International Doctoral Program in Science Position

Tailoring conductive paths in novel plasmonic/electronic devices

Background and motivation

The frontier of electronics is the construction of neuromorphic circuits, i.e. a neural hardware mimicking the procedure used by human brains to process data. The main features of neuromorphic hardware should be: parallel multichannel operations, signal processing via comparison of input data with a specific activation functions and memorization of information until an erasing signal is applied. Substitution Traditional electronics to provide a faster data transfer and processing has been sometime provided by photonics. However, hybrid technologies, as for example plasmonic circuits, might represent a crossover point exploiting the advantages that each solution offers. In this context, the switching can be obtained by varying the absorption and scattering loss of a plasmonic mode within a specific insulator layer. Hence the material composing the layer play a fundamental role in determining the behavior of the optoelectronic device, in particular by controlling the conductivity and the switching performances. The present PhD program will investigate plasmonic devices (based on the propagation of Surface Plasmon Polariton quasiparticles) that might be applied as neuromorphic circuits. More specifically, the program will investigate novel materials and geometries to realize plasmonic memristors (re-writable memories based on resistive properties). The novel plasmonic memristors will be the basic elements to realize hybrid optic and electronic neuromorphic circuits.

The project requires a student who focuses his activity on the design, construction and characterization of innovative multilayer plasmonic circuits. This will involve simulations of light propagation in nonlinear regime and of plasmonic propagation using both finite difference calculation codes and in COMSOL language. Moreover, the student will synthesize and characterize thin film and nanogranular materials for realization of the novel prototypes, which will be tested in the laboratory.

Profile

- Master's degree or similar qualification in Physics, Materials Science, Electronics or adjacent fields. The title must be obtained by October 31st, 2020.
- A solid background in physics or materials science is required.
- Experience in optics, laboratory skills, nonlinear propagation simulation will be considered as an advantage. Programming skills with the finite-element algorithms are also desired.
- Good knowledge of the English language, both spoken and written, is essential.
- Strong commitment, ability to work in a team, and eager for international mobility are desired.

Opportunities

- Experimental research participating to the international collaboration between research groups USA and Italy. **Double degree opportunity.**

Contacts

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