



PhD in FISICA / PHYSICS - 40th cycle

**THEMATIC Research Field: DESIGN AND IMPLEMENTATION OF PHOTONICS SYSTEMS
FOR AUGMENTED AND VIRTUAL REALITY**

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

Luxottica, a worldwide leading company in the eyewear market, has started a highly innovative project, the Smart Eyewear Lab (SEL, <https://www.essilorluxottica.com/en/careers/smart-eyewear-lab/>) in collaboration with Polimi, to design and develop the eyewear of the future. The aim of the research is to turn eyeglasses into the portal of the metaverse, exploiting their natural coupling with our senses. In the long run, this result will be achieved by adding revolutionary capabilities of Augmented Reality (AR) to age-old devices designed to correct vision impairments and to protect the eyes from sunlight. The main objective of the Ph.D. Program is the development of photonic devices needed for a new generation of smart eyewear.

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

The eyewear of the future, featuring immersive AR functions, requires new photonic devices that combine digital images with the vision of the real world in a natural and comfortable way. The optical integration process consists of the realisation of a near-eye display and its adaptation to the eyewear, maintaining the comfort and wearability. The research and development activities will consist of four main tasks. i) Generation of digital holograms of real objects or virtual information and their implementation on Spatial Light Modulators (SLM) illuminated by coherent light. ii) Transfer of holographic images close to the eye using refractive, reflective and/or waveguide optical systems compliant with the shape of



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| | the glasses.iii) Fusion of virtual and real images by means of Holographic Optical Elements (HOE) or nanostructured metasurfaces, which redirect to the eye the generated holograms while transmitting the natural light from the environment. iv) Assembling of the optical elements in a prototype of near-eye display and testing with cameras, which simulate, as far as possible, the vision properties of the human eye in terms of field of view and accommodation capability. |
| Educational objectives | The PhD candidate will work in a multidisciplinary team including top researchers in photonics, electronics, and artificial intelligence. He/she will learn digital holography, diffractive optics, metamaterials, nanofabrication, computational methods and system integration. |
| Job opportunities | The candidate will work in a Joint Research Center Polimi-Luxottica and carry out an internship at a Luxottica site in Italy or abroad. Job opportunities will be in companies that develop devices and photonics systems for virtual and augmented reality: a highly innovative and promising technological segment. |
| Composition of the research group | 2 Full Professors 2 Associated Professors 2 Assistant Professors 3 PhD Students |
| Name of the research directors | Prof. Giulio Cerullo Prof. Gianluca Valentini |

| Contacts |
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| <p>Giulio Cerullo Giulio.cerullo@polimi.it Gianluca Valentini: gianluca.valentini@polimi.it</p> |

| 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 | 700.0 € |
| 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 student per 3 years: max 5.707,20 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 use computer and desk