

PHD CIFRE ACTIVE METASURFACES FOR AUTOMOTIVE APPLICATIONS (H/F)

Valeo is an automotive supplier and partner of all automakers worldwide. A technology company, Valeo offers innovative systems and equipment to reduce CO2 emissions and develop intuitive driving.

Present in 29 countries with 65 R&D centers and 183 production sites, the Group generated sales of 20 billion euros in 2022, of which 10% was invested in Research & Development. Valeo is listed on the Paris Stock Exchange.



General description:

Metasurfaces have gained attention as a potential replacement for traditional lenses and other photonic devices in a variety of applications, particularly in the automotive industry in the visible light range. Their compact size, efficiency and ability to manipulate the wavefront of the light make them attractive to improve the performance and functionality of various optical systems, such as extended signaling for exterior and interior lighting projection on curved surfaces. New materials, manufacturing and designing methods are needed to achieve large-diameter scale metasurfaces of high optical quality resolution for grazing projection applications which will lead to safer and more efficient vehicles.



SMART TECHNOLOGY
FOR SMARTER CARS

Mission description:

This PhD thesis has the ambition to develop large-diameter metasurfaces with high resolution and performance operating in the visible light range. A metasurface is made of subwavelength metallic or dielectric nanostructures whose shape and arrangement enables light to be focused and/or filtered. The interaction with light is due either to plasmonic resonances (metallic nanostructures) or cavity resonators (dielectric nanorods). By controlling this interaction through the judicious design of the metasurface elements, it is possible to locally control the phase and amplitude of the light traveling through the metasurface and arbitrarily control the wavefront.

The PhD work will include metasurface design, manufacturing process and optical characterization. The candidate will be co-supervised by two entities: VALEO Lighting Systems and C2N research laboratory at Cimphonie and Minaphot Groups.

Metasurface design (nanophotonics) and related projection performances (ray tracing) will be achieved through commercial softwares such as Lumerical FDTD (ANSYS) and Zemax (Optics Studio) together with a combination of analytical calculations based on electrodynamic theory. The theoretical study as well as the design and simulation of the future metasurface will be performed at VALEO. For the process development, the candidate will work in the advanced clean room of C2N on state-of-the art equipment for micro- and nano-fabrication. Characterization of the devices will be done in the both labs.

For a final and global assessment, several proposals of lighting systems will be adapted in order to test their projection performances with the developed metasurface, especially for digital dynamic projection applications.

This work will allow the PhD student to acquire a large experience in nano-technology and device fabrication (electron beam lithography, thin metal and dielectric layer deposition, dry etching and other clean room tools), in physics of semi-conductors as well as in optical characterizations of the metasurfaces devices.



PhD objectives:

The expected outcomes of this project include:

1. Identification of the optimal materials (dielectric, semiconductor, metal) and geometries for metasurfaces in the visible range for automotive applications.
2. Simulation models and design guidelines for metasurfaces in different optical systems used in automotives.
3. Micro and Nano-Fabrication techniques for metasurfaces with high precision and reproducibility.
4. Experimental characterization and evaluation of the performance of metasurfaces in automotive for dynamic projection applications.

Let's talk about you !

Recruitment criteria

Required education level:

- Master 2 or diplôme d'ingénieur bac+5 (in optics, physics or electronics)

Required background:

- Physics of solids (semiconductors) and matter-light interaction.
- Knowledge in micro- and nano-fabrication is welcome.
- Knowledge of Lumerical (FDTD method) and/or Zemax (Ray tracing) is very appreciated.

Cross-disciplinary skills:

- Teamwork, ability to synthesize, autonomy and initiative

Computer softwares:

- Microsoft Office
- OpticStudio Software - Zemax
- Logiciel Lumerical FDTD, STACK

English level:

- Good proficiency in English expected.





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Additional information:

Start date: February 2024

Duration: 36 months

Place of work: Bobigny (93) and Palaiseau (91)

Contract: CIFRE contract between VALEO & C2N

Deadline for submission : 1st December 2023

Contact persons:

To apply, please email your cover letter, CV and letters of recommendation (optional) to the following people:

- Dr. Eduardo ALVEAR (VALEO lighting Systems, Bobigny),
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Thanks to its strategy based on innovation, Valeo is at the heart of the three revolutions that are shaking up the automotive industry: the electrification of the vehicle, the advent of the autonomous and connected vehicle, and the development of digital mobility. These are revolutions that Valeo was able to anticipate, and which are today synonymous with tremendous career opportunities, including abroad! At Valeo, innovation is driven by the diversity, authenticity and energy of our talents. Would you like to experience new technological and human adventures? Join Valeo and its 114,700 employees in 29 countries!

More information on Valeo: <https://www.valeo.com>

