FKE-Seminar

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Germanene: the germanium analogue of graphene

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Seminarraum 362, Floragasse 7, 1. Stock, 1040 Wien

Recently, a few research groups have reported the growth of germanene, a new member of the graphene family [1]. Germanene is in many aspects very similar to graphene, but in contrast to the planar graphene lattice, the germanene honeycomb lattice is slightly buckled and composed of two vertically displaced sub-lattices. Frist principles total energy calculations have revealed that free-standing germanene is a two-dimensional Dirac fermion system, i.e. the electrons behave as massless relativistic particles that are described by the Dirac equation, i.e. the relativistic variant of the Schrödinger equation. We will give a brief update of the growth and electronic properties of germanene on Pt/Ge(110) nanocrystals [2,3]. Subsequently, we will show that large and continuous single germanene layers can be grown on molybdenum disulfide (MoS_2) [4]. The structural and electronic properties of the germanene layer are studied with scanning tunneling microscopy and spectroscopy. The lattice constant of the germanene layer is 3.8±0.1 Å, i.e. substantially larger than the lattice constant of MoS_2 (3.16 Å), and the interlayer distance between the germanene layer and the MoS_2 substrate is 3.2±0.2 Å, suggesting that we are dealing with a low-buckled germanene layer. The density of states of the germanene layer exhibits a V-shape, which is reminiscent for a two-dimensional Dirac system. The minimum of the density of states is located near the Fermi level.

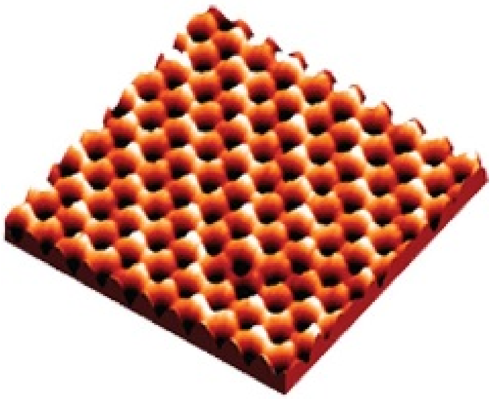

Figure caption Scanning tunneling microscopy image (4.5 nm by 4.5 nm) of the buckled honeycomb lattice of germanene. Sample bias -0.5 V, tunnel current 0.2 nA.

References

[1] A. Acun et al. *J. Phys. Cond. Mat.* **27**, 443002 (2015) and references therein.
[2] P. Bampoulis et al. *J. Phys. Cond. Mat.,* **26**, 442001 (2014).
[3] L. Zhang et al., *Appl. Phys. Lett.* **107**, 111605 (2015).
[4] L. Zhang et al. *Phys. Rev. Lett.* **116**, 256804 (2016).

Host: A. Lugstein