11:54AM B48.00003: Phase-dependent dissipation and supercurrent of a graphene-superconductor ring under microwave irradiation
ZIWEI DOU (Presenter), TARO WAKAMURA, Universite Paris-Saclay, PAULI VIRTANEN, Department of Physics and Nanoscience Center, University of Jyvaskyla, NIAN-JHENG WU, RICHARD DEBLOCK, SANDRINE AUTIER-LAURENT, Universite Paris-Saclay, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, SOPHIE GUERON, HELENE BOUCHIAT, MEYDI FERRIER, Universite Paris-Saclay — A junction with two superconductors coupled by a normal metal hosts Andreev bound states whose energy spectrum is phase-dependent and exhibits a minigap, resulting in a periodic supercurrent. Phase-dependent dissipation also appears due to finite-time relaxation in Andreev levels. While current phase relation and dissipation have previously been measured near thermal equilibrium, their behavior in nonequilibrium is still elusive. By measuring the ac susceptibility of a graphene-superconductor junction under irradiation, we observe the nonequilibrium dissipation and supercurrent simultaneously for the first time. We find the supercurrent dependence on frequency and power deviates from adiabatic ac Josephson effect due to finite relaxation rate. Notably, with irradiation frequency larger than the minigap, the dissipation shows an enhancement at phase 0 where the minigap is largest and dissipation is minimum in equilibrium. We argue that this is evidence of the nonequilibrium distribution function which allows additional transitions between levels on the same side of the minigap. Our results demonstrate the ultra-sensitivity of the dissipation measurement for other proximitised superconducting systems where novel physics can be revealed by nonequilibrium-induced level transitions.

12:06PM B48.00004: Magneto-transport in Planar Graphene/d-wave Superconductor Junctions* KEVIN SEURRE (Presenter), VINCENT HUMBERT, Unité Mixte de Physique, CNRS, Thales, Université Paris-Saclay, 91767, Palaiseau, France, DAVID PERCONTE, Univ. Grenoble Alpes, CNRS, Grenoble INP, Institut Néel, 38000 Grenoble, France, CHRISTIAN ULYSSE, Centre for Nanoscience and Nanotechnology, CNRS, Université Paris-Sud/Université Paris-Saclay, Boulevard Thomas Gobert, Palaiseau, France, ANKE SANDER, JUAN TRASTOY, BRUNO DLUBAK, PIERRE SENEOR, JAVIER E VILLEGAS, Unité Mixte de Physique, CNRS, Thales, Université Paris-Saclay, 91767, Palaiseau, France — We have recently shown experimental evidence for proximity-induced d-wave superconductivity in graphene using planar graphene/d-wave $YBaCuO_{7-x}$ (YBCO) junctions, as evidenced by the conductance dependence on bias and gate voltages [1,2]. Here, we investigate the magnetic field effects on the junctions' conductance. We find two striking effects. On the one hand, the superconducting-gap related features are progressively suppressed upon increasing the applied magnetic field, and vanish above a characteristic field in the range of 0.5-1 T. On the other hand, we find field-induced periodic oscillations of the conductance, which are only observed at energies below the superconducting gap. These oscillations are the most visible for YBCO/graphene interfaces of relatively low transparence. These findings will be discussed by considering the creation of superconducting vortices in the proximitized graphene, based on which we performed numerical simulations that can account for some of the observed behaviors.

[1] D. Perconte, et al. , Nat. Phys. 14, 25 (2018).
[2] D. Perconte, K. Seurre et al. , Phys. Rev. Lett. 125, (2020).

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12:18PM B48.00005: Superconducting proximity effect in ultra-scaled pure Ge quantum dots.* JOVIAN DELAFORCE (Presenter), Institut Neel, MASIAR SISTANI, Institute of Solid State Electronics, TU Wien, ROMAN B. G. KRAMER, MARTIEN DEN HERTOG, NICOLAS ROCH, CÉCILE NAUD, Institut Neel, ALOIS LUGSTEIN, Institute of Solid State Electronics, TU Wien, OLIVIER BUISSON, Institut Neel — The diverse applications and rich physics of hybrid superconducting-semiconducting systems has attracted significant research interest in improving the quality of these devices. Significant focus has been made on hybrid systems using a combination of Ge and Si to form a high mobility hole gas. However, there has been little research on pure Ge systems.
Using a thermally induced exchange reaction between single-crystalline Ge nanowires and Al pads, we fabricate monolithic Al-Ge-Al nanowire heterostructures with ultra-scale Ge segments contacted by crystalline Al leads. This fabrication technique allows full electrostatic control of the Ge segment and thus the ability to overcome the Schottky barrier.
We will present the low temperature transport properties of Al-Ge-Al nanowire heterostructures with ultra-scaled Ge segments of 40 nm in length and 25 nm in dimater. Exploiting the large tunability and high quality Al contacts we will show that we can access a variety of quantum transport regimes in a single device: from a quantum dot with single hole filling up to proximity induced supercurrent inside the pure Ge segment.

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12:30PM B48.00006: Superconducting Proximity Effect on a Magnetically Doped Topological Insulator Controlled by Magnetization*
RIKIZO YANO (Presenter), IMaSS, Nagoya University, MASAHIRO YAMAMOTO, KOHEI TSUMURA, Dep. of Appl. Phys., Nagoya University, HISHIRO T. HIROSE, Laboratory for Materials and Structures, Tokyo Institute of Technology, VASILY S. STOLYAROV, TQPSS, Moscow Institute of Physics and Technology, YUKIO TANAKA, Dep. of Appl. Phys., Nagoya University, HIROMI KASHIWAYA, National Institute of Advanced Industrial Science and Technology, YASUHIRO ASANO, Center of Topological Science and Technology, Hokkaido University, TAKAO SASAGAWA, Laboratory for Materials and Structures, Tokyo Institute of Technology, SATOSHI KASHIWAYA, Dep. of Appl. Phys., Nagoya University — Proximity effect (PE) on magnetized topological insulators (TIs) has the potential to induce unconventional Cooper pairs, some of which can host Majorana fermions whose antiparticles are themselves. Theory predicts that the magnetized TI systems can tune its PE from a topological to a non-topological state by magnetization and chemical potential.
In this study, we investigated the magnetization dependence of PE on an Nb/ Fe-doped Bi_2Te_2Se Josephson junction. We evaluated I_c-H characteristics before/after applying large magnetic fields. The I_c-H patterns show typical Fraunhofer-like patterns with slight hysteresis. After large magnetic fields (> 0.5 T), the patterns were drastically shift depending on the direction of the last large fields. This shift indicates that the critical currents are sensitive to the existing remnant magnetization. We also observed a transition-like behavior in the conductance spectrum, which may relate with a topological phase transition.

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