UNIVERSITÀ DEGLI STUDI DI TORINO

Dipartimento di Fisica

Avviso di seminario

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ISTITUTO ITALIANO DI TECNOLOGIA (IIT)

Nanostructures – Neuro Technology

Multifunctional biosensing with three-dimensional plasmonic nanoantennas

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Sala Wataghin, Dipartimento di Fisica, via P. Giuria 1, Torino

Il relatore

Dr. Michele Di Palo

Michele Dipalo graduated in Physics of Advanced Technology at the University of Turin in 2005. From 2005 to 2010 he worked in the Electron Devices and Circuits Department at the University of Ulm in Germany, as PhD fellow first and as post-doc later, on the development of diamond/gallium nitride based electrochemical sensors and high power transistors. From 2011 he worked on the development of high power microwave devices and circuits for RADAR applications, including electro-optic links for antenna remoting. From 2013 he works as post-doc at IIT in Genova on an interdepartmental project between Nanostructures and Neuro-Technology.

Summary

At present date the study of biological systems is performed mainly by either optical, chemical or electrical methods. In most cases, each of these methods gives only partial information about the system, and is not simply combined with the other two; therefore a whole picture of complex bio-systems is not yet easily achievable with established techniques. This is particularly true for neuronal networks where both spatial and time scales spread over several orders of magnitude, with nanoscale chemical processes influencing network electrical responses on millimetre scale areas.

Plasmonic nanoantennas are very promising tools to overcome these limitations, because they can enhance sensitivity of spectroscopic analysis thanks to their ability to localize and enhance the electric field of incoming light in the visible-near infrared range.

With the aim of combining optical, chemical and electrical investigations of biological samples, we integrate three-dimensional plasmonic nanoantennas on multi-electrode arrays (MEA) biosensors. The nanoantennas can be used simultaneously as enhancers for Surface Enhanced Raman Spectroscopy (SERS) analysis and as nanoelectrodes for recording of neuronal extracellular electrical activity of neuronal networks. Thus, the novel device concept merges Raman spectroscopy and electrical acquisitions of living cells with the same tool, enabling the monitoring of chemical processes at the single neuron level as well as the acquisition of large area network spontaneous responses.