years in Japan and China as Research Associate and Associate Professor, respectively. Finally, at fall 2009, he moved to his present position as Team Leader at the Italian Institute of Technology. His research interests focus on photonic devices at the nanoscale.

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