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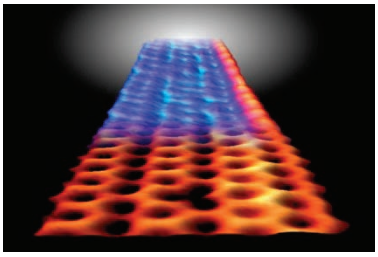

Guest Lecture

Title:

“Weak Topological Insulators: Status and Perspectives”

Speaker: Prof. Dr. Markus Morgenstern

Address: Head of Physics Centre of RWTH Aachen, Germany

Date: Friday, 20th of May 2016
Time: 14:00
Place: Seminar Room CBEG02 (387, Photonics); Gußhausstraße 27

Abstract: Three-dimensional insulating crystals, which respect time reversal symmetry, can be classified as trivial insulators, strong topological insulators and weak topological insulators. While many examples of trivial or strong topological insulators are meanwhile known, weak topological insulators have barely been probed. They offer pairs of topologically protected surface states on most surfaces, but always exhibit one dark surface without such surface states. All step edges of this dark surface naturally belong to the bright surfaces such that they contain spin helical edge states with perfect e^2/h conductivity, as long as time-reversal symmetry remains valid opening the possibility to create one-dimensional conducting networks on the surface. The first weak topological insulator $Bi_{14}Rh_3I_9$ was synthesized recently [1].

Within the talk, I will recall the concept of topological insulators from the perspective of an experimentalist before concentrating on the weak topological insulators. In particular, I will show that scanning tunneling spectroscopy reveals the edge states on the dark surface of $Bi_{14}Rh_3I_9$ which are only 1 nm wide. They can be scratched into the surface using an atomic force microscope which provides a simple tool for guiding the edge state [2].

Albeit the edge state is currently not at the Fermi level, I will present evidence that this is caused by a surface charge imbalance only, implying strategies for compensation.

Finally, it is shown experimentally that the edge states can be removed by chemically dimerizing adjacent layers of the weak topological insulator.

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[1] B. Rasche, A. Isaeva, M. Ruck, S. Borisenko, V. Zabolotnyy, B. Büchner, K. Koepernik, C. Ortix, M. Richter, and J. van den Brink, Nature Mater. 12, 422 (2012).

[2] C. Pauly, B. Rasche, K. Koepernik, M. Liebmann, M. Pratzer, M. Richter, J. Kellner, M. Eschbach, B. Kaufmann, L. Plucinski, C. M. Schneider, M. Ruck, J. van den Brink, and M. Morgenstern, Nature Phys. 11, 338 (2015).