Helical quantum Hall phase in graphene on SrTiO3

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In this talk I will present a new strategy to induce a helical phase in graphene constructed on the basis of the quantum Hall effect. I will show that the ground state of charge neutral graphene under perpendicular magnetic field can be tuned in a quantum Hall topological insulator state with a ferromagnetic order that exhibits spin-filtered, helical edge channels. This topological phase emerges in the graphene zeroth Landau level via a suitable screening of the Coulomb interaction by a $SrTiO_3$ high-*k* dielectric substrate. We observed robust helical edge transport emerging at a magnetic field as low as 1 T and withstanding temperatures up to 110 K over micron-long distances. This new and versatile graphene platform opens up a promising avenue for topological superconductivity.

References

[1] L. Veyrat, C. Déprez, A. Alexis, X. Li, F. Gay, K. Watanabe, T. Taniguchi, Z. Han, B. Piot, H. Sellier, B. Sacépé, Science 367, 781 (2020)

Figures

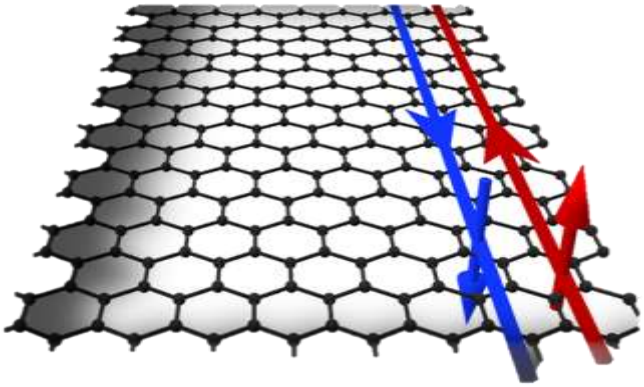

Figure 1: Spin-filtered helical edge channels propagating on the edge of graphene.