Hysteresis loops of the magnetoconductance in graphene devices

Andrea Candini\textsuperscript{a}, Christian Alvino\textsuperscript{a,b}, Wolfgang Wernsdorfer\textsuperscript{c} and Marco Affronte\textsuperscript{a,b}

\textsuperscript{a}Istituto Nanoscienze – CNR Centro S3, Modena. Via Campi 213/a 41125 Modena. Italy
\textsuperscript{b}Dipartimento di Fisica, Università di Modena e Reggio Emilia, Via Campi 213/a 41125 Modena. Italy
\textsuperscript{c}Institut Néel, CNRS, BP166, 25 Av des Martyrs, 38042 Grenoble, France

andrea.candini@unimore.it

We report a systematic study of the low temperature magnetoconductance of various graphene devices with the field applied in the plane of graphene. At temperatures below 1K, the magnetoconductance signal depends on the gate and its sign is related to universal conductance fluctuations. When the field is swept at high enough rates ($dB/dt > 10$ mT/s) a hysteresis is observed in the signal. We have systematically measured different devices of various sizes, from unpatterned large flakes down to narrow ribbons (50nm large) and constrictions (30nm in width), finding that the magnetic signal does not depend on the size nor on the transport regime of the device. We attribute the origin of the signal to the magnetization reversal of paramagnetic centers in graphene, which might originate from structural defects in the graphene layer, most probably vacancies \cite{1}. Based on the field and temperature dependencies of the hysteresis, we conclude that the spin of the localized moments is higher than $S = 1/2$, in agreement with recent works\cite{2,3}.

References

\cite{1} A. Candini et al. accepted for publication in Phys Rev. B (2011) and selected as an Edotor's Suggestion. Available online at: arXiv:1101.3030v1
\cite{3} D.W. Boukhvalov et al., arXiv:1012.3828v1 (2010)

Figures

![Graphene Device Hysteresis](image.png)

Fig1: Parallel magnetoconductance of a graphene device for a fixed gate voltage, taken at 0.04 K and at a field sweep rate of 0.05 T/s. The hysteresis is clearly visible. Figure taken from reference [1].