



PhD in FISICA / PHYSICS - 38th cycle

THEMATIC Research Field: GROUP IV EPILAYERS FOR INFRARED SENSING AND QUANTUM COMPUTATION

Monthly net income of PhDscholarship (max 36 months)

€ 1350.0

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

Heterostructures exploiting Group IV semiconductors such as Si, Ge and Sn and becoming more and more relevant for several applications including infrared sensing and quantum computation. The detection of near and mid-infrared radiation is extremely relevant in material recognition, sensing and imaging. Most of the devices available nowadays for industrial, biomedical and scientific applications are based on compound semiconductors, however, such material systems suffer from a less mature technology, as compared to Si, which complicates the integration with the read-out circuit and increases production costs. Solutions compatible with Si-based technology are, therefore, highly desirable. The availability of Si-compatible materials enabling the fabrication of near and mid-infrared detectors, waveguides and modulators would therefore greatly increase the number of applications profiting from infrared devices. At the same time, quantum computation would greatly benefit from the availability of CMOS compatible materials and processes to achieve the large scale production of electrostatically defined quantum dots that can be operated as qubit. In this context, hole states in Ge quantum wells feature unique physical properties that make them ideal for qubit implementation. The objective of the research are consistent with projects: -group-IV LASer and deTectors on Si-TEchnology Platform – LASTSTEP and Integrated GermaNIum quanTum tEchnology - IGNITE.

Methods and techniques that will be



developed and used to carry out the research	<p>The methods and technique developed during the research activity comprise:</p> <ul style="list-style-type: none"> - Epitaxial growth of semiconductor heterostructures - Structural characterization by X-ray diffraction and atomic force microscopy - Device fabrication by optical lithography <p>Electro-optical characterization also at cryogenic temperatures</p>
Educational objectives	Knowledge of the electro-optical properties of semiconducting thin films and heterostructures, numerical modelling and fabrication of photodetectors.
Job opportunities	R &D in semiconductor industries and academic institutions.
Composition of the research group	1 Full Professors 1 Associated Professors 1 Assistant Professors 3 PhD Students
Name of the research directors	Giovanni Isella, Jacopo Frigerio

Contacts
giovanni.isella@polimi.it

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	675.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>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 5.095,96euros per student.</p> <p>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</p>



allowed by the regulations.

Computer and desk availability: *individual use*

Desk availability: individual use