Magic-angle graphene superconducting nano-calorimeter

Giorgio Di Battista[1]
Paul Seifert[1], Kenji Watanabe[2], Takashi Taniguchi[2], Kin-Chung Fong[3,4], Alessandro Principi[5] and Dmitri K. Efetov[1]

[1]*ICFO - Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels, Barcelona, 08860, Spain*

[2]*National Institute for Materials Science, 1-1 Namiki, Tsukuba, 305-0044, Japan*

[3]*Quantum Information Processing Group, Raytheon BBN Technologies, Cambridge, Massachusetts 02138, United States*

[4]*Department of Physics, Harvard University, Cambridge, Massachusetts 02138, United States*

[5]*Department of Physics and Astronomy, The University of Manchester, M13 9PL Manchester, United Kingdom*

dmitri.efetov@icfo.eu
giorgio.dibattista@icfo.eu

Superconducting nano-calorimeters are currently some of the most sensitive sensors for detecting electromagnetic radiation. Two-dimensional materials, thanks to their small heat capacity are progressively evolving into a novel platform to develop a new generation of sensors that can further push the limits of detector sensitivities [1]. Specifically, magic-angle twisted bilayer graphene (MAG) exhibits a record-small heat capacity and a sharp superconducting transition that makes it suitable for superconducting calorimetry [2]. Here we investigate the thermal and optoelectronic properties of the MAG and provide precious insights towards applications. This study establishes MAG as a promising two-dimensional material for ultra-sensitive photodetection.

References

[1] Gil-Ho Lee et al., Nature, 586 (2020) 42-46
[2] Paul Seifert et al., Nano Letters, 5 (2020) 3459-3464

Figures

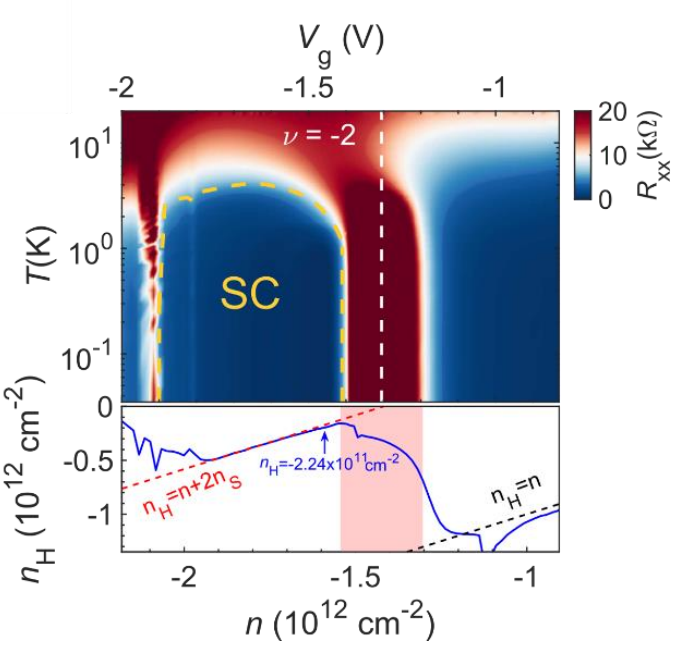

Figure 1: *Colormap of the longitudinal resistance as a function of back-gate-applied voltage V_g and device temperature T. The boundaries of the superconducting dome—indicated by the dashed yellow line—are defined by the 50% of the normal state resistance. In blue the low-field Hall effect (300 mT) for the same doping region of the top panel.*