ICT PHD

Research project for a PhD curriculum in ICT Electronics and Telecommunication

**Tutor**: Luigi Rovati

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**Proposed Title of the research:**

Advanced integrated electronic biosensensors for nanoscale entity detection

**Keywords: (5)**

Biosensors, nonoparticles detection, biomedical device, bioelectronics, green technology

**Research objectives: --(max 10 rows)**

The project aims at developing an innovative biosensing platform by combining high frequency impedance techniques (> 50 MHz) and optical techniques to manipulate and measure nanoparticles. This combination of complementary methods allows obtaining unique information on micro/nanoparticles including but not limited to bio-analytes, e.g. virus. The new platform will allow to study nano-bio interactions, nono-pollutants, viruses. The identification of these nanoparticles plays a central role in the action "Zero pollution action plan" in the green transition deal. In fact, it is well known that nanoparticles suspended in fluids (air and water) are the main environmental cause of multiple mental and physical illnesses and premature deaths, especially among children, people with certain medical conditions and the elderly.

**Proposed research activity -- (max 10 rows)**

The objective of the PhD is the experimental investigation, modeling and simulation of innovative hybrid optical-electronic sensor platforms. In particular, high frequency impedance techniques (> 50 MHz) and optical techniques for the manipulation and measurement of nanoparticles will be integrated. Nanoelectronic devices are based on ion-sensitive field-effect transistor arrays (ISFETs) and/or arrays of 65000 impedance-sensitive nanoelectrodes (180 nm diameter) sensitive to impedance (in the 1.5 - 400 MHz band) for the detection of analytes, including biological ones (cells, viruses, biomolecules).

As regards the optical part of the platform, optical tweezers will be design and realized. This optical tool will allow manipulating of the sample and at the same time perform indirect dimensional measurements using the impedance sensors.

**Supporting research projects (and Department)**

Dottorati di ricerca su tematiche green e dell’innovazione: nuove risorse dal PON Ricerca e Innovazione 14-20: D.M. n. 1061 del 10-8-2021

**Possible connections with research groups, companies, universities.**

Tecnopolo “Mario Veronesi” di Mirandola

IUNET nanoelectronics consortium

TUWien (Prof. Clemens Heitzinger)

NXP Semiconductors

 (\*) optional

(\*\*) optional/to be completed on the second year