Quantum Hall Effect in Graphene with Superconducting Electrodes

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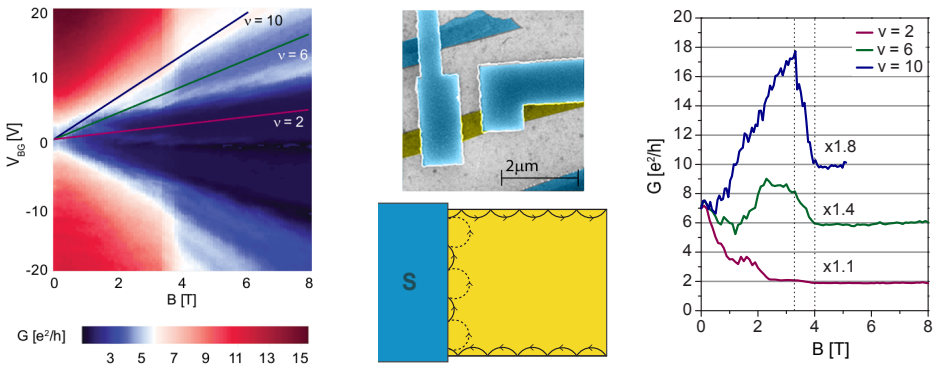
We have realized an integer quantum Hall system with superconducting contacts by connecting graphene to niobium electrodes[1]. Below their upper critical field of 4 tesla, an integer quantum Hall effect coexists with superconductivity in the leads, but with a plateau conductance that is larger than in the normal state. We ascribe this enhanced quantum Hall plateau conductance to Andreev processes at the graphene-superconductor interface leading to the formation of so-called Andreev edge-states. The enhancement depends strongly on the filling-factor, and is less pronounced on the first plateau, due to the special nature of the zero energy Landau level in monolayer graphene.



left: Conductance G as a function of magnetic field and gate voltage. middle: SEM picture of a typical device (top), quasiclassical illustration of chiral edge states along the sample border and an Andreev edge state along the N-S interface (bottom). right: conductance as a function of B for fixed filling factors ν=2,6, and 10.

[1] P. Rickhaus, M. Weiss, L. Marot, and C. Schönenberger, NanoLetters 12, 1942 (2012)