Chapter: Visualizing Topological Surface States And Their Novel Properties Using...

Topological surface states are a type of electronic state that can exist on the surface of a topological insulator or superconductor. These states are protected by topology, which means that they cannot be destroyed by any local perturbation. This makes them very robust and has led to a great deal of interest in their potential applications in next-generation electronic devices.

Topological Insulators: Chapter 7. Visualizing Topological Surface States and their Novel Properties using Scanning Tunneling Microscopy and Spectroscopy ... of Condensed Matter Science Book 6)

★★★★★ 5 out of 5

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Enhanced typesetting	: Enabled
Print length	: 50 pages

In this chapter, we will provide an overview of the theoretical and experimental techniques used to visualize topological surface states and their novel properties. These techniques include scanning tunneling microscopy, angle-resolved photoemission spectroscopy, and spin-resolved photoemission spectroscopy. We will also discuss the use of these

techniques to study the topological properties of materials such as topological insulators and superconductors.

Scanning Tunneling Microscopy

Scanning tunneling microscopy (STM) is a technique that can be used to image the surface of a material with atomic-scale resolution. STM works by scanning a sharp metal tip over the surface of the material. When the tip is close to the surface, electrons can tunnel from the tip to the surface or vice versa. The tunneling current is very sensitive to the distance between the tip and the surface, so STM can be used to create a three-dimensional image of the surface.

STM has been used to image topological surface states on a variety of materials, including topological insulators and superconductors. In these materials, the topological surface states are typically found to be localized at the surface of the material. This localization is due to the fact that the topological surface states are protected by topology.

Angle-Resolved Photoemission Spectroscopy

Angle-resolved photoemission spectroscopy (ARPES) is a technique that can be used to measure the electronic structure of a material. ARPES works by shining a beam of light on the surface of the material and measuring the energy and momentum of the electrons that are emitted from the surface. The energy and momentum of the electrons can be used to determine the electronic band structure of the material.

ARPES has been used to study the electronic structure of topological surface states on a variety of materials. In these materials, the topological surface states are typically found to be located at the Dirac point in the

electronic band structure. The Dirac point is a point in the electronic band structure where the energy of the electrons is zero.

Spin-Resolved Photoemission Spectroscopy

Spin-resolved photoemission spectroscopy (SRPES) is a technique that can be used to measure the spin polarization of the electrons that are emitted from a material. SRPES works by shining a beam of light on the surface of the material and measuring the spin of the electrons that are emitted from the surface. The spin of the electrons can be used to determine the magnetic properties of the material.

SRPES has been used to study the spin polarization of the electrons in topological surface states. In these materials, the topological surface states are typically found to be spin-polarized. This spin polarization is due to the fact that the topological surface states are protected by topology.

In this chapter, we have provided an overview of the theoretical and experimental techniques used to visualize topological surface states and their novel properties. These techniques include scanning tunneling microscopy, angle-resolved photoemission spectroscopy, and spin-resolved photoemission spectroscopy. We have also discussed the use of these techniques to study the topological properties of materials such as topological insulators and superconductors.

The study of topological surface states is a rapidly growing field of research. These states have a number of unique properties that make them very promising for applications in next-generation electronic devices. As the field continues to grow, we can expect to see even more exciting developments in this area.

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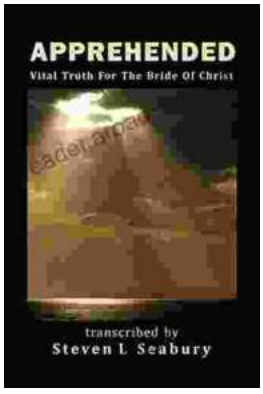

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