On behalf of the

Science College CMS
Vienna Computational Materials Laboratory
and Center for Computational Materials Science

we cordially invite you to the following seminar

Prof. Karsten Horn, Ph.D.
Fritz-Haber-Institute of the Max-Planck-Society, Berlin, Germany

Graphene - unusual electronic structure of a 2D model solid

Electrons in graphene, the single atom layer of hexagonally coordinated carbon, show a behaviour that is different from those in any other material. This unexpected finding, in a material that was thought to be well known, has motivated an enormous number of studies within the last six years, dealing with the massless "Dirac Fermion" charge carriers that determine many of its properties. I will show, using photoelectron spectroscopy data, how the evolution of the band structure of graphene from the single layer to the bi- and trilayer, and ultimately to the 3D graphite band structure provides an almost textbook-like demonstration of the evolution of low dimensional electronic structures. Effects of n- and p-type doping through adsorbates and intercalation processes can be examined in detail. On account of its simple band structure, graphene is also ideal for studies of the spectral function in terms of many-body processes such as electron-phonon, electron-electron and electron-plasmon coupling. Thus in a study of electron-phonon coupling, a difference between single and bilayer graphene is able to explain the difference in friction between these two systems as observed in friction force microscopy [1]. The decoupling of graphene from the substrate through intercalated hydrogen permits the observation of a new quasiparticle [2], i.e. a coupled hole-plasmon mode predicted by Lundqvist in 1967. Small amounts of adsorbed hydrogen are shown to induce a metal-insulator transition at very low (1% of a monolayer) coverages, and are assigned to defect-induced localization processes [3]. Graphene grown on ferromagnetic surfaces, suggested to be suitable for an application as spin filter, exhibit an induced magnetic on the carbon atoms as revealed by x-ray magnetic circular dichroism [4]. Graphene is thus an ideal material to investigate many-body physics and low dimensional electronic structure in general.

[1] T. Filleter et al., Phys Rev. Lett., 102 (2009) 086102.
[2] A. Bostwick et al., Science, 328 (2010) 999(2010).
[3] A. Bostwick et al., Phys Rev. Lett., 103 (2009) 056404.
[4] M. Weser et al., Appl. Phys. Lett., 96 (2010) 012504.

Work performed with Eli Rotenberg, Aaron Bostwick and colleagues at ALS Berkeley, Thomas Seyller and colleagues at the University of Erlangen, and Yuriy Dedkov, FHI Berlin.

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Strudlhofgasse 4, 3rd floor, 1090 Wien