Long-Range Propagation and Interference of d-Wave Superconducting Pairs in Graphene

D. Perconte*[1,2], K. Seurre[1], V. Humbert[1], C. Ulysse[3], A. Sander[1], J. Trastoy[1], V. Zatko[1], F. Godel[1], P. R. Kidambi[4,5], S. Hofmann[5], X. P. Zhang[6], D. Bercioux[6], F. S. Bergeret[6], B. Dlubak[1], P. Seneor[1], and Javier E. Villegas[1]

1 Unité Mixte de Physique, CNRS, Thales, Université Paris-Saclay, 91767 Palaiseau, France
2 now at Université Grenoble Alpes, CNRS, Grenoble INP, Institut Néel, Grenoble, France
3 Centre for Nanoscience and Nanotechnology, CNRS, Université Paris-Sud/Université Paris-Saclay, Boulevard Thomas Gobert, 91120 Palaiseau, France
4 Department of Chemical and Biomolecular Engineering, Vanderbilt University, 2400 Highland Avenue, Nashville, Tennessee 37212, USA
5 Department of Engineering, University of Cambridge, Cambridge CB3 0FA, United Kingdom
6 Centro de Fisica de Materiales (CFM-MPC), Centro Mixto CSIC-UPV/EHU, 20018 Donostia-San Sebastián, Basque Country, Spain

**Presenting author: david.perconte@neel.cnrs.fr*

We have recently shown that proximity with a high-temperature superconductor induces unconventional superconducting correlations in graphene[1]. We will here talk about recent experiments demonstrating [2] that those correlations propagate hundreds of nanometers, allowing for the unique observation of d-wave Andreev-pair interferences in YBa2Cu3O7-graphene devices that behave as a Fabry-Perot cavity. The interferences show as a series of pronounced conductance oscillations. We are able to separate from these conductance oscillations the part stemming from the superconducting normal interface and the part stemming from Fabry Perot like oscillations. The present demonstration is pivotal to the study of exotic directional effects expected for nodal superconductivity in Dirac materials. If time allows, results obtained in the current institute will be presented at the end.

[1] Perconte, D., Cuellar, F. A., et. al. (2018). Tunable Klein-like tunnelling of high-temperature superconducting pairs into graphene. Nature Physics, 14(1), 25-29.
[2] Perconte, D. and Seurre, K. et. Al. (2020). Long-Range Propagation and Interference of d-Wave Superconducting Pairs in Graphene. Physical Review Letters 125 (08). 087002