



## PhD in FISICA / PHYSICS - 39th cycle

### THEMATIC Research Field: FEMTOSECOND TIME DOMAIN INVESTIGATION OF FUNCTIONALIZED TWO-DIMENSIONAL SEMICONDUCTORS

#### 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

The Research is funded by Project PRIN 2022 VIBETWO ID 202284JP34 CUP D53D23002160006 and Project HE Pathfinder Open QUONDENSATE n. 101130384. Two-dimensional (2D) semiconductors have been the subject of vigorous experimental and theoretical study over the last ten years. Open questions regard their functionalization with organic molecules for improved light harvesting and local modification to create quantum single photon emitters. This project aims at the application of different ultrafast spectroscopy techniques to the study of the optical properties of functionalized and locally modified 2D materials. Ultrafast and nonlinear optical spectroscopy techniques use sequences of coherent, ultrashort light pulses to study photoinduced dynamical processes in atoms, molecules, nanostructures, and solids. This field of research has experienced an impetuous growth in recent years, due to the technological progress and to the development of sophisticated spectroscopic techniques, which greatly increase the amount of information extracted from the system under study. The Physics Department at Politecnico di Milano possesses several sophisticated experimental setups for laser spectroscopy, which will be further developed and applied by the scholar.

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

The fellow will work on the application of sophisticated ultrafast and nonlinear spectroscopy (such as transient absorption and multidimensional electronic spectroscopy) and microscopy (widefield multiplexed holography)



	techniques to the study of cutting-edge problems in functionalized 2D semiconductors. Particular focus will be on the role of coherence in the light harvesting and charge transfer processes between two-dimensional semiconductors and biomolecules, and on quantum single photon emitters created within nanosheets of 2D semiconductors.
<b>Educational objectives</b>	The scholar will receive a multidisciplinary training in topics including nonlinear optics, ultrafast spectroscopy, nonlinear microscopy, and the physics of condensed matter and biomolecules. He/she will have the opportunity to visit partner laboratories in Italy and abroad.
<b>Job opportunities</b>	Due to the multidisciplinary training in cutting edge techniques of optics and photonics as well as solid-state physics and nanoscience, the scholar will have excellent job opportunities in high-tech industries. In addition, he/she will be well positioned for an academic career.
<b>Composition of the research group</b>	1 Full Professors 3 Associated Professors 2 Assistant Professors 5 PhD Students
<b>Name of the research directors</b>	Giulio Cerullo, Christoph Gadermaier

<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>	--



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:** 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 and desk availability:** Individual use computer and share use desk.