Investigation of electronic and magnetic properties of graphene on ferromagnetic substrates

Friday, 28.06.2013
13:00 – 14:00 (45+15 min)
Seminar Room 115, Hallwachsstr. 3, 01069 Dresden

Graphene is a promising material for future electronic applications because of its high electron mobility and its long spin lifetime. The fruitful use of the spin state in electronic devices appears to be the challenge of the next decades. One example of the huge benefit of its use is the giant magneto-resistivity discovered in 1988 by Grünberg and Fert.

In order to realize graphene- and spin-based electronic devices, the investigation of electronic and magnetic interactions between graphene and ferromagnetic substrates represents a useful approach. Here the electronic structure of graphene on Ni(111) was investigated. ARPES measurements indicate a strong hybridization between the graphene π states and the Ni 3d states, which avoids the linear dispersion at the Fermi level. The hybridization creates several new interface states leading to an induced magnetic moment in the graphene layer. Further intercalation experiments, using one monolayer Al or Fe, shows that it is possible to switch the magnetic moment off or to increase it by three times. This illustrates a promising observation, which enables to tune the magnetic coupling between graphene and the ferromagnetic Ni substrate.

Further V. M. Karpan et. al. predicts that graphene could be used as a perfect spin-filtering material using the spin depended resistance of the graphene Ni heterojunction [1]. The filtering efficiency was predicted to increase with the increasing number of graphene layers sandwiched between ferromagnetic electrodes. By cracking of pyridine, we found a way to prepare (1+x layer) graphene/Ni(111). The first strongly bounded graphene layer studied in ARPES measurements avoids the filtering effect. Subsequently, intercalation of one monolayer Au decouples the whole graphene stack turning the band structure into the band structure of nearly free-standing graphene. This system shows all required properties to act as a 98 percent spin filter device [2].