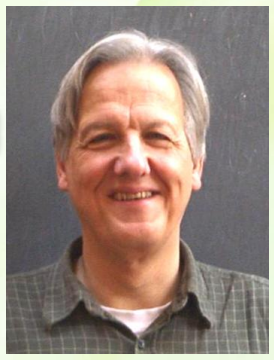
Special Seminar



Speaker

Prof. Laurens Molenkamp

Physics Institute (EP3), Wuerzburg University , Germany

Date Jan. 20th, 2014 (Monday)

Time 2:20 PM ~ 3:20 PM

Location R833, CCMS & New Physics Building

Topic

HgTe as a Topological Insulator

Abstract

Topological insulators are a new class of materials, insulating in the bulk but supporting an unusual metal on their surfaces. HgTe was the first material that was demonstrated to be a topological insulator, and in this talk I will discuss our research on this compound to illustrate the main trends in the field.

While bulk HgTe is a semimetal, it can be turned into a topological insulator by lowering the crystalline symmetry.

The most straightforward way to do so is by growing a quantum well with (Hg,Cd)Te barriers. Such structures exhibit the quantum spin Hall effect, where a pair of spin polarized helical edge channels (one-dimensional conductors) develops when the bulk of the material is insulating. Our transport data provide very direct evidence for the existence of this third quantum Hall effect, which now is seen as the prime manifestation of a 2-dimensional topological insulator.

To turn the material into a 3-dimensional topological insulator, we utilize growth induced strain in relatively thick (ca. 100 nm) HgTe epitaxial layers. The high electronic quality of such layers allows a direct observation of the quantum Hall effect of the 2-dimensional topological surface states. These states appear to be decoupled from the bulk.

The topological metallic states are unusual in that their bandstructure closely mimics that found for elementary particles, yielding experimental access to a number celebrated predictions of quantum field theory. E.g., it should be possible to generate Majorana fermions by fabricating a Josephson junction involving the surface states.

I will discuss our experiments on such structures.

Sponsors

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