Electrostatically tailored supercurrent in graphene bilayer weak links

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The realization of graphene nanostructures based on electrostatic gating remains a serious challenge due to its lack of a band gap and the absence of back scattering due to Klein tunnelling [1]. Yet, AB-stacked graphene bilayer offers the opportunity to open a band gap by exposing displacement fields perpendicular to the graphene plane [2,3].

Taking advantage of the electrostatic tunability, we design dual-gated nano-structures based on edge-connected bilayer graphene-hexagonal boron nitride van der Waals heterostructures [4]. The displacement fields are induced between a pre-patterned overall back gate and a local top gate structure which consists of two gate fingers that can be controlled independently. Contact is made with superconducting titanium/aluminium electrodes allowing to pass a proximity-induced supercurrent through the graphene junction [5]. The devices can be driven in various geometrical configurations (*i.e.* wide junction, half-junction barrier and split-gate) by means of electrostatic gating.

Here, we show the magnetic field dependence of the critical current for different junction geometries being in full control of the confinement of the supercurrent and the presented experimental results are supported by an analytical model.

References

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Figures

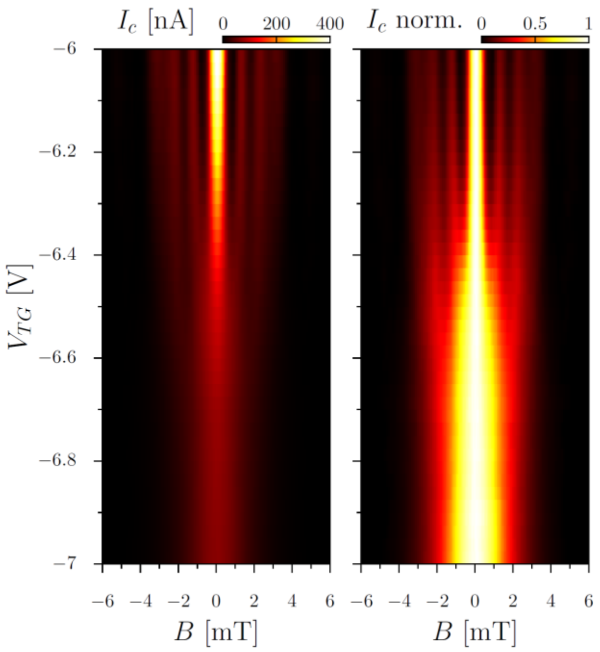

Figure 1: Magnetic interferometry of the supercurrent. Color maps of the critical current amplitude I_c (left) and normalized critical current amplitude I_c norm. (right) as functions of the magnetic field B and the top gate voltage V_{TG} , showing the evolution of the magnetic interference pattern when the supercurrent density is confined from 2D to 1D.