

Hartmut Zabel  
Michael Farle *Editors*

# Magnetic Nanostructures

Spin Dynamics and Spin Transport

# Magnetic Nanostructures Spin Dynamics And Spin Transport Springer Tracts In Modern Physics

**Mario Rocca, Talat Rahman, Luca  
Vattuone**



## **Magnetic Nanostructures Spin Dynamics And Spin Transport Springer Tracts In Modern Physics:**

Magnetic Nanostructures Hartmut Zabel, Michael Farle, 2012-09-15 Nanomagnetism and spintronics is a rapidly expanding and increasingly important field of research with many applications already on the market and many more to be expected in the near future This field started in the mid 1980s with the discovery of the GMR effect recently awarded with the Nobel prize to Albert Fert and Peter Gr nberg The present volume covers the most important and most timely aspects of magnetic heterostructures including spin torque effects spin injection spin transport spin fluctuations proximity effects and electrical control of spin valves The chapters are written by internationally recognized experts in their respective fields and provide an overview of the latest status      **Atomistic Spin Dynamics** Olle Eriksson, Anders Bergman, Lars Bergqvist, Johan Hellsvik, 2017-02-10 The purpose of this book is to provide a theoretical foundation and an understanding of atomistic spin dynamics ASD and to give examples of where the atomistic Landau Lifshitz Gilbert equation can and should be used As argued in the text a description of magnetism in an atomistic way is very natural and allows for an interpretation of experimental results in a clear and deep way This description also allows for calculations from first principles of all parameters needed to perform the spin dynamics simulations without using experimental results as input to the simulations As shown in the book we are now at a very exciting situation where it is possible to perform accurate and efficient atomistic simulations on a length and time scale which is balancing on the edge of what is experimentally possible In this way ASD simulations can both validate and be validated by state of the art experiments and ASD simulations also have the possibility to act as a predictive tool that is able to explain the magnetization dynamics in experimentally inaccessible situations The purpose of this book has been to communicate technically relevant concepts An even larger motivation is to communicate an inspiration to magnetism and magnetization dynamics and the emerging technological fields that one may foresee e g in magnonics solitonics and skyrmionics      Magnetism of Surfaces, Interfaces, and Nanoscale Materials Robert E. Camley, Zbigniew Celinski, Robert L. Stamps, 2015-10-27 In the past 30 years magnetic research has been dominated by the question of how surfaces and interfaces influence the magnetic and transport properties of nanostructures thin films and multilayers The research has been particularly important in the magnetic recording industry where the giant magnetoresistance effect led to a new generation of storage devices including hand held memories such as those found in the ipod More recently transfer of spin angular momentum across interfaces has opened a new field for high frequency applications This book gives a comprehensive view of research at the forefront of these fields The frontier is expanding through dynamic exchange between theory and experiment Contributions have been chosen to reflect this giving the reader a unified overview of the topic Addresses both theory and experiment that are vital for gaining an essential understanding of topics at the interface between magnetism and materials science Chapters written by experts provide great insights into complex material Discusses fundamental background material and state of the art applications serving as an indispensable

guide for students and professionals at all levels of expertise Stresses interdisciplinary aspects of the field including physics chemistry nanocharacterization and materials science Combines basic materials with applications thus widening the scope of the book and its readership *Springer Handbook of Surface Science* Mario Rocca,Talat Rahman,Luca Vattuone,2021-01-14 This handbook delivers an up to date comprehensive and authoritative coverage of the broad field of surface science encompassing a range of important materials such metals semiconductors insulators ultrathin films and supported nanoobjects Over 100 experts from all branches of experiment and theory review in 39 chapters all major aspects of solid state surfaces from basic principles to applications including the latest ground breaking research results Beginning with the fundamental background of kinetics and thermodynamics at surfaces the handbook leads the reader through the basics of crystallographic structures and electronic properties to the advanced topics at the forefront of current research These include but are not limited to novel applications in nanoelectronics nanomechanical devices plasmonics carbon films catalysis and biology The handbook is an ideal reference guide and instructional aid for a wide range of physicists chemists materials scientists and engineers active throughout academic and industrial research Chalcogenide Xinyu Liu,Sanghoon Lee,Jacek K. Furdyna,Tengfei Luo,Yong Zhang,2019-11-14 Chalcogenide From 3D to 2D and Beyond reviews graphene like 2D chalcogenide systems that include topological insulators interesting thermoelectric structures and structures that exhibit a host of spin phenomena that are unique to 2D and lower dimensional geometries The book describes state of the art materials in growth and fabrication magnetic electronic and optical characterization as well as the experimental and theoretical aspects of this family of materials Bulk chalcogenides chalcogenide films their heterostructures and low dimensional chalcogenide based quantum structures are discussed Particular attention is paid to findings that are relevant to the continued search for new physical phenomena and new functionalities Finally the book covers the enormous opportunities that have emerged as it has become possible to achieve lower dimensional chalcogenide structures by epitaxial techniques Provides readers with foundational information on the materials growth fabrication magnetic electronic and optical characterization of chalcogenide materials Discusses not only bulk chalcogenides and chalcogenide thin films but also two dimensional chalcogenide materials systems Reviews the most important applications in optoelectronics photovoltaics and thermoelectrics Theory of the Muon Anomalous Magnetic Moment Kirill Melnikov,Arkady Vainshtein,2007-01-09 The theory of the muon anomalous magnetic moment is particle physics in a nutshell It is an interesting exciting and difficult subject and this book provides a comprehensive review of it The theory of the muon anomalous magnetic moment is at the cutting edge of current research in particle physics and any deviation between the theoretical prediction and the experimental value might be interpreted as a signal of an as yet unknown new physics *Symmetry, Spin Dynamics and the Properties of Nanostructures - Lecture Notes of the 11th International School on Theoretical Physics* Vitalii K. E. T. Al DUGAEV,2015-11-09 This book is a collection of lecture notes which were presented by invited speakers at the Eleventh

School on Theoretical Physics Symmetry and Structural Properties of Condensed Matter SSPCM 2014 in Rzesz w Poland in September 2014 The main challenge for the lecturers was the objective to present their subject as a review as well as in the form of introduction for beginners Topics considered in the volume concentrate on spin dynamics and spin transport in magnetic and non magnetic structures spin orbit interaction in two dimensional systems and graphene and new mathematical method used in the condensed matter physics The British National Bibliography Arthur James Wells,1998

*Spin Dynamics in Confined Magnetic Structures II* Burkard Hillebrands,Kamel Ounadjela,2003-09-04 This second volume of the book on spin dynamics in confined magnetic structures covers central aspects of spin dynamic phenomena so that researchers can find a comprehensive compilation of the current work in the field Introductory chapters help newcomers to understand the basic concepts and the more advanced chapters give the current state of the art for most spin dynamic issues in the milliseconds to femtoseconds range Both experimental techniques and theoretical work are discussed The comprehensive presentation of these developments makes this volume very timely and valuable for every researcher working in the field of magnetism It describes the new experimental techniques which have advanced this field very rapidly Among the techniques covered particular attention is given to those involving high temporal elemental and spatial resolution as well as to techniques involving magnetic field pulses with very short rise times and durations **Spin Dynamics and Damping**

**in Ferromagnetic Thin Films and Nanostructures** Anjan Barman,Jaivardhan Sinha,2017-12-27 This book provides a comprehensive overview of the latest developments in the field of spin dynamics and magnetic damping It discusses the various ways to tune damping specifically dynamic and static control in a ferromagnetic layer heavy metal layer In addition it addresses all optical detection techniques for the investigation of modulation of damping for example the time resolved magneto optical Kerr effect technique **Spin Dynamics in Confined Magnetic Structures III** Burkard

Hillebrands,Andre Thiaville,2006-09-06 This third volume of Spin Dynamics in Confined Magnetic Structures addresses central aspects of spin dynamic phenomena on a tutorial level Researchers will find a comprehensive compilation of the current work in the field Introductory chapters help newcomers to understand the basic concepts The more advanced chapters give the current state of the art of spin dynamic issues ranging from the femtosecond to the microsecond regime This volume concentrates on new experimental techniques such as ferromagnetic resonance force microscopy and two photon photoemission as well as on aspects of precessional switching spin wave excitation vortex dynamics spin relaxation domain wall dynamics in nanowires and their applications to magnetic logic devices One chapter is devoted to the very hot subject of spin transfer torque combining electronic transport and micromagnetics The comprehensive presentation makes it a very timely and valuable resource for every researcher working in the field of magnetism Spin Dynamics in Confined Magnetic Structures I Burkard Hillebrands,Kamel Ounadjela,2001-11-06 Introductory chapters help newcomers to understand the basic concepts and the more advanced chapters give the current state of the art for most spin dynamic issues

in the milliseconds to femtoseconds range Emphasis is placed on both the discussion of the experimental techniques and on the theoretical work The comprehensive presentation of these developments makes this volume very timely and valuable for every researcher working in the field of magnetism *Spin Dynamics in Confined Magnetic Structures III* Burkard Hillebrands, Andre Thiaville, 2006-11-13 The third volume of this book addresses central aspects of spin dynamic phenomena on a tutorial level This volume concentrates on new experimental techniques such as ferromagnetic resonance force microscopy and two photon photoemission There is a chapter devoted to the hot subject of spin transfer torque The comprehensive presentation makes this a timely and valuable resource for every researcher working in the field of magnetism *Spin Dynamics in Confined Magnetic Structures I* Burkard Hillebrands, Kamel Ounadjela, 2001-11-06 Introductory chapters help newcomers to understand the basic concepts and the more advanced chapters give the current state of the art for most spin dynamic issues in the milliseconds to femtoseconds range Emphasis is placed on both the discussion of the experimental techniques and on the theoretical work The comprehensive presentation of these developments makes this volume very timely and valuable for every researcher working in the field of magnetism **Spin Dynamics in Confined Magnetic Structures II** Burkard Hillebrands, Kamel Ounadjela, 2003-03-12 This second volume of the book on spin dynamics in confined magnetic structures covers central aspects of spin dynamic phenomena so that researchers can find a comprehensive compilation of the current work in the field Introductory chapters help newcomers to understand the basic concepts and the more advanced chapters give the current state of the art for most spin dynamic issues in the milliseconds to femtoseconds range Both experimental techniques and theoretical work are discussed The comprehensive presentation of these developments makes this volume very timely and valuable for every researcher working in the field of magnetism It describes the new experimental techniques which have advanced this field very rapidly Among the techniques covered particular attention is given to those involving high temporal elemental and spatial resolution as well as to techniques involving magnetic field pulses with very short rise times and durations *Magnetism* Joachim Stöhr, Hans Christoph Siegmann, 2007-01-19 This text book gives a comprehensive account of magnetism one of the oldest yet most vibrant fields of physics It spans the historical development the physical foundations and the continuing research underlying the subject The book covers both the classical and quantum mechanical aspects of magnetism and novel experimental techniques Perhaps uniquely it discusses spin transport and magnetization dynamics phenomena associated with atomically and spin engineered nano structures against the backdrop of spintronics and magnetic storage and memory applications The book is for students and serves as a reference for scientists in academia and research laboratories **Handbook of Spin Transport and Magnetism** Evgeny Y. Tsymlal, Igor Zutic, 2011-08-25 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 Gr nberg s Nobel Prize winning discovery of giant magnetoresistance GMR in magnetic metallic multilayers Handbook of

Spin Transport and Magnetism provides a comprehensive balanced account of the state of the art in the field known as spin electronics or spintronics. It reveals how key phenomena first discovered in one class of materials such as spin injection in metals have been revisited decades later in other materials systems including silicon organic semiconductors carbon nanotubes graphene and carefully engineered nanostructures. The first section of the book offers a historical and personal perspective of the field written by Nobel Prize laureate Albert Fert. The second section addresses physical phenomena such as GMR in hybrid structures of ferromagnetic and normal metals. The third section discusses recent developments in spin dependent tunneling including magnetic tunnel junctions with ferroelectric barriers. In the fourth section the contributors look at how to control spin and magnetism in semiconductors. In the fifth section they examine phenomena typically found in nanostructures made from metals superconductors molecular magnets carbon nanotubes quantum dots and graphene. The final section covers novel spin based applications including advanced magnetic sensors nonvolatile magnetoresistive random access memory and semiconductor spin lasers. The techniques and materials of spintronics have rapidly evolved in recent years leading to vast improvements in hard drive storage and magnetic sensing. With extensive cross references between chapters this seminal handbook provides a complete guide to spin transport and magnetism across various classes of materials and structures.

Spin Dynamics in Confined Magnetic Structures I Burkard Hillebrands, Kamel Ounadjela, 2003-07-01. Introductory chapters help newcomers to understand the basic concepts and the more advanced chapters give the current state of the art for most spin dynamic issues in the milliseconds to femtoseconds range. Emphasis is placed on both the discussion of the experimental techniques and on the theoretical work. The comprehensive presentation of these developments makes this volume very timely and valuable for every researcher working in the field of magnetism.

**Spin Transport and Current Induced Magnetization Dynamics in Magnetic Nanostructures** Chen, Xi, 2010

**Magnetic Interactions and Spin Transport** Almadena Chtchelkanova, Stuart A. Wolf, Yves Idzerda, 2003-01-31. Stuart Wolf. This book originated as a series of lectures that were given as part of a Summer School on Spintronics in the end of August 1998 at Lake Tahoe Nevada. It has taken some time to get these lectures in a form suitable for this book and so the process has been an iterative one to provide current information on the topics that are covered. There are some topics that have developed in the intervening years and we have tried to at least alert the readers to them in the Introduction where a rather complete set of references is provided to the current state of the art. The field of magnetism once thought to be dead or dying has seen a remarkable rebirth in the last decade and promises to get even more important as we enter the new millennium. This rebirth is due to some very new insight into how the spin degree of freedom of both electrons and nucleons can play a role in a new type of electronics that utilizes the spin in addition to or in place of the charge. For this new field to mature and prosper it is important that students and postdoctoral fellows have access to the appropriate literature that can give them a sound basis in the fundamentals of this new field and I hope that this book is a very good start in this direction.

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