



Joan van der Waals Colloquium

Leiden Institute of Physics
Leiden University



Niko Tombros

Physics of Nanodevices,
Zernike Institute for Advanced Materials, Groningen

“Is graphene an excellent material for spintronic applications ?”

There are two basic parameters which define how promising a non-magnetic material is for spintronic applications: 1) The spin relaxation time at room temperature, which tells us how long spin information can survive in the material and 2) The spin relaxation length which tells us about the distance spin information can travel through the material before it gets lost. I will give an overview of electron spin injection, spin transport, spin precession and spin manipulation in graphene field effect devices with ferromagnetic contacts. I will show that spins can be transported through a graphene layer with a spin relaxation length of about 2 micrometers at room temperature. By applying a perpendicular magnetic field Hanle spin precession can be studied and information about spin relaxation and the carrier diffusion can be obtained [1]. Typical values for the spin relaxation time in graphene deposited on a silicon oxide substrate are around 200 ps. We have observed a scaling between the spin relaxation times and lengths and the carrier mobility in graphene [2]. This scaling indicates that the spin relaxation mechanism is of extrinsic origin. Improving the electronic quality of graphene should therefore result to a considerable increase of the spin relaxation length. Currently we obtain very high mobilities ($>5.0 \cdot 10^4$ cm²/Vs) for graphene deposited on a boron nitride crystal [3] and for suspended graphene [4]. Spin transport experiments on such high mobility graphene will clarify the origin of spin relaxation in this system.

[1] N. Tombros et al., Nature 448, 571 (2007) [2] M. Popinciuc et al., Phys. Rev. B 80, 214427 (2009) [3] P. J. Zomer et al., Appl. Phys. Lett. 99, 232104 (2011) [4] N. Tombros et al., Nature Physics, 7, 697–700 (2011)

Friday 9 March 2012,
16.00h – 17.00h (drinks afterwards)
Oort Building, De Sitterzaal

next Joan van der Waals colloquia:

- 23 March : Henri Werij (TNO)
- 13 April : Mirjam Leunissen (AMOLF)