



## PhD in FISICA / PHYSICS - 38th cycle

**PARTENARIATO PNRR Research Field: INFRARED HYPERSPECTRAL IMAGING FOR MATERIAL SCIENCE AND CIRCULAR ECONOMY..**

**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

PATENARIATO PNRR N. CUP: **B53C22001750006**;  
 DECRETO DI CONCESSIONE: **D.D. 126 del 21/06/2022**  
 DECRETO DIRETTORIALE AVVISO: D.D. 3264 del  
 28/12/2021 Avviso pubblico per la presentazione di  
 proposte progettuali per "Rafforzamento e creazione di  
 Infrastrutture di Ricerca" da finanziare nell'ambito del  
 PNRR Missione 4, "Istruzione e Ricerca" - Componente 2,  
 "Dalla ricerca all'impresa" - Linea di investimento 3.1,  
 "Fondo per la realizzazione di un sistema integrato di  
 infrastrutture di ricerca e innovazione", finanziato  
 dall'Unione europea - NextGenerationEU

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. The research project aims to develop an innovative Hyperspectral camera operating in the Short Wavelength Infrared Range (SWIR). Infrared spectroscopy in this range ( $\lambda$  1-2.5  $\mu$ m) is a powerful tool for material identification through the measurement of the overtones of molecular vibrations. Plenty of applications can be found in remote sensing, like in satellite surveillance, and in industrial contexts. The green deal, which is strongly supported by the European Community and by the largest international agencies like US EPA call for the urgent development of efficient instrument for circular economy and identification of plastics dispersed in the environment. In fact, microplastics are becoming a severe threat to biota and human health. The SWIR Hyperspectral camera developed within the Ph.D. project will outperform the



	currently available devices thanks to the Fourier domain approach, made accessible through a patented interferometer based on a completely new concept.
<b>Methods and techniques that will be developed and used to carry out the research</b>	The scholar will develop a SWIR hyperspectral imaging workstation. The system will be based on a special configuration of the TWINS interferometer made with IR grade optical components, coupled to a InGaAs or to a MCT camera. The system will acquire reflectance images with a large field of view, when coupled to a macro opticalsystem. At variance, when coupled to a microscope, the workstation will produce spectral images with micron resolution. In both cases the images will show the absorption bands characteristic of the materials under investigation. The workstation will provide unprecedented performance thanks to the high throughput of the interferometer, for identifying and sorting a variety of substances at different scales. Applications for circular economy and environment protection are envisaged.
<b>Educational objectives</b>	The scholar will receive a multidisciplinary training in topics including optics, spectroscopy, interferometry and microscopy. He/she will have the opportunity to visit partner laboratories in the iPHOQS project.
<b>Job opportunities</b>	Due to the multidisciplinary training in optics and photonics as well as in material science the scholar will have excellent job opportunities in industries developing analytical instrument for circular economy and spectroscopy in general. In addition, he/she will be well positioned for a career in university or research center.
<b>Composition of the research group</b>	3 Full Professors 5 Associated Professors 3 Assistant Professors 5 PhD Students
<b>Name of the research directors</b>	Gianluca Valentini, Giulio Cerullo

<b>Contacts</b>	
gianluca.valentini@polimi.it: +39-02-23996071; giulio.cerullo@polimi.it: +39-02-23996164.	



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	597.75 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p><b>Educational activities</b> 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.</p> <p><b>Teaching assistantship:</b> 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.</p> <p><b>Computer availability:</b> individual use</p> <p><b>Desk availability:</b> shared use</p>