



## PhD in FISICA / PHYSICS - 38th cycle

### PARTENARIATO PNRR Research Field: ADVANCED PHOTONIC COMPONENTS AND SYSTEMS FOR TIME-DOMAIN DIFFUSE OPTICAL APPLICATIONS

#### Monthly net income of PhDscholarship (max 36 months)

**€ 1195.5**

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

The aim of this PhD project, in the framework of the Italian I-PHOQS infrastructure (**CUP B53C22001750006** D.D. del 28/12/2021) is the development of advanced photonic components and workstations for non-invasive multi-functional spectroscopy and tomography in clinical in vivo diagnostics.

The goal of the research is to push photonics technologies beyond the state-of-the-art to provide unique instrumentation with top-class performances, open to access to external users for frontier research in biomedicine.

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

The PhD candidate will develop multifunctional time-domain diffuse optical tomography components and workstation for deep (cm) optical tomography on humans for non-invasive reconstruction of functions as for instance: (i) microvascular blood flow (TD-DCS); (ii) deep spontaneous Raman emitters (TD-DIRS); (iii) cerebral hemodynamics (TD-fNIRS); (iv) tissue composition and novel biomarkers (TD-BROAD).

In all cases, the candidate will develop and validate novel components (e.g., single-photon detectors, picosecond laser sources) also by analog/digital electronic circuit design.

These components will be key innovative devices for new workstations showing strong integration of hardware and software components opening the facility also to researchers studying novel computational imaging algorithms.



<b>Educational objectives</b>	The PhD candidate will receive a multidisciplinary training in topics including lasers, detection techniques at the single-photon level, optical microscopy and tomography, study of photon migration through biological tissues, image reconstruction and analysis of biological signals. He/she will be exposed to the steps required for the development, validation and use of complex photonics instrumentation for next-generation biomedical diagnostic techniques
<b>Job opportunities</b>	The candidate will be exposed both to the greatly growing field of health technologies and to the vibrant area of photonics with strong multidisciplinary attitude, well apt to find job opportunities in high-tech industries. In addition, he/she will be well positioned for a career in university or research center.
<b>Composition of the research group</b>	5 Full Professors 5 Associated Professors 5 Assistant Professors 13 PhD Students
<b>Name of the research directors</b>	laura Di Sieno, Alberto Dalla Mora, Antonio Pifferi

<b>Contacts</b>
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<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	597.5 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
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**Educational activities** Educational activities for 3 years 4.872,90€

**Teaching assistantship:** 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:** individual use

**Desk availability:** shared use