# Topological Insulators and Superconductors

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1. What is a topological insulator?
2. 2D topological insulators:
    a) Quantum Hall effect
    b) Quantum spin-Hall effect
    c) Role of disorder
3. 3D topological insulators
    a) Surface Dirac fermions
    b) Topology versus localization
    c) Role of interaction
4. Topological insulators meet superconductors
    a) Proximity effect in topological insulators
    b) Majorana bound states
    c) Intrinsic topological superconductors
5. Summary and perspectives

An ordinary insulator has no mobile charge carriers. However, in some insulating materials free conducting electrons may appear on the surface of the sample due to topological reasons. These materials are referred to as topological insulators. Owing to their topological origin, the surface electron states are protected against almost any perturbation. The topological properties give rise to a number of striking physical phenomena and make topological insulators a very interesting and promising object for both fundamental physics and potential applications.

Topological insulators have emerged 5 years ago. Since then the field of topological insulators has been developed into a whole new branch of modern physics. The full classification of the topological materials has been established including several distinct types of topological insulators and superconductors. The latter are superconductors with low-energy surface states appearing on the background of the superconducting gap. In the Lecture we will review fascinating physical properties of the topological insulators and superconductors and discuss very peculiar disorder and interaction effects in these materials.