

## PhD in FISICA / PHYSICS - 41st cycle

## THEMATIC Research Field: TAILORING LIGHT-MATTER INTERACTIONS VIA STRUCTURED LIGHT

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

1500.0

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	Structuring optical beams enables the engineering of tailored phase, polarization, or intensity distributions, offering new degrees of freedom for controlling light in applications ranging from optical communication to quantum information processing and super-resolution imaging. While structured light has been extensively studied in free space, much less is known about how its interaction with solids can modify fundamental light-matter interactions. Understanding these effects could unlock new opportunities for manipulating optical responses in solid-state systems, enabling innovative photonic and optoelectronic devices. In this project the applicant will study light-matter interactions with a focus on how engineering the light degrees of freedom can be used to shape novel responses. Strongly anisotropic materials, including emerging two-dimensional crystals, will be investigated to highlight the interplay between optical and material anisotropy, enabling unprecedented control over light-matter interactions at the nanoscale.	
Methods and techniques that will be developed and used to carry out the research	Numerical electromagnetic simulations by means of commercial software (Lumerical FDTD, Comsol, CST, ecc.). Development of optical setups to structure light beams (through light spatial modulators or optical metasurfaces) and the detection of structured light-matter interactions. Fabrication of metasurfaces and 2D materials samples.	
Educational objectives	Learning commercial software for simulation of light-	



	matter interaction at the nanoscale; Learning 2D samples preparation and cleanroom nanofabrication techniques; learning how to build custom optical setup for the generation and detection of structured light matter- interactions.
Job opportunities	The research proposed is at the forefront of scientific innovation in Photonics that sees the attention of Tech giants for the development of next generation integrated optical devices. Moreover, such research topic is subject every year for several new academic positions in the top Universities around the World.
Composition of the research group	1 Full Professors 1 Associated Professors 4 Assistant Professors 5 PhD Students
Name of the research directors	Antonio Ambrosio

Contacts

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Additional support - Financial aid per PhD student per year (gross amount)				
Housing - Foreign Students	1st year	2nd year	3rd year	
	1000.0 € per student	1000.0 € per student	1000.0 € per student	
	max number of financial aid available: 1, given in order of merit (only for students with scholarship)			
Housing - Out-of-town residents	1st year	2nd year	3rd year	
	1000.0 € per student	1000.0 € per student	1000.0 € per student	
	max number of financial aid available: 1, given in order of merit (only for students with scholarship)			

Scholarship Increase for a period abroad		
Amount monthly	750.0 €	
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

## POLITECNICO DI MILANO



student per 3 years: max 6.114,50 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 or shared use computer and desk.