Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Spin and charge transport in high-mobility suspended graphene[1]

MARCOS GUIMARAES, PAUL ZOMER, ALINA VELIGURA, THOMAS MAASSEN, IVAN VERA-MARUN, NIKOLAOS TOMBROS, BART VAN WEES, Physics of Nanodevices, Zernike Institute for Advanced Materials, University of Groningen, The Netherlands — Recent developments in graphene device fabrication techniques have made it possible to study the intrinsic properties of graphene by removing the substrate and making it suspended. Here we report electronic spin and charge transport measurements in high-mobility (over 70 000 cm^2/Vs) suspended graphene devices. To achieve this high quality we apply a large DC current density to heat the graphene flake, removing contaminations. We show that using the current annealing technique it is possible to produce ballistic nanoconstrictions, where quantized conductance at zero magnetic field is observed [N. Tombros et al., Nat. Phys. 7, 697 (2011)]. Studying the evolution of the position of the conductance plateaus in magnetic field we determine the width of the constriction. Spin transport measurements using ferromagnetic electrodes were also performed in our suspended graphene devices [M.H.D. Guimarães et al., in preparation]. Analyzing non-local Hanle precession measurements we extract the spin relaxation time and the spin diffusion constant as a function of the charge carrier density. Combining our measurements with computer simulations we show that the measured spin relaxation times are limited by the non-cleaned regions of the device.

[1]This work was financially supported by the Dutch Foundation for Fundamental Research on Matter (FOM) and NWO and realized using NanoLab.NL facilities.

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Date submitted: 28 Nov 2011 Electronic form version 1.4