

Post-doc and PhD positions in Physics,
Condensed Matter



Alloyed materials for photonics: exploring dielectric response in group IV nanowires

Term and Location A three years PhD and a one-year post-doctoral positions are available in the STEM group at the Laboratoire de Physique des Solides of Université Paris-Saclay (Orsay, France) beginning as early as Spring 2022. Both positions are funded in the context of the French ANR project AMPHORE.

Scientific context Over the last few years, the emergence of data-intensive technological areas has triggered an urgent need for implementing telecommunication functionalities in group IV materials. This has encouraged researchers to develop novel direct bandgap systems while keeping their compatibility with Si CMOS electronics. These systems would make possible to unite electronic and optoelectronic features on a single chip. Such an achievement would pave the way to a new Si technological revolution without the need for the challenging III-V heterogeneous integration. Among the variety of materials investigated, hexagonal-diamond $\text{Si}_{1-x}\text{Ge}_x$ alloyed nanowires (2H- $\text{Si}_{1-x}\text{Ge}_x$ NWs) are extremely attractive due to their easiness of fabrication and peculiar optical features. Indeed, although 2H-Si bulk is stable only at very high pressures, recent studies demonstrated that at the nanoscale, 2H-SiGe crystals can exist as pure wires. These nanostructures offer the unique possibility to combine an indirect semiconductor (2H-Si) with a direct one (2H-Ge) to obtain a light-emitting direct bandgap material in the telecommunication wave length range.

Project description The successful candidates will investigate, through the effectual combination of *ab initio* approaches, semi-empirical methods, and computer simulations, the potentialities of 2H- $\text{Si}_{1-x}\text{Ge}_x$ NWs as light emitters. The main goal is to reach a deep theoretical understanding, via precise state-of-the-art quantum-mechanical modelling, of the dielectric response of 2H- $\text{Si}_{1-x}\text{Ge}_x$ NWs in a realistic environment, including morphology, substrates, and dopants. Furthermore, the activity will provide an accurate interpretation of targeted experiments using advanced nanometre-scale optical measurements with fast electrons that will be conducted in the group.

Working environment The STEM group at the Laboratoire de Physique des Solides is a world leading electron microscopy team well recognized for its work on the structural, optical and electronic characterization of nanostructures combining experimental spectro-microscopy and *ab initio* modeling. Located south of Paris, Université Paris-Saclay is at the core of the biggest scientific pole in France and it has been recently ranked first European university in physics by the Academic Ranking of World Universities.

Profile candidate Besides a keen interest in the application of quantum mechanical methods for the modelling of real materials and a strong background in physics or materials science, we expect excellent communication skills in English and willingness to collaborate in an interdisciplinary team. Programming experience is also desirable, but not mandatory.

How to apply For information on the research group please visit the website <https://equip2.lps.u-psud.fr/stem/>. Qualified candidates should send a CV, a list of publications, contact details of at least two references, and an estimated availability date to Michele Amato (michele.amato@universite-paris-saclay.fr). The preferred format is a single PDF-document.

Closing Date Candidatures will be considered right up until the two positions are filled.