Minicolloque n° MMPS20 ☐ **Oral**

Graphene based Josephson parametric amplifier

Guilliam Butseraen[a*], K. Watanabe[b], T. Taniguchi[b], François Lefloch[c], Julien Renard[a]

a. Univ. Grenoble Alpes, CNRS, Grenoble INP, Institut Néel, Grenoble, France
b. National Institute for Materials Science, Tsukuba 305-0044, Japan
c. CEA, INAC-PHELIQS, F-38054 Grenoble, France

* email : guilliam.butseraen@neel.cnrs.fr

Devices based on the control of quantum states will revolutionize information and communications technologies. Several implementations of the quantum bit (Qubit), i.e. the building block for systems targeting quantum-enabled functionalities, were already demonstrated. Approaches based on all-superconducting materials provide the most advanced solid-state platform to date but they rely on magnetic effects for control and operation, which is not an industry standard for devices and might induce unwanted interaction between different elements of the circuit. We report the integration of graphene in the key element of superconducting circuits: the Josephson junction. The field effect enables the junction to gain electrical tunability, a breakthrough for control and future integration. Graphene Josephson junctions have recently been implemented in superconducting microwave circuits [1], qubits[2] and also in bolometers[3,4]. In this presentation, I will report the progress we have made towards the development of another key circuit of superconducting quantum technologies: a Josephson parametric amplifier.

[1] Schmidt, F.E. *et al.*, *Nat Commun*, **9** (2018) 4069.
[2] Wang, J.I. *et al.*, *Nature Nanotech*, **14** (2019) 120.
[3] Gil-Ho Lee *et al.*, *Nature* **586,** 42–46 (2020)
[4] R. Kokkoniemi *et al.*, *Nature* **586,** 47–51 (2020).

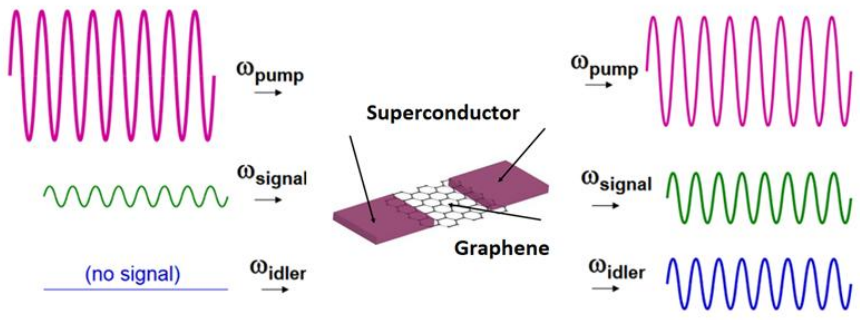

Figure 1 : Scheme of the amplification process in a Josephson parametric amplifier built with a graphene Josephson junction. Pump photons are converted into signal and idler photons.