



PhD in FISICA / PHYSICS - 38th cycle

THEMATIC Research Field: ULTRAFAST SPECTROSCOPY AND IMAGING WITH QUANTUM LIGHT

Monthly net income of PhDscholarship (max 36 months)

€ 1195.5

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

This fellowship will be in the context of the iPHOQS project, a large-scale Italian Research Infrastructure in the field of photonics and quantum science. This research project aims to bring these two emerging fields of science and technology in synergy. Quantum light, in fact, opens new avenues for spectroscopy and imaging, by introducing novel degrees of freedom linked to the parameters of the quantum state of light and by measuring the variation of photon statistics when coupling to matter. This research activity will use quantum light as a powerful spectroscopic and imaging tool to measure intrinsic properties of complex molecules and to image soft/hard matter in ways that are not possible using classical light.

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

The scholar will develop the following experimental workstations:

1. platform for ultrafast spectroscopy using single and entangled photons or squeezed states of light. The platform will exploit photon correlations to enhance non-linear signals or to generate entirely new signals not available with classical light;
2. platform for temporal and spatial detection of quantum light based on compressed-sensing approaches and novel single-photon time-resolved cameras for imaging and spectroscopy of samples at the single-photon limit. The workstations will be based on an ultrafast laser source for the generation of entangled photons, heralded



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| | single-photons and squeezed states of light by non-linear optical processes, covering the visible and near-infrared regions. Detection stages will include single-photon avalanche photodiodes, position-sensitive single-photon detectors or fast time-gated camera. |
| Educational objectives | The scholar will receive a multidisciplinary training in topics including quantum optics, nonlinear optics, ultrafast spectroscopy and linear/nonlinear microscopy. He/she will have the opportunity to visit partner laboratories in the iPHOQS project. |
| Job opportunities | 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. |
| Composition of the research group | 3 Full Professors 5 Associated Professors 3 Assistant Professors 5 PhD Students |
| Name of the research directors | Giulio Cerullo; Antonio Pifferi |

| Contacts | |
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| Additional support - Financial aid per PhD student per year (gross amount) | |
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| Housing - Foreign Students | -- |
| Housing - Out-of-town residents (more than 80Km out of Milano) | -- |

| Scholarship Increase for a period abroad |
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| Amount monthly | 597.75 € |
| 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 4.872,90 euros

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