Laboratoire des solides irradiés
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Fully funded PhD position available

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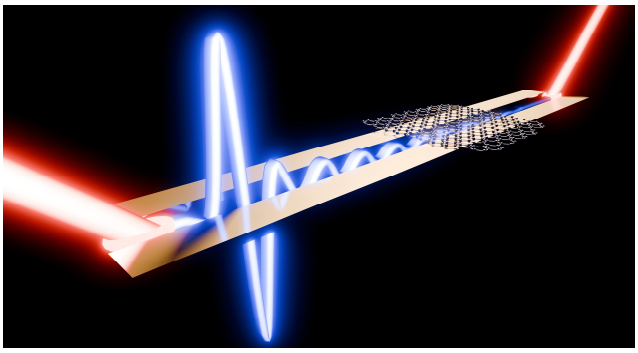
On-chip Terahertz Spectroscopy of 2D Materials

In the recent years, the study of 2D materials such as the transition metal dichalcogenides (TMD) has led to the discovery of novel quantum states of matter. However, the fabrication of these materials often leads to small samples (~µm) which can limit the range of tools used for their study and applications. This is the case of terahertz (THz) spectroscopy which, though limited by diffraction (~300 µm), would be a powerful tool because the THz frequency range lies in the same energy range as many electronic excitations in these quantum materials.



In this Master project, we propose to develop a method to perform spectroscopy on micrometer scale 2D materials beyond the current diffraction limitation of standard THz spectroscopy. This new technique uses "on-chip" generation and detection of THz pulses and will allow the candidate to study $NbSe_2$, an exotic SC hosting simultaneously SC and a charge-density-wave (CDW) state. $NbSe_2$ samples will be progressively exfoliated and measured down to the ultimate monolayer 2D limit. These already unprecedented results will pave the way for a PhD thesis for which the candidate will implement pump-probe "on-chip" THz spectroscopy, investigating the dynamics and interaction of the Higgs and CDW modes when driven far away from equilibrium and the possibility of inducing long-lived metastable SC states in this system. .

Environment :
The hosting group Nouveaux Etats Electroniques (NEE) is expert in equilibrium and non-equilibrium dynamics of superconductors. The student will operate a KiloHertz amplified laser system providing femtosecond pulses of 5 mJ. THz spectrometer and optical cryostats are installed and regularly operating. The supervisors Romain Grasset and Yannis Laplace have large experience both on THz spectroscopy of superconductors.