



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

Research Area n. 2 - Electronics

**THEMATIC Research Field: DEVELOPMENT OF INNOVATIVE ASICS FOR BROAD BAND,  
HIGH-RESOLUTION SPECTROSCOPY OF PLANETARY SURFACES**

**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**

Assessing the chemical composition of planets' and asteroids' surfaces is a key part of the investigation of these bodies. The relative abundance of the surface (down to a few m) major elements with atomic number  $Z > 20$  can be estimated using fluorescent X-ray spectroscopy, using solar X-rays to excite element's atoms. The main goal of X-ray fluorescence is to determine the intensity of Fe-L, Fe-K, Al-K, Mg-K, Si-K complexes and S-K $\alpha$ , S-K $\beta$  fluorescent lines. From these lines mass abundance ratios can be determined (Mg/Si, Fe/Si, etc.). The comparison of these abundance ratio to those of meteorites and mineral analogs measured in laboratory can provide a first classification of planetary surfaces complementary to other analysis techniques. Gamma-ray spectroscopy of nuclear lines can also be used to assess abundances of elements in the planetary surface down to 20 cm and can provide information on high atomic number elements. A space-qualified X-and gamma-rays spectrometer, covering a unique wide energy band, from a few keV to several MeV, is going to be designed as one of the payload foreseen in the project TASTE (Terrain Analyser and Sample Tester Explorer) of the Italian Space Agency (ASI). The spectrometer is also involved in a study for an application on a rover to search for precious elements and Rare Earths on the surface of



	the Moon. A core-element of the spectrometer will be an advanced mixed-signal CMOS ASIC (Application Specific Integrated Circuit) with ambitious goals of low power consumption, wide dynamic range, ultra low noise, high stability and radiation resistance, whose design, tests and space qualification will be the main topic of the PhD research.
<b>Methods and techniques that will be developed and used to carry out the research</b>	The research activity will include all the phases related to the design and development of all the stages of the ASIC: from the conception to the design, simulation, fabrication and full experimental characterization.
<b>Educational objectives</b>	The PhD student will acquire skills in the design, simulation, layout and experimental characterization of advanced mixed signal CMOS ASICs for scientific applications. Professional simulators and laboratory instrumentation will be used. Collaboration in team with other PhD students and with external national and international research groups will complete the training.
<b>Job opportunities</b>	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 and ASIC design or in national or international Institutions for Scientific Research.
<b>Composition of the research group</b>	1 Full Professors 0 Associated Professors 2 Assistant Professors 1 PhD Students
<b>Name of the research directors</b>	Prof. Giuseppe Bertuccio

<b>Contacts</b>	
Giuseppe.Bertuccio@polimi.it Tel. +39 02 2399.7346	

<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--



<b>Housing - Out-of-town residents</b>	--
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<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

<b>Stage and period abroad</b>	
<b>Institution or company where the candidate will spend the period abroad (name and brief description)</b>	
<b>By number of months abroad</b>	0

**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 Project is within a scientific collaboration between Politecnico di Milano and the Trieste Astronomical Observatory of the Italian National Institute of Astrophysics (INAF).

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 in collaboration with other scientific laboratories located in Trieste, Pavia, Bologna and Rome are scheduled. The Politecnico di Milano residence “La Presentazione” in



Como offers apartments to PhD students (subjected to availability).