



PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 41st cycle

Research Area n. 2 - Electronics

**THEMATIC Research Field: LOW NOISE DETECTORS, ELECTRONICS AND SIGNAL
PROCESSING FOR CHARGE DETECTION MASS SPECTROMETRY**

Monthly net income of PhDscholarship (max 36 months)

1400.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

**Motivation and objectives of the research
in this field**

Modern instrumentation dedicated to the measurement of fundamental physical quantities often requires the most advanced custom electronic devices and readout electronics to reach the highest resolution and accuracy. This general statement particularly applies to Charge Detection Mass Spectrometry (CD-MS) which is used to identify molecules or to determine their composition. In CD-MS, the mass of each individual ion is determined from the measurement of its mass to charge ratio (m/z) and its electric charge, opening the door to accurate mass measurements for samples into the giga-Dalton regime, expanding the reach of conventional mass spectrometry and allowing mass distributions to be determined for viruses, gene therapies, and vaccines. The precision and the speed in the measurement of the electric charge is crucial for take full advantage of the potential of CD-MS. Resolution in charge measurements as high as 0.2 electrons r.m.s. in sub-millisecond measuring times are required but currently not achievable. The improvement in the precision and speed in the charge measurement require advanced design of the charge detector, preamplifier and signal processing, which is the main topic of this scientific and technological research program.

**Methods and techniques that will be
developed and used to carry out the**

The research activity will include all the phases related to



research	the design and development of the detectors, readout electronics and signal processing for Charge Detection Mass Spectrometers: from the conception to the design, simulation, fabrication or implementation and full experimental characterization.
Educational objectives	The PhD student will acquire skills in the design, simulation, and experimental characterization of a complex instrument such as a Charge Detection Mass Spectrometer to make it ready for scientific, industrial and medical applications. Professional simulators and laboratory instrumentation will be used in the research program. Collaboration in a team with other PhD students and within an international research context will complete the training.
Job opportunities	At the end of the PhD, the candidate will be ready to consider job opportunities both in companies requiring researchers or engineers skilled in advanced electronic instrumentation design or in national or international Institutions for Scientific Research.
Composition of the research group	1 Full Professors 0 Associated Professors 1 Assistant Professors 2 PhD Students
Name of the research directors	Prof. Giuseppe Bertuccio

Contacts
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6



Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences).

TEACHING ASSISTANTSHIP: availability of funding in recognition of supporting teaching activities by the PhD student

There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

COMPUTER AVAILABILITY:

1st year: Yes

2nd year: Yes

3rd year: Yes

DESK AVAILABILITY:

1st year: Yes

2nd year: Yes

3rd year: Yes

The Research Program is within a scientific and technological collaboration between Politecnico di Milano, Indiana University (USA) and Megadalton Solution (Indiana, USA).

The main Laboratory in which the research activity will be carried out is the “*Semiconductor Devices and Integrated Circuit Laboratory (SDIC Lab)*” located at Politecnico di Milano, Como Campus, Via Anzani 42, 22100 Como (<https://sdiclab.deib.polimi.it/>).

Research activities at the laboratories of Indiana University and Megadalton Solution can be scheduled.

The Politecnico di Milano residence “La Presentazione” in Como offers apartments to PhD students (subjected to availability).

<https://sdiclab.deib.polimi.it/>