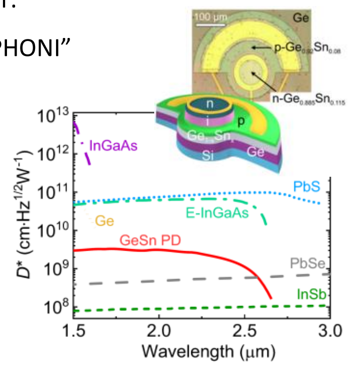
Silicon meets infrared: GeSn as the key to next-generation photonic devices

We are looking for a highly motivated and talented physics or optics postdoc with suitable experience in photonics to join our team at PHELIQS to develop GeSn infrared optoelectronic devices on a Si wafer.

Starting date. Fall/winter 2026 with a two-year contract funded by the ANR JCJC "SINPHONI" project led by Dr. Simone Assali.



Room-temperature detectivity of a GeSn SWIR photodetector.[2,3]

Project description. The infrared is an exciting playground to establish major breakthroughs across multiple photonics technologies, such as imaging, sensing of gases and molecules, industrial monitoring, medical diagnostics, and food inspection, to name a few. Over the last decade, direct band gap GeSn semiconductors grown on a Si wafer have been established as a promising monolithic platform for photonic devices (photodetectors, LEDs, and lasers) that are essential to infrared imaging and sensing technologies.[1-5] The essence of the GeSn materials lies in the possibility to exceed by one order of magnitude the equilibrium solubility of 1 at.% Sn in Ge and achieve an indirect to direct band gap transition above 8 at.% Sn. The ability to control the composition of GeSn thus enables a wealth of passive and active photonic devices in the short-wave infrared (SWIR: 1.5-3 µm) and mid-wave infrared (MWIR: 3-8 µm), with the capability to reach the long-wave infrared (LWIR: 8-20 µm). The integration of GeSn devices in practical applications such as infrared imaging[6] and gas detection[4] further highlights the potential for scalable technologies.

The aim of the project is to improve the understanding of the optoelectronic properties of GeSn and engineer novel photonic devices and real-world applications. The first objective is to develop a new setup for infrared time-resolved spectroscopy and correlate the results with the absorption and photoluminescence measurements acquired using a FTIR setup. This will strengthen the ongoing materials development at CVD-MBE growth facility at PHELIQS. The second objective is to fabricate novel SWIR-MWIR GeSn photodetectors and integrate them into an infrared imaging setup to characterize their optoelectronic properties in real world conditions. The candidate will work within a team of researchers and will advise graduate and undergraduate students in their research projects, hence in a collaborative environment to reach the aforementioned research objectives.

Environment. The SiNaPS research group at PHELIQS (https://www.pheliqs.fr/Pages/Sinaps/Presentation.aspx), hosted at CEA Grenoble, develops new photonic and quantum materials and devices based on group IV semiconductors. Within the CEA campus, the group has direct access to a nano-characterization platform (PFNC) and to a class 1000 academic cleanroom facility (PTA). The SiNaPS lab is equipped with infrared optical setups (0.5-8 µm wavelengths) for materials and devices characterization. CEA is located next to other major scientific institutions, such as CNRS (Institut Néel), ERSF (synchrotron), and many high-tech companies (STMicroelectronics, Soitec, Lynred, Verkor), as well as the University Grenoble Alpes. The local environment of CEA and more in general the Grenoble area is a fertile ground to establish new businesses in semiconductors, photonics, and quantum technologies, as recently highlighted in Nature.[7] Grenoble is a vibrant city offering many cultural and nightlife activities, and being located in the heart of the Alps it is the paradise for all outdoor enthusiasts all-year-round.

Required experience. Postdoc candidates are required to have a Ph.D. degree in physics or a related discipline (optics, nanosciences, ...). The successful candidate will bring a strong background in some of the following areas: photonics, semiconductor physics, device micro-/nano-fabrication, materials science, cryogenic experiments, experiment control and data acquisition using Python. French language proficiency is not necessary.

How to apply. Please contact Dr. Simone Assali by e-mail (simone.assali@cea.fr) with an application containing:

- a curriculum vitae (including prior research experience and skills acquired as well as names of potential referees).
- your academic records (Master's and PhD diploma).
- a list of relevant publications.
- a short statement of your research interest and how it relates to the project.

References.

1. O. Moutanabbir *et al.*, Monolithic infrared silicon photonics: The rise of (Si)GeSn semiconductors, Appl. Phys. Lett. 118, 110502 (2021).
2. M. Atalla *et al.*, High-Bandwidth Extended-SWIR GeSn Photodetectors on Silicon, ACS Photonics 9, 4 (2022).
3. M.-H. Chou *et al.,* High-Detectivity GeSn Mid-Infrared Photodetectors for Sensitive Infrared Spectroscopy, Adv. Photonics Res. 2400155 (2024).
4. C. Cardoux *et al.,* Direct bandgap $Ge_{0.846}Sn_{0.154}$ photodiodes for gas sensing in the mid-wave infrared, IEEE J. Quantum Electr. 31, 1 (2025).
5. Y. Zhou *et al.,* Electrically injected GeSn lasers with peak wavelength up to 2.7 µm, Photon. Res. 10, 1 (2022).
6. E. Talamas Simola *et al.,* CMOS-Compatible Bias-Tunable Dual-Band Detector Based on GeSn/Ge/Si Coupled Photodiodes, ACS Phot. 8 (2021).
7. How Grenoble has mastered industry-academia science collaborations, Nature Spotlight (2023).

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