



# PhD in FISICA / PHYSICS - 39th cycle

**PNRR 118 TDA Research Field: COHERENT RAMAN MICROSCOPY**

<b>Monthly net income of PhDscholarship (max 36 months)</b>
<b>€ 1195.5</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

<b>Context of the research activity</b>	
<b>Motivation and objectives of the research in this field</b>	<p>Spontaneous Raman Spectroscopy is a well-known technique to perform a detailed molecular analysis of a biological sample. However, the intrinsic slowness of the technique prevents a real-time imaging of the samples. The aim of this research is to develop an innovative Coherent Raman Microscopy (CRM) setup for fast and multiplex imaging of biological samples. The measured data will be analyzed using artificial intelligence and deep-learning algorithms for de-noising, filtering, feature extraction. These activities has numerous applications of great societal relevance, such as sustainable and inclusive digital transition, which is able to face contemporary environmental and social challenges, as well as stimulate the competitiveness and innovation of the production system, in line with the goals of the PNRR. See <a href="http://www.vibra.polimi.it">www.vibra.polimi.it</a></p>
<b>Methods and techniques that will be developed and used to carry out the research</b>	<ol style="list-style-type: none"> <li>1) Generation of suitable narrowband ps and broadband fs pulses via non-linear optics;</li> <li>(2) radiation-matter interaction in CRM, including also second-harmonic generation and two-photon excited fluorescence microscopy;</li> <li>(3) advanced instrumentation (beam scanning, detection, control);</li> <li>(4) multivariate statistical analysis and deep-learning algorithms;</li> <li>(5) biological applications, from cells to tissues.</li> </ol>
<b>Educational objectives</b>	<p>The candidate will gain specific skills in the design of a complete multimodal CRM instrument, which will be used</p>



	in collaboration with biologists for the study of cells and tissues.
<b>Job opportunities</b>	The skills acquired during this research project will give the opportunity of a career in industrial companies oriented to the R&D of innovative laser systems, spectroscopic instruments and microscopes, as well as in bio-photonics labs and industries.
<b>Composition of the research group</b>	1 Full Professors 2 Associated Professors 3 Assistant Professors 5 PhD Students
<b>Name of the research directors</b>	Dario Polli

#### Contacts

Prof. Dario Polli: (see <http://polli.faculty.polimi.it/> )

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

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

#### Scholarship Increase for a period abroad

<b>Amount monthly</b>	597.75 €
<b>By number of months</b>	6

#### National Operational Program for Research and Innovation

<b>Company where the candidate will attend the stage (name and brief description)</b>	CRI - Cambridge Raman Imaging SRL
<b>By number of months at the company</b>	6
<b>Institution or company where the candidate will spend the period abroad (name and brief description)</b>	INSTITUT FRESNEL - Faculté des Sciences - Avenue Escadrille Normandie-Niemen - MARSEILLE - MOSAIC
<b>By number of months abroad</b>	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 **4.872,90** 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 and Desk availability:** *shared use computer and desk*

**Other Information:**

see Link : [www.vibra.polimi.it](http://www.vibra.polimi.it)

Industrial Partner: **INSTITUT FRESNEL** - Faculté des Sciences - Avenue Escadrille Normandie-Niémen - 13397 MARSEILLE CEDEX

MOSAIC group (<https://www.fresnel.fr/spip/spip.php?article1418&lang=en>)