

# INTERNSHIP PROPOSAL

(One page maximum)

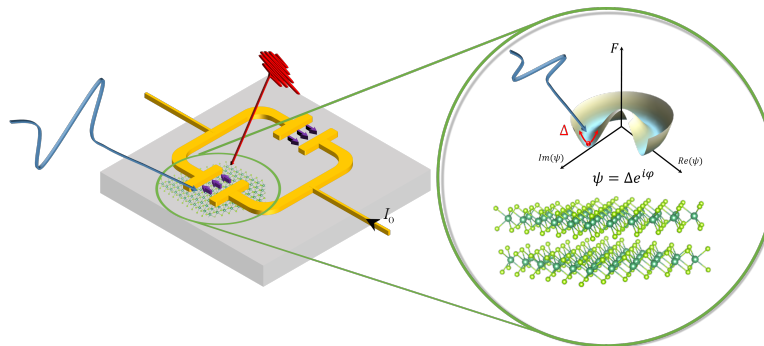
Laboratory name: Laboratoire des solides irradiés-Ecole Polytechnique  
CNRS identification code: UMR7642  
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Internship location: Laboratoire des solides irradiés-Ecole Polytechnique-Institut Polytechnique de Paris

Thesis possibility after internship: YES  
Funding: YES If YES, which type of funding: ANR

## TeraHertz cavity electrodynamics of superconducting collective modes

Strong light-matter interactions between quantum materials and the vacuum field of cavities at TeraHertz (THz) frequencies is emerging as a new frontier for the control of material properties [1]. Among quantum materials, superconductors (SC) hold a special place and a timely question has arisen regarding the possibility to tune their spectacular properties by dressing their collective modes with THz cavity photons [2]. In this internship, we propose to study the collective modes of NbSe<sub>2</sub>, an exotic SC exhibiting simultaneously SC and a charge density-wave (CDW) state. Of particular interest will be to investigate the dynamics of its Higgs-mode, an analogue of the Higgs-boson in SCs, and its interaction with the CDW mode. This will be achieved with a combination of equilibrium THz time-domain spectroscopy and pump-probe THz spectroscopy. The first steps towards integration of this SC inside THz cavities and the dressing of its collective modes will be carried out. The consortium of this collaborative project also includes experts in Raman spectroscopy and the theory of condensed-matter and SCs.



Artist view of the SC NbSe<sub>2</sub> embedded in a THz cavity

- [1] F. Schlawin et al., Applied Physics Reviews 9, 011312 (2022)  
[2] A. Alloca et al. Phys. Rev. B 99, 020504 (2021)

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics:	YES	Soft Matter and Biological Physics:	NO
Quantum Physics:	YES	Theoretical Physics:	NO