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Title:

Topological Insulators and Superconductors: a brief introduction

Abstract:

The development of quantum physics in the beginning of the 20th century revolutionized people's understanding of materials. Based on the laws of quantum physics, solids were classified into insulators, semiconductors, metals, and superconductors. For decades, it was believed that all insulators were similar to one another when it came to their inability to conduct electricity, and that all superconductors were also similar to one another when it came to their extreme ability to carry electrical current.

Such belief was first shaken in 1980, and then shattered seven years ago, when it became apparent that the behavior of electrons in solids can also be classified using a branch of mathematics known as topology. For example, according to the topological classification of solids, some insulators (dubbed "topological" insulators) conduct electricity on their surfaces whereas others (dubbed "non-topological" or "ordinary" insulators) do not. The metal at the surface of a topological insulator is quite special: electrons behave as relativistic Dirac fermions, their conduction of electricity is remarkably robust, and their magnetic properties peculiar. Partly due to these features, topological materials have attracted enormous interest in the physics community.

This talk will constitute a "crash course" to some basic ideas behind topological insulators and superconductors, at a level that is accessible both for theorists and experimentalists.