



# PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 38th cycle

**PARTENARIATO PNRR Research Field: DEVELOPMENT OF NOVEL 2D MATERIALS FOR ADVANCED APPLICATIONS**

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

**€ 1400.0**

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**

**CUP D43C22003090001**

**Decreto di concessione D.D. 1561 del 11/10/2022**

D.D. 341 del 15/03/2022 Avviso pubblico per la presentazione di Proposte di intervento per la creazione di "Partenariati estesi alle università, ai centri di ricerca, alle aziende per il finanziamento di progetti di ricerca di base" - nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4 "Istruzione e ricerca" - Componente 2 "Dalla ricerca all'impresa" - Investimento 1.3, finanziato dall'Unione europea - NextGenerationEU

Development of novel 2D nanomaterials and 2D heterostructures, including synthesis from bottom-up approaches, structural characterization to the nano/atomic scale by a combination of microscopy and spectroscopy techniques, and assessment of functional properties. The research will span from fundamental science investigation, in order to understand growth mechanisms and structure-property relation, to application-oriented activity aimed at understanding the functional properties of interest (e.g. electronic, optical, electrochemical) for different fields, with a focus on energy (photoconversion, photocatalysis, energy storage), but in principle also relevant for future 2D electronics/optoelectronics and sensing. The focus will be on inorganic 2D systems (e.g. transition metal dichalcogenides ? TMD - such as MoS<sub>2</sub>,



	<p>WS<sub>2</sub>, or other) and 2D all-carbon networks beyond graphene (e.g. sp-sp<sub>2</sub> systems such as graphdiynes), and the related lateral or vertical heterostructures. The research will address also issues such as 2D materials stability and transfer on different substrates.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>Material fabrication will be achieved by physical techniques (e.g. pulsed laser deposition, e-beam or thermal evaporation) and by on-surface synthesis on proper template surfaces (i.e. self-assembly of precursor molecules). Material investigation will be performed at first by in situ scanning tunneling microscopy and spectroscopy (STM/STS) in UHV; vibrational spectroscopy (Raman, SERS) both in situ and ex situ; Scanning Electron Microscopy (SEM). Other characterizations, at Nanolab or through established collaborations, will be employed such as electron spectroscopy techniques, optical, electrical or electrochemical measurements.</p>
<p><b>Educational objectives</b></p>	<p>Education of people to be ?launched? in the world of research and technology in the field of physics, nanotechnology and materials engineering, able to manage interdisciplinary issues, design, perform and interpret complex experiments and produce new equipment.</p>
<p><b>Job opportunities</b></p>	<p>Private and public R. &amp;D. Highly qualified positions in a wide range of industries related with production, development and use of materials for energy, electronics and other applications.</p>
<p><b>Composition of the research group</b></p>	<p>3 Full Professors 4 Associated Professors 2 Assistant Professors 10 PhD Students</p>
<p><b>Name of the research directors</b></p>	<p>ANDREA LI BASSI, CARLO S. CASARI</p>

#### Contacts

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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	700.0 €
By number of months	6

**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

***Educational activities:***

Financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations and computer, etc. This amount is equal to 10% of the annual gross amount, for 3 years.

***Teaching assistantship:***

Availability of funding in recognition of supporting teaching activities by the PhD student. 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:*** individual use.