Ballistic graphene Josephson junctions.

J. R. Prance

Department of Physics, Lancaster University, Lancaster LA1 4YB, UK

The superconducting proximity effect in high quality, encapsulated graphene can extend over length scales of several microns. This makes it possible to build extended graphene SNS junctions where transport through the graphene is ballistic and coherent, and where the critical current of the junction can be controlled using local gate voltages. In measurements of niobium/graphene/niobium junctions, we find that supercurrent can persist to surprisingly high magnetic fields (up to $\sim 1\,\mathrm{T}$) due to scattering at the graphene edges[1]. At low magnetic fields, we find that supercurrent flows along the edges of the graphene when a gap is opened in the graphene density of states[2]. To explore the applications of these junctions, we measure DC SQUIDs where the critical current of each junction can be controlled using a local gate. This allows the sensitivity and symmetry of the SQUID to be varied in-situ.[3]

[1]Ben Shalom et al., Nat. Phy. **12**, pp318-322 (2016)
[2]Zhu et al., Nat. Commun. **8**, 14552 (2017)
[3]Thompson et al., Appl. Phys. Lett. **110**, 162602 (2017)