

Spin Dependent Transport in Magnetic Nanostructures

Edited by

Sadamichi Maekawa and Teruya Shinjo

ADVANCES IN CONDENSED MATTER SCIENCE, VOLUME THREE

Spin Dependent Transport In Magnetic Nanostructures

Sadamichi Maekawa, Teruya Shinjo



Spin Dependent Transport In Magnetic Nanostructures:

Spin Dependent Transport in Magnetic Nanostructures Sadamichi Maekawa, Teruya Shinjo, 2002-07-11 In magnetic systems of nano meter size the interplay between spin and charge of electrons provides unique transport phenomena In magnetic superlattices magnetic and non magnetic metallic thin films with thickness of the order of one nano meter are piled up alternately Since the discovery of giant magnetoresistance GMR in these superlattices in 1988 spin dependent transport phenomena in magnetic nanostructures have received much attention from both academic and technological points of view Ferromagnetic tunnel junctions made of ferromagnetic metal electrodes and a very thin insulating barrier between them are also of current interest as magnetoresistive devices where the tunneling current depends on the relative orientation of magnetization TMR In addition to magnetic superlattices and magnetic tunnel junctions magnetic granular systems and magnetic dots have been studied extensively as magnetoresistive systems Edited by two of the world s leading authorities Spin Dependent Transport in Magnetic Nanostructures introduces and explains the basic physics and applications of a variety of spin dependent transport phenomena in magnetic nanostructures with particular emphasis on magnetic multilayers and magnetic tunnel junctions

Spin-dependent Transport Phenomena in Magnetic Nanostructures A. S. Sahakyan, R. M. Movsesyan, A. N. Kocharian, 2017 *Spin-dependent Transport in Semiconductor-based Magnetic Nanostructures* Athanasios N. Chantis, 2002 *Handbook of Spin Transport and Magnetism* Evgeny Y. Tsymbal, Igor Zutic, 2016-04-19 In the past several decades the research on spin transport and magnetism has led to remarkable scientific and technological breakthroughs including Albert Fert and Peter Grunberg s Nobel Prize winning discovery of giant magnetoresistance GMR in magnetic metallic multilayers Handbook of Spin Transport and Magnetism provides a comprehensive bal *Transport Phenomena in Micro- and Nanoscale Functional Materials and Devices* Joao B. Sousa, Joao O. Ventura, Andre Pereira, 2021-03-23 Transport Phenomena in Micro and Nanoscale Functional Materials and Devices offers a pragmatic view on transport phenomena for micro and nanoscale materials and devices both as a research tool and as a means to implant new functions in materials Chapters emphasize transport properties TP as a research tool at the micro nano level and give an experimental view on underlying techniques The relevance of TP is highlighted through the interplay between a micro nanocarrier s characteristics and media characteristics long short range order and disorder excitations couplings and in energy conversions Later sections contain case studies on the role of transport properties in functional nanomaterials This includes transport in thin films and nanostructures from nanogranular films to graphene and 2D semiconductors and spintronics and from read heads MRAMs and sensors to nano oscillators and energy conversion from figures of merit micro coolers and micro heaters to spin caloritronics Presents a pragmatic description of electrical transport phenomena in micro and nanoscale materials and devices from an experimental viewpoint Provides an in depth overview of the experimental techniques available to measure transport phenomena in micro and nanoscale materials Features case

studies to illustrate how each technique works Highlights emerging areas of interest in micro and nanomaterial transport phenomena including spintronics *Nanooptics, Nanophotonics, Nanostructures, and Their Applications* Olena Fesenko, Leonid Yatsenko, 2018-06-26 This book presents some of the latest achievements in nanotechnology and nanomaterials from leading researchers in Ukraine Europe and beyond It features selected peer reviewed contributions from participants in the 5th International Science and Practice Conference Nanotechnology and Nanomaterials NANO2017 held in Chernivtsi Ukraine on August 23 26 2017 The International Conference was organized jointly by the Institute of Physics of the National Academy of Sciences of Ukraine Ivan Franko National University of Lviv Ukraine University of Tartu Estonia University of Turin Italy and Pierre and Marie Curie University France Internationally recognized experts from a wide range of universities and research institutions share their knowledge and key results on topics ranging from nanooptics and nanoplasmonics to interface studies This book's companion volume also addresses topics such as energy storage and biomedical applications

Spin Electronics David D. Awschalom, Robert A. Buhrman, James M. Daughton, Stephan von Molnár, Michael L. Roukes, 2013-06-29 The history of scientific research and technological development is replete with examples of breakthroughs that have advanced the frontiers of knowledge but seldom does it record events that constitute paradigm shifts in broad areas of intellectual pursuit One notable exception however is that of spin electronics also called spintronics magnetoelectronics or magnetronics wherein information is carried by electron spin in addition to or in place of electron charge It is now well established in scientific and engineering communities that Moore's Law having been an excellent predictor of integrated circuit density and computer performance since the 1970s now faces great challenges as the scale of electronic devices has been reduced to the level where quantum effects become significant factors in device operation Electron spin is one such effect that offers the opportunity to continue the gains predicted by Moore's Law by taking advantage of the confluence of magnetism and semiconductor electronics in the newly emerging discipline of spin electronics From a fundamental viewpoint spin polarization transport in a material occurs when there is an imbalance of spin populations at the Fermi energy In ferromagnetic metals this imbalance results from a shift in the energy states available to spin up and spin down electrons In practical applications a ferromagnetic metal may be used as a source of spin polarized electrons to be injected into a semiconductor a superconductor or a normal metal or to tunnel through an insulating barrier

Introduction to Spintronics Supriyo Bandyopadhyay, Marc Cahay, 2008-03-20 Using spin to replace or augment the role of charge in signal processing devices computing systems and circuits may improve speed power consumption and device density in some cases making the study of spin one of the fastest growing areas in micro and nanoelectronics With most of the literature on the subject still highly advanced and heavily theoretical the demand for a practical introduction to the concepts relating to spin has only now been filled Explains effects such as giant magnetoresistance the subject of the 2007 Nobel Prize in physics Introduction to Spintronics is an accessible organized and progressive presentation of the quantum mechanical

concept of spin The authors build a foundation of principles and equations underlying the physics transport and dynamics of spin in solid state systems They explain the use of spin for encoding qubits in quantum logic processors clarify how spin orbit interaction forms the basis for certain spin based devices such as spintronic field effect transistors and discuss the effects of magnetic fields on spin based device performance Covers active hybrid spintronic devices monolithic spintronic devices passive spintronic devices and devices based on the giant magnetoresistance effect The final chapters introduce the burgeoning field of spin based reversible logic gates spintronic embodiments of quantum computers and other topics in quantum mechanics that have applications in spintronics An Introduction to Spintronics provides the knowledge and understanding of the field needed to conduct independent research in spintronics [Nanomagnetism](#) ,2006-03-27

Nanoscience is of central importance in the physical and biological sciences and is now pervasive in technology However nanomagnetism has a special role to play as magnetic properties depend uniquely on both dimensionality and lengthscales Nanomagnetism is already central to data storage sensor and device technologies but is increasingly being used in the life sciences and medicine This volume aims to introduce scientists computer scientists engineers and technologists from diverse fields to this fascinating and technologically important new branch of nanoscience The volume should appeal to both the interested general reader but also to the researcher wishing to obtain an overview of this fast moving field The contributions come from acknowledged leaders in the field who each give authoritative accounts of key fundamental aspects of nanomagnetism to which they have themselves made a major contribution After a brief introduction by the editors Wu first surveys the fundamental properties of magnetic nanostructures The interlayer exchange interactions within magnetic multilayer structures is next discussed by Stiles Camley then discusses the static dynamic and thermal properties of magnetic multilayers and nanostructures followed by an account of the phenomenon of exchange anisotropy by Berkowitz and Kodama This latter phenomenon is widely in current read head devices for example The transport properties of nanostructures also are spectacular and again underpin computer technology as we see from the discussion of giant magnetoresistance GMR and tunnelling magnetoresistance TMR presented by Fert and his colleagues Beyond GMR and TMR we look to the field of spintronics where new electronic devices are envisioned and for which quantum computing may depend as discussed in the chapter by Flatte and Jonker The volume concludes with discussion of the recently discovered phenomenon of current induced switching of magnetization by Edwards and Mathon Subject is in the forefront of nanoscience All Section authors are leading figures in this key field Presentations are accessible to non specialists with focus on underlying fundamentals *Handbook of Nanophysics* Klaus D. Sattler,2016-04-19 In the 1990s nanoparticles and quantum dots began to be used in optical electronic and biological applications Now they are being studied for use in solid state quantum computation tumor imaging and photovoltaics Handbook of Nanophysics Nanoparticles and Quantum Dots focuses on the fundamental physics of these nanoscale materials and struct

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