Superconductivity In Graphene And Carbon Nanotubes Proximity Effect And Nonlocal Transport Springer Theses

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Graphene~~Dmitri Efetov \"Magic Angle Bilayer Graphene - Superconductors, Orbital Magnets, Correlated States\" Bilayer graphene and twisted bilayer graphene: Specular Andreev reflection by Subroto Mukerjee~~ Superconductivity In Graphene And Carbon
Graphene, a single sheet of carbon atoms, has many extreme electrical and mechanical properties. Two years ago, researchers showed how two sheets laid on top of each other and twisted at just the...

New study explains why superconductivity takes place in ...
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Superconductivity in Graphene and Carbon Nanotubes ...
Furthermore it is shown that graphene-supercondutor-graphene junctions can be used to favor the splitting of Cooper pairs for the generation of non-locally entangled electron pairs. Finally, using similar techniques the thesis analyzes the transport properties of carbon nanotube devices coupled with superconducting electrodes and in graphene superlattices.

Superconductivity in Graphene and Carbon Nanotubes ...
New study explains why superconductivity takes place in graphene. Graphene, a single sheet of carbon atoms, has many extreme electrical and mechanical properties. Two years ago, researchers showed how two sheets laid on top of each other and twisted at just the right angle can become superconducting, so that the material loses its electrical resistivity.

Superconductivity in graphene - Superhardmaterial
Superconductivity with Magic-Angle Graphene. ... The double mono-layers of carbon have captivated researchers because, in contrast to cuprates, their structural simplicity has become an excellent ...

Contest between superconductivity and insulating states in ...
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Superconductivity in Graphene and Carbon Nanotubes ...

Experimentally, previous attempts to induce superconductivity in monolayer graphene were limited to the proximity induced superconductivity 19 and in situ ARPES measurements on metal decorated graphene 20,21 which identified features attributed to dopant‐related vibrational modes 20 and found signatures of heavy doping as well as the appearance of an IL band in Ca-intercalated graphene bilayer (no IL band could be seen for Li intercalation).

Superconductivity in Ca-doped graphene laminates

Furthermore it is shown that graphene-supercondutor-graphene junctions can be used to favor the splitting of Cooper pairs for the generation of non-locally entangled electron pairs. Finally, using...

Superconductivity in Graphene and Carbon Nanotubes ...

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Superconductivity in Graphene and Carbon Nanotubes eBook ...

Get this from a library! Superconductivity in Graphene and Carbon Nanotubes : Proximity effect and nonlocal transport. [Pablo Burset Atienza] -- The unique electronic band structure of graphene gives rise to remarkable properties when in contact with a superconducting electrode. In this thesis two main aspects of these junctions are analyzed: ...

Superconductivity in Graphene and Carbon Nanotubes ...

Superconductivity in Graphene and Carbon Nanotubes : Proximity effect and nonlocal transport.. [Pablo Burset Atienza.] -- The unique electronic band structure of graphene gives rise to remarkable properties when in contact with a superconducting electrode.

The unique electronic band structure of graphene gives rise to remarkable properties when in contact with a superconducting electrode. In this thesis two main aspects of these junctions are analyzed: the induced superconducting proximity effect and the non-local transport properties in multi-terminal devices. For this purpose specific models are developed and studied using Green function techniques, which allow us to take into account the detailed microscopic structure of the graphene-superconductor interface. It is shown that these junctions are characterized by the appearance of bound states at subgap energies which are localized at the interface region. Furthermore it is shown that graphene-supercondutor-graphene junctions can be used to favor the splitting of Cooper pairs for the generation of non-locally entangled electron pairs. Finally, using similar techniques the thesis analyzes the transport properties of carbon nanotube devices coupled with superconducting electrodes and in graphene superlattices.

Superconductors (SCs) are attractive materials in all respects for any community. They provide a deep insight into the physical properties of the condensed matters and also have useful applications as ultra-low-power-dissipation systems that can help resolve the present energy problems. In particular, the recent advancement of carbon-based new superconductors (CNSCs) is significant. Before 2004, the superconducting transition temperature (Tc) of carbon-based SCs was below 1 K, except in fullerene clusters. However, in 2004, a Russian group discovered that diamond highly doped with boron could be an SC at Tc = 4 K. The following year, a group from Cambridge found that calcium-intercalated graphite could be an SC with Tc = 11.5 K. In 2006 and 2008, the editor‐s group from Japan also discovered that carbon nanotubes could be SCs at Tc = 12 K. Since then, research on CNSCs has increased notably. A small mass of carbon can produce high phonon frequency and high Debye temperature. Combining these with other specified properties of CNSCs (such as one-dimensional electronic states) is highly expected to open doors to high-Tc superconductivity like those of CuO2- and Fe-based SCs, which were the only SCs to show Tc > 40 K in the past. CNSCs, such as diamond, graphite, carbon nanotubes, fullerenes, and others, are a very attractive field of research, and this book is the first to describe their basic physics and the recent advances toward high Tc in this field.

This book includes the fundamental science and applications of carbon-based materials, in particular fused polycyclic hydrocarbon, fullerene, diamond, carbides, graphite and graphene etc. During the past decade, these carbon-based materials have attracted much interest from many scientists and engineers because of their exciting physical properties and potential application toward electronic and energy devices. In this book, the fundamental theory referring to these materials, their syntheses and characterizations, the physical properties (physics), and the applications are fully described, which will contribute to an advancement of not only basic science in this research field but also technology using these materials. The book's targets are researchers and engineers in the field and graduate school students who specialize in physics, chemistry, and materials science. Thus, this book addresses the physics and chemistry of the principal materials in the twenty-first century.

This book summarizes the basic physics of graphite and newly discovered phenomena in this material. The book contains the knowledge needed to understand novel properties of functionalized graphite demonstrating the occurrence of remarkable phenomena in disordered graphite and graphite-based heterostructures. It also discusses applications of thin graphitic samples in future electronics. Graphite consists of a stack of nearly decoupled two-dimensional graphene planes. Because of the low dimensionality and the presence of Dirac fermions, much of graphite physics resembles that of graphene. On the other hand, the multi-layered nature of the graphite structure together with structural and/or chemical disorder are responsible for phenomena that are not observed yet in graphene, such as ferromagnetic order and superconductivity. Each chapter was written by one or more experts in the field whose contributions were relevant in the (re)discovery of (un)known phenomena in graphite. The book is intended as reference for beginners and experts in the field, introducing them to many aspects of the new physics of graphite, with a fresh overview of recently found phenomena and the theoretical frames to understand them.

Written in a self-contained manner, this textbook allows both advanced students and practicing applied physicists and engineers to learn the relevant aspects from the bottom up. All logical steps are laid out without omitting steps. The book covers electrical transport properties in carbon based materials by dealing with statistical mechanics of carbon nanotubes and graphene - presenting many fresh and sometimes provoking views. Both second quantization and superconductivity are covered and discussed thoroughly. An extensive list of references is given in the end of each chapter, while derivations and proofs of specific equations are discussed in the appendix. The experienced authors have studied the electrical transport in carbon nanotubes and graphene for several years, and have contributed relevantly to the understanding and further development of the field. The content is based on the material taught by one of the authors, Prof Fujita, for courses in quantum theory of solids and quantum statistical mechanics at the University at Buffalo, and some topics have also been taught by Prof.

Suzuki in a course on advanced condensed matter physics at the Tokyo University of Science. For graduate students in physics, chemistry, electrical engineering and material sciences, with a knowledge of dynamics, quantum mechanics, electromagnetism and solid-state physics at the senior undergraduate level. Includes a large numbers of exercise-type problems.

The purpose of this book is two fold. First to explain the properties of low dimensional solids such as electronic, vibrational and magnetic structure in terms of simple models. These are used to account for the properties of three dimensional materials providing an elementary introduction to the physics of low dimensional materials. The second objective is to discuss the properties of newer low dimensional materials not made of carbon. These are now the subject of research and describe various phenomena in them such magnetism and superconductivity. Contents: Computational Material ScienceElectronic PropertiesVibrational PropertiesCarbon NanotubesOther Kinds of NanotubesGrapheneOther Low Dimensional MaterialsMagnetism in Low Dimensional MaterialsSuperconductivity in Low Dimensional Materials Readership: Researchers and students in the field of low dimensional materials. Keywords: Graphene;2 Dimensional Materials;Carbon Nanotubes and Tubes of Other Materials;Magnetism in Low Dimensional Materials;Superconductivity in Low Dimensional MaterialsReview: Key Features: This book deals with not only conductivity but a range of other phenomena such as low dimensional magnetism and superconductivity and some very new low dimensional materials such silicene

This book is a collection of the chapters intended to study only practical applications of HTS materials. You will find here a great number of research on actual applications of HTS as well as possible future applications of HTS. Depending on the strength of the applied magnetic field, applications of HTS may be divided in two groups: large scale applications (large magnetic fields) and small scale applications (small magnetic fields). 12 chapters in the book are fascinating studies about large scale applications as well as small scale applications of HTS. Some chapters are presenting interesting research on the synthesis of special materials that may be useful in practical applications of HTS. There are also research about properties of high-Tc superconductors and experimental research about HTS materials with potential applications. The future of practical applications of HTS materials is very exciting. I hope that this book will be useful in the research of new radical solutions for practical applications of HTS materials and that it will encourage further experimental research of HTS materials with potential technological applications.

This thesis presents first observations of superconductivity in one- or two-atomic-scale thin layer materials. The thesis begins with a historical overview of superconductivity and the electronic structure of two-dimensional materials, and mentions that these key ingredients lead to the possibility of the two-dimensional superconductor with high phase-transition temperature and critical magnetic field. Thereafter, the thesis moves its focus onto the implemented experiments, in which mainly two different materials thallium-deposited silicon surfaces and metal-intercalated bilayer graphenes, are used. The study of the first material is the first experimental demonstration of both a gigantic Rashba effect and superconductivity in the materials supposed to be superconductors without spatial inversion symmetry. The study of the latter material is relevant to superconductivity in a bilayer graphene, which was a big experimental challenge for a decade, and has been first achieved by the author. The description of the generic and innovative measurement technique, highly effective in probing electric resistivity of ultra-thin materials unstable in an ambient environment, makes this thesis a valuable source for researchers not only in surface physics but also in nano-materials science and other condensed-matter physics.

This book provides detailed knowledge about fullerene nanowhiskers and the related low-dimensional fullerene nanomaterials. It introduces tubular nanofibers made of fullerenes, fullerene nanotubes, and single crystalline thin film made of C60, called fullerene nanosheet. Since the discovery of C60 in 1985, various fullerene molecules, including higher fullerenes such as C70, endohedral fullerenes, and fullerene derivatives have been synthesized. In 2001, a new form of crystalline carbon nanofiber, fullerene nanowhisker, was discovered. This book is the first publication featuring the fullerene nanowhiskers made of C60, C70, and C60 derivatives. The synthetic method (liquid liquid interfacial precipitation method) and the physical and chemical properties such as electrical, mechanical, optical, magnetic, thermodynamic, and surface properties are shown for the fullerene nanowhiskers, including their electronic device application.

Graphene is the first example of two-dimensional materials and is the most important growth area of contemporary research. It forms the basis for new nanoelectronic applications. Graphene, which comprises field-effect structures, has remarkable physical properties. This book focuses on practical applications determined by the unique properties of graphene. Basic concepts are elucidated by end-of-chapter problems, the answers to which are provided in the accompanying solutions manual. The mechanisms of electric and thermal transport in the gated graphene, interface phenomena, quantum dots, non-equilibrium states, scattering and dissipation, as well as coherent transport in graphene junctions are considered in detail in the book. Detailed analyses and comparison between theory and experiments is complemented with a variety of practical examples. The book has evolved from the author's own research experience and from his interaction with other scientists at tertiary institutions and is targeted at a wide audience ranging from graduate students and postdoctoral fellows to mature researchers and industrial engineers.