



PhD in FISICA / PHYSICS - 40th cycle

PNRR 630 Research Field: DEVELOPMENT OF A BROADBAND COHERENT RAMAN MICROSCOPE FOR APPLICATIONS TO LIFE SCIENCES

Monthly net income of PhDscholarship (max 36 months)

€ 1300.0

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

Context of the research activity

<p>Motivation and objectives of the research in this field</p>	<p>Stimulated Raman scattering (SRS) microscopy is a powerful label-free imaging technique which can acquire in a very short time the vibrational fingerprint revealing the molecular composition of cells and tissues. However, so far SRS has been limited to specialized research laboratories by the complexity of the apparatus. The start-up company CRI s.r.l., a spin-off of Politecnico di Milano, has been established to change this situation by developing, and eventually commercializing, a broadband SRS microscope. This PhD thesis will contribute to this research program covering different aspects such as the excitation laser, the detection system, the microscope and data analysis.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>In collaboration with the start-up company CRI s.r.l., the scholar will develop a broadband SRS microscopy setup using unique and proprietary excitation source and detection system. A synchronized dual-wavelength fiber laser will be used for excitation, while a multi-channel lock-in amplifier will be used for broadband detection. The microscope, using high-speed strip mosaicing scanning, will then be used for different biomedical applications, such as chemometric histopathology for precision medicine and label-free imaging of live cells and their interactions. Analysis of the hyperspectral data cubes will be performed also using AI.</p>
<p>Educational objectives</p>	<p>The scholar will receive a multidisciplinary training in topics including laser physics, nonlinear optics, vibrational</p>



	spectroscopy, biomedical optics and optical microscopy. He/she will be exposed to the steps required for the industrial development of a deep-tech instrument such as the coherent Raman microscope by the company CRI s.r.l..
Job opportunities	Due to the multidisciplinary training in cutting edge techniques of optics and photonics as well as vibrational spectroscopy and biomedical optics, the scholar will have excellent job opportunities in high-tech industries. In addition, he/she will be well positioned for an academic career.
Composition of the research group	1 Full Professors 2 Associated Professors 2 Assistant Professors 4 PhD Students
Name of the research directors	Prof. Giulio Cerullo, Prof. Dario Polli

Contacts

Giulio Cerullo giulio.cerullo@polimi.it;
Dario Polli dario.polli@polimi.it.

Additional support - Financial aid per PhD student per year (gross amount)

Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad

Amount monthly	650.0 €
By number of months	6

National Operational Program for Research and Innovation

Company where the candidate will attend the stage (name and brief description)	Cambridge Raman Imaging srl
By number of months at the company	18
Institution or company where the candidate will spend the period abroad (name and brief description)	The PhD Student will have the opportunity to do an internship in a leading international university like Cambridge, MIT or Harvard.
By number of months abroad	6

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

Educational activities: Educational activities (purchase of study books and material, funding for



participation to courses, summer schools, workshops and conferences). Financial aid per PhD student per 3 years: max 5.300,25 euros per student.

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: *individual use or shared use.*

Other information: *CRI s.r.l. is a spin-off company of Politecnico di Milano, founded with the mission to develop a turnkey broadband SRS microscope suitable for non-specialist users. The company, which has been funded by the European Innovation Council, has a product portfolio from the excitation laser to the detection system to the full-fledged microscope.*