Antiferromagnetic to Ferromagnetic phase transition in bilayer graphene

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We report on magnetotransport measurements up to 30 T performed on a bilayer graphene Hall bar, enclosed by two thin hexagonal boron nitride flakes. In the quantum Hall regime, our high-mobility sample exhibits an insulating state at the neutrality point which evolves into a metallic phase when a strong in-plane field is applied, as expected for a transition from a canted antiferromagnetic to a ferromagnetic spin-ordered phase. We individuate a temperature-independent crossing in the four-terminal resistance as a function of the total magnetic field, corresponding to the critical point of the transition. We show that the critical field scales linearly with the perpendicular component of the field, as expected from the underlying competition between the Zeeman energy and interaction-induced anisotropies. A clear scaling of the resistance is also found and a universal behavior is proposed in the vicinity of the transition [1].

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References

[1] S. Pezzini, C. Cobaleda, B. A. Piot,V. Bellani, and E. Diez Physical Review B **90**, 121404(R) (2014)

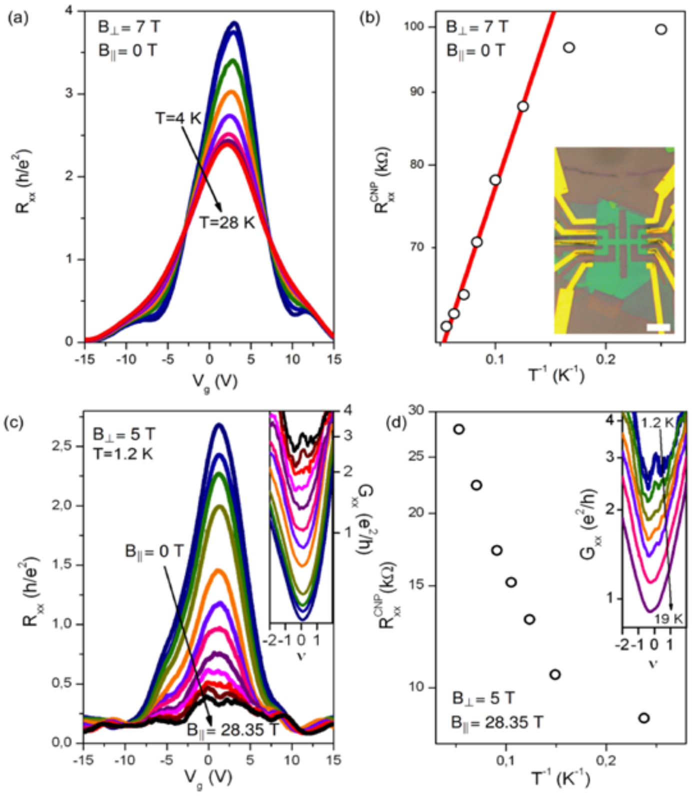

Figure 1: (a) R_{xx} as a function of V_g for increasing temperatures at $B_\perp = B_{tot} = 7$ T. (b) Insulating T dependence of the longitudinal resistance at the neutrality point : the red line is a fit to $R_{xx} \propto \exp(\Delta/2k_BT)$. Inset: Optical microscopy image of the sample (the scale bar corresponds to 5 μm). (c) R_{xx} as a function of V_g for increasing $B_\parallel$ with fixed $B_\perp = 5$ T, at T 1.2 K. Inset: G_{xx} as a function of the filling factor for the same values of $B_\parallel$. (d) Metallic T-dependence of R_{xx}. Inset: G_{xx} as a function of the filling factor for increasing temperatures in strong $B_\parallel$.