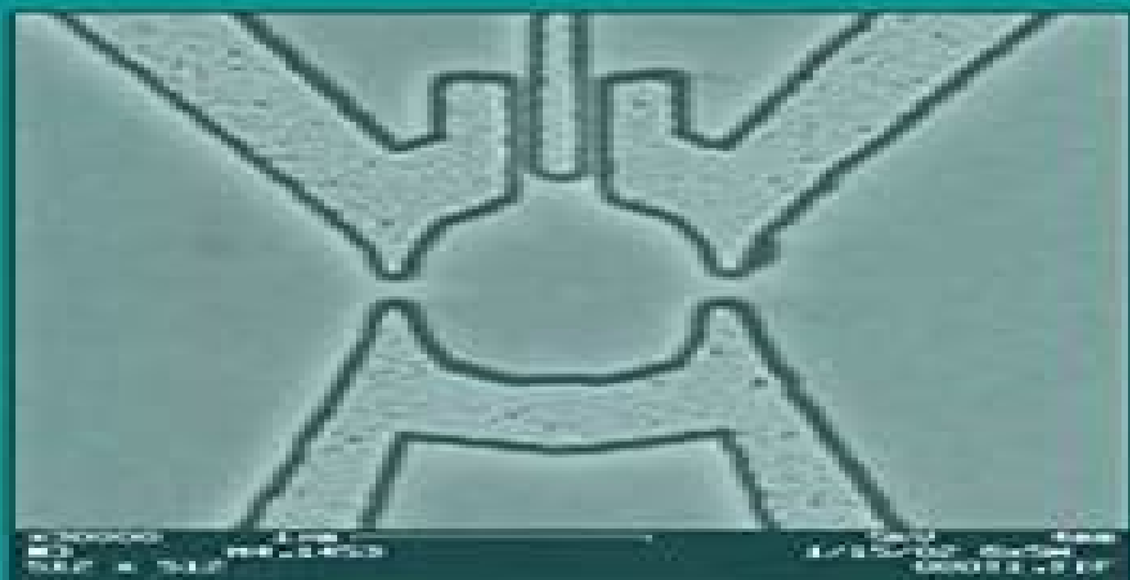
Electron Transport in Quantum Dots

Edited by
Jonathan P. Bird



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Electron Transport In Quantum Dots

Catherine Louise Hirshfeld Crouch

Electron Transport In Quantum Dots:

Electron Transport in Quantum Dots Jonathan P. Bird,2013-11-27 When I was contacted by Kluwer Academic Publishers in the Fall of 200 I inviting me to edit a volume of papers on the issue of electron transport in quantum dots I was excited by what I saw as an ideal opportunity to provide an overview of a field of research that has made significant contributions in recent years both to our understanding of fundamental physics and to the development of novel nanoelectronic technologies The need for such a volume seemed to be made more pressing by the fact that few comprehensive reviews of this topic have appeared in the literature in spite of the vast activity in this area over the course of the last decade or so With this motivation I set out to try to compile a volume that would fairly reflect the wide range of opinions that has emerged in the study of electron transport in quantum dots Indeed there has been no effort on my part to ensure any consistency between the different chapters since I would prefer that this volume instead serve as a useful forum for the debate of critical issues in this still developing field In this matter I have been assisted greatly by the excellent series of articles provided by the different authors who are widely recognized as some of the leaders in this vital area of research

Electron Transport in Quantum Dot Devices Kittipong Tantisantisom,2011 **Quantum Dots** Alexander Tartakovskii,2012-07-19 A comprehensive review of cutting edge solid state research focusing on quantum dot nanostructures for graduate students and researchers **Electron Transport in Quantum Dots** Jonathan P. Bird,2014-09-01 *Electron Transport in Quantum Dots Defined in Low-dimensional Semiconductor Structures* Marcus Larsson,2011 *Nonequilibrium Electron Transport in Quantum Dot and Quantum Point Contact Systems* Anasuya Erin Krishnaswamy,1999 Much experimental research has been performed in the equilibrium regime on individual quantum dots and quantum point contacts QPCs The focus of the research presented here is electron transport in the nonequilibrium regime in coupled quantum dot and QPC systems fabricated on AlGaAs GaAs material using the split gate technique Near equilibrium magnetoconductance measurements were performed on a quantum dot and a QPC Oscillations were seen in the conductance of the sensor which corresponded to Aharonov Bohm oscillations in the quantum dot to our knowledge the first such observation Sudden jumps in the conductance of the QPC were observed under certain gate biases and under certain magnetic fields When the gate biases and magnetic field were held constant and the conductance was observed over time switching was observed with the form of a random telegraph signal RTS RTS switching is usually attributed to charging of a single impurity However in this case switching may have been due to tunneling via edge states in the dot Nonequilibrium transport in single quantum dots was investigated A knee or kink was observed in the current voltage characteristics of two dots on different material The bias conditions under which the knee occurred point to electron heating as the physical mechanism for the observed behavior However the data can not be fit accurately over all bias ranges with an energy balance hot electron model Modifications to the model are needed to accurately represent the devices studied here Finally the effect of nonlinear transport through a one dimensional 1D QPC on the equilibrium conductance of an adjacent OD quantum dot was explored This was the first attempt to observe Coulomb drag between a OD and 1D system It was observed that the equilibrium conductance peaks in the quantum dot were broadened as the current in the QPC increased This apparent electron heating effect in the dot can be explained by a simple ballistic phonon model However reasonable phase coherence times can be estimated from peak fitting using a Breit Wigner formula which points to a Coulomb interaction More detailed numerical calculations should illuminate the dominant scattering processes *Mesoscopic Electron Transport* Lydia L. Sohn,Leo P. Kouwenhoven,Gerd Schön,2013-06-29 Ongoing developments in nanofabrication technology and the availability of novel materials have led to the emergence and evolution of new topics for mesoscopic research including scanning tunnelling microscopic studies of few atom metallic clusters discrete energy level spectroscopy the prediction of Kondo type physics in the transport properties of quantum dots time dependent effects and the properties of interacting systems e g of Luttinger liquids The overall understanding of each of these areas is still incomplete nevertheless with the foundations laid by studies in the more traditional systems there is no doubt that these new areas will advance mesoscopic electron transport to a new phenomenological level both experimentally and theoretically Mesoscopic Electron Transport highlights selected areas in the field provides a comprehensive review of such systems and also serves as an introduction to the new and developing areas of mesoscopic electron transport Electron Transport and Coherence in Semiconductor Quantum Dots and Rings Wilfred Gerard van der Wiel,2001-01-01 **Electron Transport in Semiconducting Nanowires and Quantum Dots** Gregory Holloway,2017 Single electrons confined in electrostatic quantum dots are a promising platform for realizing spin based quantum information processing In this scheme the spin of each electron is encoded as a qubit and can be manipulated and measured by modulating the gate voltages defining each dot Since each qubit is realized in a single quantum dot one could imagine scaling up this system by placing many quantum dots together in a tightly packed array To be truly scalable each qubit must exhibit minimal variation such that their behavior is consistent across the entire device Transport through these quantum dots must therefore be explored in detail to determine the source of these variations and design strategies to combat their effects In this thesis a study of the transport properties of InAs nanowires and Si quantum dots is presented In both systems the close proximity of the conduction electrons to defect prone surfaces or interfaces causes them to be very sensitive to the physical properties of these regions Through cryogenic transport measurements and the development of relevant physical models the effects of surface states oxide charge traps and interface defects are explored In general these defects possess a finite charge which modifies the electrostatic potential and alters electron transport These additional changes to the electrostatic potential are detrimental for spin based quantum information processing which requires precise control of this potential In addition the severity of each of these effects can be different in each device leading to variation which limits scalability By studying these effects we aim to better understand their properties and origins such that they can be mitigated Static defects such as surface states are found to be a dominant source of scattering that limits mobility In InAs nanowires we find that these effects can be removed through growth of an epitaxial shell that physically separates the nanowire surface from the conducting core Dynamic defects on the other hand lead to charge noise that shifts the potential causing instability This noise originates from charge traps in close proximity to the conduction channel For nanowires the native oxide that forms at the surface is a likely location for these traps to occur Through removal of this oxide and replacement with a defect free dielectric shell greatly improved stability is observed To test the viability of these fabrication techniques nanowires treated with the most promising surface processes are used to fabricate top gated nanowire field effect transistors These devices are used to realize electrostatically defined double quantum dots which show well controlled transport properties and minimal charge noise In Si electron transport is studied in a pair of capacitively coupled metal oxide semiconductor quantum dots Here the capacitive coupling is used implement charge sensing such that the electrostatic potential of one dot can be measured down to the single electron regime The pair of dots is also used to implement a novel memristive system which demonstrates current hysteresis This shows the versatility of this system and its capability to control individual electrons similar to the requirements needed to implement spin based quantum information processing *Electron Transport in GaAs Quantum Dots under High Frequencies* Bernard Richard Matis,2011 Ph D **Electron Transport Through Quantum Dots Coupled to Various Leads** Daichi Matsumoto,2001 **Conditional Counting Statistics of Electron Transport in Quantum Dot Systems** □□□,2012 Electron Transport and Spectroscopy in Open Semiconductor Quantum Dots David P. Pivin,1998 *Non-equilibrium Electron Transport Through a Double Quantum Dot System* Verena Körting,2008 **Electron Transport and Dephasing in Semiconductor Quantum Dots** Andrew G. A. Huibers,1999 **Phase Coherent Electron Transport in Open Quantum Dots and Quantum Dot Arrays** J. P. Bird,R. Akis,D. K. Ferry,M. E. Hassen,A. Shailos,ARIZONA STATE UNIV TEMPE.,2000 Recent studies of coherent electron transport in open quantum dots and quantum dot arrays are reviewed Our interest focuses on the connection between the quantum and semi classical descriptions of transport in these Structures which provide ideal systems for the experimental study of quantum chaos **Single Electron Transport and Charge Quantization in Coupled Quantum Dots** Catherine Louise Hirshfeld Crouch,1996 **Path-resolved Electron Transport in a Triangular Triple Quantum Dot System** Monika Kotzian,2016 Triple quantum dots path resolved transport Coulomb correlations Dreifachquantenpunkte pfadaufgel ster Transport Coulomb Korrelationen Electron Transport in Quantum Dots and Heat Transport in Molecules ,2014 *Electron Transport in N-type SiGe Double Quantum Dots* A. Ferguson,2003

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