Observation of current whirlpools in graphene at room temperature

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Classical hydrodynamics, where interparticle collisions dominate transport, can give rise to peculiar flow patterns. An analogous flow regime can also manifest itself in solid-state systems, most notably in graphene [1-4]. In this talk, we present an experiment where we imaged one of the most striking hydrodynamic transport patterns - stationary current whirlpools - in a room-temperature monolayer graphene device [5]. Our experiment takes advantage of a scanning nitrogen-vacancy magnetometer, which is able to non-perturbatively image the current density with nanoscale resolution [6-7]. We show that the appearance of vortices depends both on the characteristic device size and the carrier doping (electrons, holes) of graphene. Our demonstration opens exciting opportunities for investigating mesoscopic transport phenomena with local imaging techniques.

References

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Figures

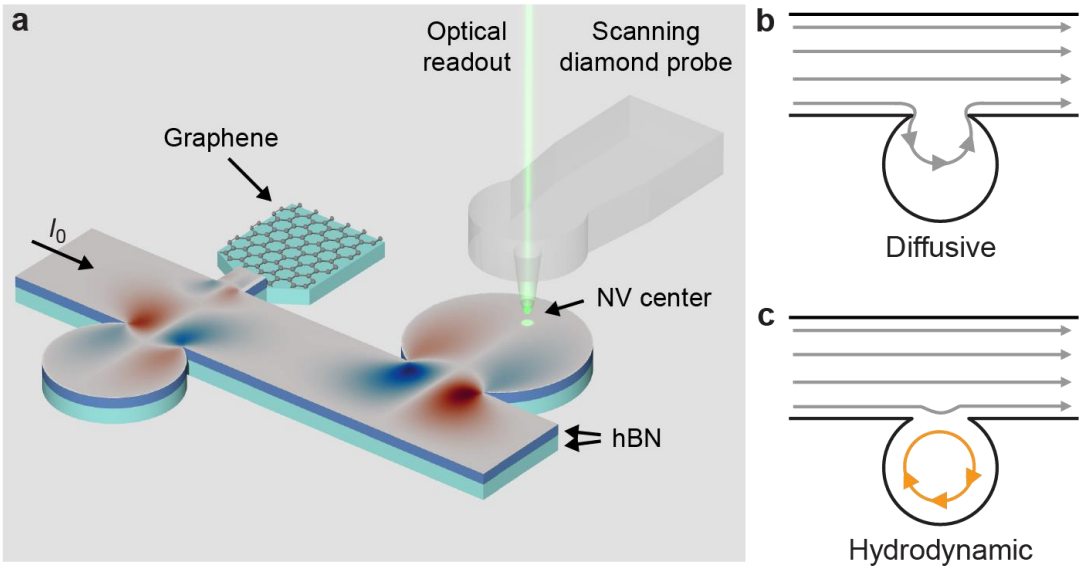

Figure 1: a Configuration of the encapsulated monolayer graphene device and scanning nitrogen-vacancy (NV) magnetometer. hBN, hexagonal boron nitride. **b** Schematic of current flow in the diffusive regime. **c** In the hydrodynamic regime, current flow inside the disk reverses direction.