



PhD in FISICA / PHYSICS - 40th cycle

THEMATIC Research Field: NONLINEAR OPTICAL MICROSCOPY

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	
Motivation and objectives of the research in this field	<p>The Research is funded by Project PDP7VARI01 - OVHNonlinear optical microscopy is an advanced imaging technique that uses high-intensity light to create high-resolution, high-contrast images through nonlinear interactions with matter. Key methods include Coherent Raman Scattering (CRS) microscopy, which encompasses Coherent Anti-Stokes Raman Scattering (CARS) for chemically specific imaging and Stimulated Raman Scattering (SRS) for quantitative chemical imaging. Two-Photon Excitation (TPE) microscopy uses near-infrared light for deeper tissue penetration and less photodamage. Second Harmonic Generation (SHG) microscopy produces images of ordered structures like collagen, while Third Harmonic Generation (THG) microscopy highlights material interfaces such as cell membranes. Multiphoton Fluorescence Microscopy involves two-photon and three-photon excitation for detailed imaging with minimal phototoxicity. These techniques are widely used in biomedical imaging, material science, and neuroscience for their powerful and detailed visualization capabilities. See www.vibra.polimi.it.</p>
Methods and techniques that will be developed and used to carry out the research	<ol style="list-style-type: none"> 1) Generation of suitable narrowband ps and broadband fs pulses via non-linear optics, including supercontinuum generation and optical parametric amplification; 2) radiation-matter interaction in nonlinear microscopy, including coherent Raman, second-harmonic generation and two-photon excited fluorescence microscopy; 3) advanced instrumentation (imaging, hardware/software, beam scanning, detection, control); 4) multivariate statistical analysis and deep-learning



	4) multivariate statistical analysis and deep-learning algorithms; 5) biological applications, from cells to tissues.
Educational objectives	The candidate will gain specific skills in the design of a complete multimodal microscope, which will be used in collaboration with biologists for the study of cells and tissues.
Job opportunities	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.
Composition of the research group	1 Full Professors 2 Associated Professors 3 Assistant Professors 5 PhD Students
Name of the research directors	Dario Polli

Contacts	
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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

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
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 5300,25 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 and desk availability: shared use computer and desk