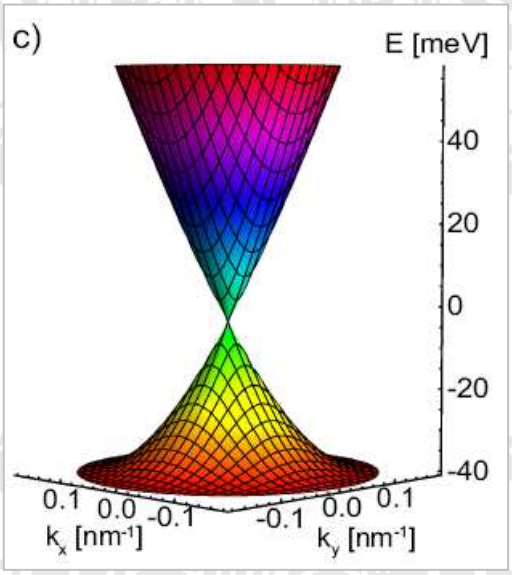
PHYSIKALISCHES KOLLOQUIUM

AM 07. FEBRUAR 2011 UM 17 UHR C.T.

IM GROßEN HÖRSAAL



DIRAC FERMIONS IN GRAPHENE AND TOPOLOGICAL INSULATORS

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The carbon atoms in graphene (Nobel Prize in Physics 2010) form a honeycomb lattice which gives rise to many of the peculiar physical properties of this fascinating material. Dictated by the interaction with the ions of the lattice, the low energy electrons in graphene have the same dispersion relation as mass-less Dirac fermions. We will discuss interesting physical phenomena of Dirac fermions in graphene such as Klein tunneling, transport through evanescent modes, and consequences of the spectrum on quantum computing devices based on graphene quantum dots.
Furthermore, we will address another – in some sense even richer – condensed matter system that shows Dirac fermion physics: Topological insulators (TIs) behave like usual insulators in the bulk but like metals at the boundaries. This gives rise to Dirac fermions at the edge of a TI. In nature, TIs have been first realized in HgTe/CdTe quantum wells (in 2D) and later on also in 3D in BiSb, BiSe, as well as BiTe crystals. We will discuss interesting physical properties of 2D TIs where spin and charge properties of the system are ultimately locked to each other.