



## PhD in FISICA / PHYSICS - 38th cycle

**PARTENARIATO PNRR Research Field: SOFT-X ULTRAFast MOLECULAR SPECTROSCOPY (I-PHOQS EXTREME PHOTONICS).**

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

**€ 1200.0**

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

Understanding attosecond-scale ( $1 \text{ as} = 10^{-18} \text{ s}$ ) response of matter has huge implications in several fields of science since it discloses the way a system initially behaves upon external excitation. This is of exceptional importance in biological systems, where the photophysics of fundamental processes (light harvesting, DNA radiation damage and related carcinogenesis, vision mechanisms etc.) is mostly known on temporal scales longer than few tens of femtoseconds. On those scales "purely electronic" phenomena, i.e. the initial steps in the response of natural systems (photoionization, electron correlation effects, charge migration etc.) remain unresolved. The aim of this project, within the framework of the Italian research infrastructure I-PHOQS, is the development of attosecond x-ray spectroscopy beyond the state of the art for the study of ultrafast charge dynamics in molecules of biological relevance. The objectives of the research are the following: - Development and optimization of sources of bright XUV and soft-X attosecond pulses via high-order harmonic generation in microfluidic devices - Development of a liquid jet source for the X-ray spectroscopy on liquid samples.

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

- Use and optimization of optical parametric amplifiers
- Fabrication of microfluidic devices by femtosecond laser micromachining.
- High-order harmonic generation and isolated attosecond pulses generation.
- Development of a liquid jet source.



<b>Educational objectives</b>	The PhD student will acquire specific competencies in the following fields: strong field physics; attosecond science; atomic and molecular physics; molecular dynamics. She/he will acquire also several technical competencies: ultrafast laser sources; vacuum technology; advanced programming and data analysis; micromachining and microfluidics.
<b>Job opportunities</b>	Post Doc in renewed research institutions working on attosecond science and ultrafast spectroscopy. Career path in the industry (lasers; advanced materials; consultancy).
<b>Composition of the research group</b>	1 Full Professors 2 Associated Professors 4 Assistant Professors 7 PhD Students
<b>Name of the research directors</b>	S. Stagira, M. Devetta, R. Vazquez Martinez

<b>Contacts</b>
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<a href="https://www.udyni.eu">https://www.udyni.eu</a>
<a href="http://www.mi.ifn.cnr.it/research/fs-micromachining">http://www.mi.ifn.cnr.it/research/fs-micromachining</a>

<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>	600.0 €
<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 (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 availability:** individual use

**Desk availability:** shared use

Other information

**Foreign Partner:** The secondment activity of the PhD will be carried inside the I-PHOQS infrastructure.