Electronic Transport in Mesoscopic Systems

SUPRIYO DATTA

Electronic Transport In Mesoscopic Systems

Pier A. Mello,Narendra Kumar

Electronic Transport In Mesoscopic Systems:

   Electronic Transport in Mesoscopic Systems Supriyo Datta,1997-05-15 A thorough account of the theory of electronic transport in semiconductor nanostructures   *Electronic Transport in Mesoscopic Systems* Supriyo Datta,1997-05-15 Advances in semiconductor technology have made possible the fabrication of structures whose dimensions are much smaller than the mean free path of an electron This book gives a thorough account of the theory of electronic transport in such mesoscopic systems After an initial chapter covering fundamental concepts the transmission function formalism is presented and used to describe three key topics in mesoscopic physics the quantum Hall effect localisation and double barrier tunnelling Other sections include a discussion of optical analogies to mesoscopic phenomena and the book concludes with a description of the non equilibrium Green s function formalism and its relation to the transmission formalism Complete with problems and solutions the book will be of great interest to graduate students of mesoscopic physics and nanoelectronic device engineering as well as to established researchers in these fields   **Electronic Trsprt Mesoscopic Sys** Supriyo Datta,2014-05-14 A thorough account of the theory of electronic transport in semiconductor nanostructures   **Electronic Transport in One-dimensional Mesoscopic Systems** Charis Quay Huei Li,2007 Finally some measurements on nanotubes are presented   Electronic Transport in Mesoscopic Systems Georgo Metalidis,2015-01-09 Electronic Transport in Mesoscopic SystemsBy Georgo Metalidis   **Coherent Electronic Transport in Time-periodic Mesoscopic Systems** Guido Burmeister,2000   Quantum Transport in Mesoscopic Systems Pier A. Mello,Narendra Kumar,2004-05-20 The aim of this book is to present a statistical theory of wave scattering by complex systems systems which have a chaotic classical dynamics as in the case of microwave cavities and quantum dots or possess quenched randomness as in the case of disordered conductors with emphasis on mesoscopic fluctuations The universal character of the statistical behavior of these phenomena is incorporated in a natural way by approaching the problem from a Maximum Entropy viewpoint Shannon s information entropy is maximized subject to the symmetries and constraints that are physically relevant within the powerful non perturbative Theory of Random Matrices This is a distinctive feature of the present book that greatly motivated our writing it Another reason is that it collects in one place the material and notions derived from the published work of the authors in collaboration with several co workers as well as from the work of others which are scattered through research journals and textbooks on the subject To make the book self contained we present in Chapters 2 and 3 the quantum theory of scattering set in the context of quasi one dimensional multichannel systems thus related directly to scattering problems in mesoscopic physics Chapter 4 discusses the linear response theory of quantum electronic transport adapted to the context of mesoscopic systems These chapters together with Chapter 5 on the Maximum Entropy Approach and Chapter 8 on weak localization have been written in a pedagogical style and can be used as part of a graduate course Chapters 6 and 7 discuss the problem of electronic transport through classically chaotic cavities and quasi one dimensional

disordered systems There are many exercises most of them worked out in detail distributed throughout the book This should help graduate students their teachers and the research scholars interested generally in the subject of quantum transport through disordered and chaotic systems in their preparation for it and beyond *Introduction to Condensed Matter Physics* Duan Feng,Guojun Jin,2005 This is volume 1 of two volume book that presents an excellent comprehensive exposition of the multi faceted subjects of modern condensed matter physics unified within an original and coherent conceptual framework Traditional subjects such as band theory and lattice dynamics are tightly organized in this framework while many new developments emerge spontaneously from it In this volume Basic concepts are emphasized usually they are intuitively introduced then more precisely formulated and compared with correlated concepts A plethora of new topics such as quasicrystals photonic crystals GMR TMR CMR high Tc superconductors Bose Einstein condensation etc are presented with sharp physical insights Bond and band approaches are discussed in parallel breaking the barrier between physics and chemistry A highly accessible chapter is included on correlated electronic states rarely found in an introductory text Introductory chapters on tunneling mesoscopic phenomena and quantum confined nanostructures constitute a sound foundation for nanoscience and nanotechnology The text is profusely illustrated with about 500 figures Mesoscopic Physics and Electronics Tsuneya Ando,Yasuhiko Arakawa,Kazuhito Furuya,Susumu Komiyama,Hisao Nakashima,2012-12-06 Semiconductor technology has developed considerably during the past several decades The exponential growth in microelectronic processing power has been achieved by a constant scaling down of integrated cir cuits Smaller fea ture sizes result in increased functional density faster speed and lower costs One key ingredient of the LSI technology is the development of the lithog raphy and microfabrication The current minimum feature size is already as small as 0 2 tm beyond the limit imposed by the wavelength of visible light and rapidly approaching fundamental limits The next generation of devices is highly likely to show unexpected properties due to quantum effects and fluctuations The device which plays an important role in LSIs is MOSFETs metal oxide semiconductor field effect transistors In MOSFETs an inversion layer is formed at the interface of silicon and its insulating oxide The inversion layer provides a unique two dimensional 2D system in which the electron concentration is controlled almost freely over a very wide range Physics of such 2D systems was born in the mid 1960s together with the development of MOSFETs The integer quantum Hall effect was first discovered in this system **2nd Workshop of Electronic Transport in Mesoscopic Systems** Ernesto Antonio Medina Dagger,Anwar Hasmy,Pedro José Colmenares,2001 *Handbook of Nanoscience, Engineering, and Technology* William A. Goddard III,Donald Brenner,Sergey Edward Lyshevski,Gerald J Iafrate,2007-05-03 The ability to study and manipulate matter at the nanoscale is the defining feature of 21st century science The first edition of the standard setting Handbook of Nanoscience Engineering and Technology saw the field through its infancy Reassembling the preeminent team of leading scientists and researchers from all areas of nanoscience and nanote *Collective Electronic Excitations in Solids and Quantum Transport*

in Mesoscopic Systems Xiaoju Wu,1996 **Binding and Scattering in Two-Dimensional Systems** J. Timothy Londergan,John P. Carini,David P. Murdock,2003-07-01 have advances in of The last few seen our understanding revolutionary years heterostructures An amount the electronic of enormous properties quantum undertaken both the and the theoretical of research has been on experimental in nanostructures The field vast of electronic now covers a aspects transport and extensive number of review of an books articles spectrum topics papers and conference continue to be in this area published Complete proceedings of this and field is the of this book beyond exciting evolving scope coverage We refer the interested reader to of the excellent and some comprehensive books and conference on this proceedings subject Much has been made in our of confined understanding quantum progress A s is well it is to construct heterostruc known possible quantum systems tures which well as one dimensional are approximated quasi two dimensional zero dimensional Our interest here is in the of or properties particles systems We brief andfields in two dimensional a intro quasi 2 D systems provide duction to the of 2 D in to motion in 2 D systems particular systems physics the confined within finite For we will assume that a area simplicity generally Such confined is defined an infinite hard wall a by potential system boundary We will 2 D will be referred to as a or as a wire Electronic and Optoelectronic Properties of Semiconductor Structures Jasprit Singh,2007-03-26 A graduate textbook presenting the underlying physics behind devices that drive today s technologies The book covers important details of structural properties bandstructure transport optical and magnetic properties of semiconductor structures Effects of low dimensional physics and strain two important driving forces in modern device technology are also discussed In addition to conventional semiconductor physics the book discusses self assembled structures mesoscopic structures and the developing field of spintronics The book utilizes carefully chosen solved examples to convey important concepts and has over 250 figures and 200 homework exercises Real world applications are highlighted throughout the book stressing the links between physical principles and actual devices Electronic and Optoelectronic Properties of Semiconductor Structures provides engineering and physics students and practitioners with complete and coherent coverage of key modern semiconductor concepts A solutions manual and set of viewgraphs for use in lectures are available for instructors from solutions cambridge org *Quantum-based Electronic Devices And Systems, Selected Topics In Electronics And Systems, Vol 14* Mitra Dutta,1998-10-23 This volume includes highlights of the theories and experimental findings that underlie essential phenomena occurring in quantum based devices and systems as well as the principles of operation of selected novel quantum based electronic devices and systems A number of the emerging approaches to creating new types of quantum based electronic devices and systems are also discussed *Electronic Transport in Semiconductor Heterostructures and in Mesoscopic Systems* K. Hess,Illinois univ at urbana-campaign beckman inst for advanced sciences and technology,1998 Much of the work in the past three years has concentrated on creating a predictive simulation tool for edge emitting semiconductor quantum well laser diodes This simulator MINILASE II has been completed and has been

compared to modulation response experiments from the Santa Barbara group Modulation response has been chosen because it is the most difficult characteristic to predict since nonlinearities enter in a crucial way The close agreement between experimental and simulation results that is described in publication 15 has necessitated a careful treatment of the device physics i We have included an 8 band k p bandstructure including the effects of strain The effects of bandstructure are twofold It had already been known that bandstructure determines the optical matrix element and therefore is crucial to obtain correct values for optical absorption spontaneous emission and stimulated emission Our self consistent simulator has shown however that of equal importance is the non parabolicity which effects the location of the quasi Fermi levels and therefore the gain Only a complete simulator such as MINILASE II can show this with all its quantitative aspects *Control of Magnetotransport in Quantum Billiards* Christian V. Morfonios,Peter Schmelcher,2016-11-16 In this book the coherent quantum transport of electrons through two dimensional mesoscopic structures is explored in dependence of the interplay between the confining geometry and the impact of applied magnetic fields aiming at conductance controllability After a top down insightful presentation of the elements of mesoscopic devices and transport theory a computational technique which treats multiterminal structures of arbitrary geometry and topology is developed The method relies on the modular assembly of the electronic propagators of subsystems which are inter or intra connected providing large flexibility in system setups combined with high computational efficiency Conductance control is first demonstrated for elongated quantum billiards and arrays thereof where a weak magnetic field tunes the current by phase modulation of interfering lead coupled states geometrically separated from confined states Soft wall potentials are then employed for efficient and robust conductance switching by isolating energy persistent collimated or magnetically deflected electron paths from Fano resonances In a multiterminal configuration the guiding and focusing property of curved boundary sections enables magnetically controlled directional transport with input electron waves flowing exclusively to selected outputs Together with a comprehensive analysis of characteristic transport features and spatial distributions of scattering states the results demonstrate the geometrically assisted design of magnetoconductance control elements in the linear response regime *Introducing Molecular Electronics* Gianaurelio Cuniberti,Giorgos Fagas,Klaus Richter,2006-05-21 Klaus von Klitzing Max Planck Institut fur Festk orperforschung Heisenbergstra e 1 70569 Stuttgart Germany Already many Cassandras have prematurely announced the end of the silicon roadmap and yet conventional semiconductor based transistors have been continuously shrinking at a pace which has brought us to nowadays cheap and powerful microelectronics However it is clear that the traditional scaling laws cannot be applied if unwanted tunnel phenomena or ballistic transport dominate the device properties It is generally expected that a combination of silicon CMOS devices with molecular structure will dominate the eld of nanoelectronics in 20 years The visionary ideas of atomic or molecular scale electronics already date back thirty years but only recently advanced nanotechnology including e g scanning tunneling methods and mechanically controllable break

junctions have enabled to make distinct progress in this direction On the level of f damentalresearch stateofthearttechniquesallowtomanipulate imageand probechargetransportthroughuni molecularsystemsinanincreasinglyc trolled way Hence molecular electronics is reaching a stage of trustable and reproducible experiments This has lead to a variety of physical and chemical phenomena recently observed for charge currents owing through molecular junctions posing new challenges to theory As a result a still increasing n ber of open questions determines the future agenda in this eld

Modeling Electronic Transport in Disordered Mesoscopic Systems Chenyi Zhou,2020 The aim of this thesis is to extend the theoretical framework of nonequilibrium electronic transport to incorporate quantum effects in disordered mesoscopic systems Our theoretical methods are developed based on the diagrammatic perturbation technique formulated with the Keldysh nonequilibrium Green s functions Given the real space Hamiltonian of the transport system together with thermal reservoir parameters we seek to compute the electronic structure and the charge current taking the various quantum effects into account Following this methodology the three most important and ubiquitous disordered mesoscopic effects are addressed viz weak localization energy relaxation and the Altshuler Aronov AA effect all of which give rise to corrections to the classical Drude description of electronic transport Specialized theoretical methods are developed for the respective physical effects For weak localization we develop a Cooperon based diagrammatic scheme using the so called dual fermion DF technique in order to take into account nonlocal interference processes which have been neglected in the prevailing coherent potential approximation CPA Numerical simulations have shown that compared to CPA our DF method yields more accurate results for transport properties of disordered quantum wires and that in particular it is able to predict the negative magnetoresistance effect which is a signature of weak localization The energy relaxation in disordered interacting wires is tackled with a self consistent GW CPA scheme Using this computational method we study how the energy distribution of interacting electrons evolves under increasing interaction and external field strengths In addition the same computational scheme is also employed to simulate the Coulomb drag effect between parallel quantum wires The interesting dependence of nonequilibrium drag current on the chemical potentials of reservoirs is discussed As to the AA effect the original diagrammatic formulation by Altshuler and Aronov is generalized to the real space Keldysh formalism Then both theoretical and numerical diagram calculations show that for a disordered wire at nonequilibrium the AA effect leads to anomalous DOS corrections at its respective Fermi energies and that the magnitudes of these local DOS corrections are position dependent The AA effect on transport properties is also analyzed which shows nontrivial behaviors with respect to system sizes and bias voltages   **Quantum Chaos and Quantum Dots** Katsuhiro Nakamura,Takahisa Harayama,2004 Dynamics of billiard balls and their role in physics have received wide attention Billiards can nowadays be created as quantum dots in the microscopic world enabling one to envisage the so called quantum chaos i e quantum manifestation of chaos of billiard balls In fact owing to recent progress in advanced technology nanoscale quantum dots such as chaotic

stadium and antidot lattices analogous to the Sinai Billiard can be fabricated at the interface of semiconductor heterojunctions This book begins ite exploration of the effect of chaotic electron dynamics on ballistic quantum transport in quantum dots with a puzzling experiment on resistance fluctuations for stadium and circle dots Throughout the text major attention is paid to the semiclassical theory which makes it possible to interpret quantum phenomena in the language of the classical world Chapters one to four are concerned with the elementary statistical methods curvature Lyapunov exponent Kolmogorov Sinai entropy and escape rate which are needed for a semiclassical description of transport in quantum dots Chapters five to ten discuss the topical subjects in the field including the ballistic weak localization Altshuler Aronov Spivak oscillation partial time reversal symmetry persistent current Arnold diffusion and Coulomb blockade

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Right has been in force in Italy since April 9th 2006 ... Arturo Martini. Catalogo della mostra. Treviso Catalogo di mostra, treviso, ex Tempio di Santa Caterina, 10 settembre - 12 novembre 1967. A cura di Giuseppe Mazzotti. Bibliografia. Catalogo delle opere. MARTINI, Arturo MARTINI, Arturo (Treviso, 1889 - Milano, 1947)Arturo Martini. ... Catalogo di mostra, treviso, ex Tempio di Santa Caterina, 10 settembre - 12 novembre 1967. Reader's Notebook Grade 5 (Journeys) Book details ; ISBN-10. 9780544592667 ; ISBN-13. 978-0544592667 ; Edition. 1st ; Publisher. HOUGHTON MIFFLIN HARCOURT ; Publication date. January 1, 2016. Journeys Common Core Reader'S Notebook ... Journeys Common Core Reader's Notebook Consumable Grade 5 ; Grade: 5 ; Material Type: Student Materials ; Format: Softcover, 432 Pages ; ISBN-13/EAN: 9780547860688 ... Common Core Reader's Notebook... by Houghton ... Journeys Common Core Reader's Notebook Grade 5 Workbook. Read more ... #5,429 in Children's Beginner Readers. #13,448 in Unknown. Customer Reviews, 4.6 out of 5 ... Journeys Common Core Reader'S Notebook Teachers ... Journeys Common Core Reader's Notebook Teachers Edition Grade 5 ; Grade: 5 ; Material Type: Teacher Materials, Resource Materials ; Format: Printables(BLM), 216 ... Journeys Reader's Notebook Grade 5 Sep 7, 2020 — This comprehensive ELA program from Houghton Mifflin Harcourt may look familiar to you. It has been successfully used in public schools, ... Grade 5 Practice Book JOURNEYS. Practice Book. Grade 5. HOUGHTON MIFFLIN HARCOURT. School Publishers ... Connect to Reading Look through A Package for Mrs. Jewls. Find words that have ... Common Core Reader's Notebook Consumable... Journeys Common Core Reader's Notebook Grade 5 Workbook. This description may be from another edition of this product. ... Weight:0.60 lbs. Dimensions:0.7" x 8.6" ... Common Core Student Edition Grade 5 2014 Buy a cheap copy of Houghton Mifflin Harcourt Journeys:... book. Journeys Common Core Student Edition Grade 5 2014 Free Shipping on all orders over $15. Woolbuddies: 20 Irresistibly Simple Needle Felting Projects This is the perfect introduction to needlefelting with adorable projects ranging from basic to advanced. All of them are gift-worthy, especially for children. 20 Irresistibly Simple Needle Felting Projects by Jackie – ... Woolbuddies: 20 Irresistibly Simple Needle Felting Projects by Jackie Huang. Jackie Huang guides you with this hardback book how to make your own needle felted ... Woolbuddies: 20 Irresistibly Simple Needle Felting Projects ... This is the perfect introduction to needlefelting with adorable projects ranging from basic to advanced. All of them are gift-worthy, especially for children. Woolbuddies: 20 Irresistibly Simple Needle Felting Projects ... Sep 17, 2013 — Here Huang teaches readers, using just some wool and a needle, how to needle felt a wide-eyed owl, a toothy shark, a fuzzy sheep, a towering ... Woolbuddies: 20 Irresistibly Simple Needle Felting Projects Praise from Stacey: Needlefelting is a fun way to make little toys, and Jackie's are some of the cutest I've seen! Not necessarily for your first needle ... Woolbuddies: 20 Irresistibly Simple Needle Felting Projects ... Here Huang teaches readers, using just some wool and a needle, how to needle felt a wide-eyed owl, a toothy shark, a fuzzy sheep, a towering giraffe, and more. 20 Irresistibly Simple Needle Felting Projects by Jackie Huang ... 20 Irresistibly Simple Needle Felting Projects by Jackie ... Jan 10, 2014 — Woolbuddies: 20 Irresistibly Simple

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