

# Magnetism and Structure in Systems of Reduced Dimension

Edited by

Robin F. C. Farrow Bernard Dieny Markus Donath Albert Fert and B. D. Hermsmeier

NATO ASI Series

# Magnetism And Structure In Systems Of Reduced <u>Dimension</u>

Fritz Herlach, Noboru Miura

# **Magnetism And Structure In Systems Of Reduced Dimension:**

Magnetism and Structure in Systems of Reduced Dimension Robin F.C. Farrow, Bernard Dieny, Markus Donath, Albert Fert, B.D. Hermsmeier, 2013-06-29 This volume contains the papers presented at the NATO Advanced Research Workshop on Magnetism and Structure in Systems of Reduced Dimension held at 1 Institut d Etudes Scientifiques de Cargese U M S C N R S Universite de Corte Universite de Nice Sophia Antipolis during June 15 19 1992 The ordering of papers in the volume reflects the sequence of papers presented at the workshop The aim was not to segregate the papers into rigidly defined areas but to group the papers into small clusters each cluster having a common theme In this way the parallel rather than serial development of areas such as preparation of films magnetic and structural characterization was highlighted Indeed the success of the field depends on such parallel development and is assisted by workshops of this nature and the international collaborations which they foster The organizers and participants of the NATO workshop express their thanks to Mme Marie France Hanseier and the staff at 1 Institut d Etudes Scientifiques de Cargese U M S C N R S Universite de Corte Universite de Nice Sophia Antipolis for making the workshop and local arrangements a memorable success Warm thanks are also expressed to Varadachari Sadagopan and Pascal Stefanou for their encouragement and help in making the workshop a reality We are also grateful to Kristl Hathaway Larry Cooper and Gary Prinz for advice in developing the workshop program

Magnetism and Structure in Systems of Reduced Dimension Robin F. C. Farrow, Bernard Dieny, Markus Frontiers in Magnetism of Reduced Dimension Systems Victor G. Bar'yakhtar, P.E. Donath, 2014-01-15 Wigen, 2012-12-06 Frontiers in Magnetism of Reduced Dimension Systems presents a definitive statement of our current knowledge and the state of the art in a field that has yet to achieve maturity even though there are a number of potential applications of thin magnetic films and multilayers such as magnetic sensors data storage retrieval media actuators etc The book is organized into 13 chapters each including a lecture and contributed papers on a similar subject Five chapters deal with theoretical descriptions of electron transport phenomena relaxation processes nonlinear paramagnetic interactions phase transitions and macroscopic quantum effects in magnetic films and particles The description of different characterization techniques occupies an important place in the book Separate chapters are dedicated to magnetic resonances FMR SWR NMR magneto optical spectroscopy controlling chaos magnetoelastic phenomena and magnetic resonance force microscopy A further chapter gives a detailed review spread over a number of papers of materials in current use in information storage devices Magnetic Properties of Metals: Magnetic and Electric Properties of Magnetic Metallic Multilayers Yoshiyuki Kawazoe, Ryunosuke Note, 2023-06-06 The subject of this volume is to present both the numerical and graphical data on the magnetic and electrical properties of magnetic metallic multilayers which are composed with stacking up of double layers of thin films one layer of which is at least the magnetic layer of 3d metals M or rare earth ones R Furthermore the data of the trilayers which have a top layer and bottom one of magnetic elements are also presented

Optical Phenomena in Semiconductor Structures of Reduced Dimensions D.J. Lockwood, Aron Pinczuk, 2012-12-06 Remarkable advances in semiconductor growth and processing technologies continue to have a profound impact on condensed matter physics and to stimulate the invention of novel optoelectronic effects Intensive research on the behaviors of free carriers has been carried out in the two dimensional systems of semiconductor heterostructures and in the one and zero dimensional systems of nanostructures created by the state of the art fabrication methods These studies have uncovered unexpected quantum mechanical correlations that arise because of the combined effects of strong electron electron interactions and wave function confinement associated with reduced dimensionality. The investigations of these phenomena are currently at the frontiers of condensed matter physics They include areas like the fractional quantum Hall effect the dynamics of electrons on an ultra short femtosecond time scale electron behavior in quantum wires and dots and studies of electron tunneling phenomena in ultra small semiconductor structures Optical techniques have made important contributions to these fields in recent years but there has been no coherent review of this work until now The book provides an overview of these recent developments that will be of interest to semiconductor materials scientists in university government and industrial laboratories Low-Dimensional Magnetism A.N. Vasiliev, O.S. Volkova, E.A. Zvereva, M.M. Markina, 2019-07-16 Low dimensional magnetism physics involves the search for new magnetic compounds and improving their characteristics to meet the needs of innovative technologies A comprehensive overview of key materials their formulation data and characteristics are detailed by the author Key selling features Explores dominant mechanisms of magnetic interaction to determine the parameters of exchange interactions in new magnetic materials Describes how magnetism and superconductivity not only compete but also help each other Details characteristics of key materials in the magnetic subsystem Results of several internationally renowned research groups are included and cited Suitable for a wide range of readers in physics materials science and chemistry interested in the problems of the structure of matter Dimensional Systems J.L. Morán-López, 2007-05-08 Oaxaca Mexico was the place chosen by a large international group of scientists to meet and discuss on the recent advances on the understanding of the physical prop ties of low dimensional systems one of the most active fields of research in condensed matter in the last years The International Symposium on the Physics of Low Dim sions took place in January 16 20 2000 The group of scientists converging into the historical city of Oaxaca in the state of the same name had come from Argentina Chile Venezuela several places in Mexico Canada U S A England France Italy Germany Russia and Switzerland The presentations at the workshop provided sta of art reviews of many of the most important problems currently under study Equally important to all the participants in the workshop was the fact that we had come to honor a friend Hans Christoph Siegmann on his sixty fifth birthday This Festschrift recognizes the intellectual leadership of Professor Siegmann in the field and as a sincere homage to his qualities as an exceptional friend college and mentor Those who have had the privilege to work closely with Hans Christoph have been deeply impressed by his remarkable analytic mind as well as by his out of range kindness and generosity Hans Christoph has contributed to the understanding of the difficult and very important problem of the magnetic properties of finite systems surfaces thin films Magnetoelectric Response in Low-Dimensional Frustrated Spin Systems Shinichiro Seki, 2012-08-27 heterostructures Electric control of magnetic properties or inversely magnetic control of dielectric properties in solids is called a magnetoelectric effect and has long been investigated from the point of view of both fundamental physics and potential application Magnetic and dielectric properties usually show minimal coupling but it recently has been discovered that magnetically induced ferroelectricity in some spiral magnets enables remarkably large and versatile magnetoelectric responses To stabilize such helimagnetism magnetic frustration competition between different magnetic interactions is considered the key In the present work two of the most typical frustrated spin systems triangular lattice antiferromagnets and edge shared chain magnets have systematically been investigated Despite the crystallographic simplicity of target systems rich magnetoelectric responses are ubiquitously observed. The current results published here offer a useful quideline in the search for new materials with unique magnetoelectric functions and also provide an important basis for a deeper understanding of magnetoelectric phenomena in more complex systems Band-Ferromagnetism K. Baberschke, M. Donath, W. Nolting, 2008-01-11 The fascinating phenomenon ferromagnetism is far from being fully understood although it surely belongs to the oldest problems of solid state physics For any investigation it appears recommendable to distinguish between materials whose spontaneous magnetization stems from localized electrons of a partially lled atomic shell and those in which it is due to itinerant electrons of a partially lled conduction band In the latter case one speaks of band ferromagnetism prototypes of which are the classical ferromagnets Fe Co and Ni The present book is a status report on the remarkable progress that has recently been made towards a microscopic understanding of band ferromagnetism as an electron c relation e ect The authors of the various chapters of this book Band Ferromagnetism Ground State and Finite Temperature Phenomena participated as selected perts in the 242nd WE Heraeus Seminar 4 6 October 2000 held under almost the same title in Wandlitz near Berlin Germany It was the second seminar of this type in Wandlitz The rst in 1998 dealt with the complementary topic of the physics of local moment ferromagnets such as Gd Twenty six invited spe ers from ten di erent countries together with fty ve further participants who presented contributions in form of posters spent three days together discussing in an enthusiastic and fertile manner the hot topics of band ferromagnetism **Fundamentals of** Low Dimensional Magnets Ram K. Gupta, Sanjay R. Mishra, Tuan Anh Nguyen, 2022-08-29 A low dimensional magnet is a key to the next generation of electronic devices In some respects low dimensional magnets refer to nanomagnets nanostructured magnets or single molecule magnets molecular nanomagnets. They also include the group of magnetic nanoparticles which have been widely used in biomedicine technology industries and environmental remediation Low dimensional magnetic materials can be used effectively in the future in powerful computers hard drives magnetic random

access memory ultra low power consumption switches etc The properties of these materials largely depend on the doping level phase defects and morphology This book covers various nanomagnets and magnetic materials The basic concepts various synthetic approaches characterizations and mathematical understanding of nanomaterials are provided Some fundamental applications of 1D 2D and 3D materials are covered This book provides the fundamentals of low dimensional magnets along with synthesis theories structure property relations and applications of ferromagnetic nanomaterials This book broadens our fundamental understanding of ferromagnetism and mechanisms for realization and advancement in devices with improved energy efficiency and high storage capacity **Physics of Low-Dimensional Semiconductor** Structures Paul N. Butcher, Norman H. March, Mario P. Tosi, 2013-11-11 Presenting the latest advances in artificial structures this volume discusses in depth the structure and electron transport mechanisms of quantum wells superlattices quantum wires and quantum dots It will serve as an invaluable reference and review for researchers and graduate students in solid state physics materials science and electrical and electronic engineering **Ultrathin Magnetic Structures III** J.A.C. Bland, Bretislav Heinrich, 2004-12-13 The ability to understand and control the unique properties of interfaces has created an entirely new field of magnetism which already has a profound impact in technology and is providing the basis for a revolution in electronics. The last decade has seen dramatic progress in the development of magnetic devices for information technology but also in the basic understanding of the physics of magnetic nanostructures This volume describes thin film magnetic properties and methods for characterising thin film structure topics that underpin the present spintronics revolution in which devices are based on combined magnetic materials and semiconductors Volume IV deals with the fundamentals of spintronics magnetoelectronic materials spin injection and detection micromagnetics and the development of magnetic random access memory based on GMR and tunnel junction devices Together these books provide readers with a comprehensive account of an exciting and rapidly developing field. The treatment is designed to be accessible both to newcomers and to experts already working in this field who would like to get a better understanding of this very diversified Low-Dimensional Systems: Theory, Preparation, and Some Applications Luis M. Liz-Marzán, Michael area of research Giersig, 2012-12-06 This volume contains papers presented at the NATO Advanced Research Workshop ARW Dynamic Interactions in Quantum Dot Systems held at Hotel Atrium in Puszczykowo near Poznan Poland May 16 19 2002 The term low dimensional systems which is used in the title of this volume refers to those systems which contain at least one dimension that is intermediate between those characteristic of atoms molecules and those of the bulk material Depending on how many dimensions lay within this range we generally speak of quantum wells quantum wires and quantum dots As such an intermediate state some properties of low dimensional systems are very different to those of their molecular and bulk counterparts These properties generally include optical electronic and magnetic properties and all these are partially covered in this book The main goal of the workshop was to discuss the actual state of the art in the broad area

ofnanotechnology The initial focus was on the innovative synthesis of nanomaterials and their properties such as quantum size effects superparamagnetism or field emission These topics lead us into the various field based interactions including plasmon magnetic spin and exciton coupling The newer more sophisticated methods for characterization of nanomaterials were discussed as well as the methods for possible industrial applications In general chemists and physicists as well as experts on both theory and experiments on nanosized regime structures were brought together to discuss the general phenomena underlying their fields ofinterest from different points ofview Thin Film Growth Techniques for Low-Dimensional Structures R.F.C. Farrow, S.S.P. Parkin, P.J. Dobson, J.H. Neave, A.S. Arrott, 2013-03-09 This work represents the account of a NATO Advanced Research Workshop on Thin Film Growth Techniques for Low Dimensional Structures held at the University of Sussex Brighton England from 15 19 Sept 1986 The objective of the workshop was to review the problems of the growth and characterisation of thin semiconductor and metal layers Recent advances in deposition techniques have made it possible to design new material which is based on ultra thin layers and this is now posing challenges for scientists technologists and engineers in the assessment and utilisation of such new material Molecular beam epitaxy MBE has become well established as a method for growing thin single crystal layers of semiconductors Until recently MBE was confined to the growth of III V compounds and alloys but now it is being used for group IV semiconductors and II VI compounds Examples of such work are given in this volume MBE has one major advantage over other crystal growth techniques in that the structure of the growing layer can be continuously monitored using reflection high energy electron diffraction RHEED This technique has offered a rare bonus in that the time dependent intensity variations of RHEED can be used to determine growth rates and alloy composition rather precisely Indeed a great deal of new information about the kinetics of crystal growth from the vapour phase is beginning to emerge Magnetic Ultra Thin Films, Multilayers and **Surfaces** F. Petroff, M.A.M. Gijs, 1997-12-18 The Symposium on Magnetic Ultrathin Films Multilayers and Surfaces hosted by the European Materials Research Society was held at the Palais de la Musique et des Congr in Strasbourg France on June 47 1996 Its central theme was the relationship of magnetic properties and device performance to structure at the nano and micrometer length scale Research on the magnetism of surfaces ultrathin films and multilayers has increased dramatically during recent years This development was triggered by the discovery of coupling between ferromagnetic layers across nonmagnetic spacer layers and of the giant magnetoresistance effect in systems of reduced dimension using various micro and nanofabrication techniques has become a subject of special interest It is certainly the promising application potential of these effects in new magnetic recording device geometries which causes this intensive research which is done both by companies and at universities and research institutes A selection of invited and contributed papers presented at the Symposium and accepted for publication is contained in this volume. The contents of these proceedings are organized into seven sections A Nanowires Nanoparticles Nanostructuring B Ultrathin Films and Surfaces Characterization C Giant

Magnetoresistance D Coupling Tunneling E Growth Structure Magnetism F Growth Structure Magnetoresistance G Coupling Magnetic processes Magneto optics The first four sections contain invited and oral contributed papers in the listed research domains while the last three sections contain the contributions presented during three large poster sessions Magnetic Fields Fritz Herlach, Noboru Miura, 2003 This three volume book provides a comprehensive review of experiments in very strong magnetic fields that can only be generated with very special magnets. The first volume is entirely devoted to the technology of laboratory magnets permanent superconducting high power water cooled and hybrid pulsed magnets both nondestructive and destructive megagauss fields Volumes 2 and 3 contain reviews of the different areas of research where strong magnetic fields are an essential research tool These volumes deal primarily with solid state physics other research areas covered are biological systems chemistry atomic and molecular physics nuclear resonance plasma physics and astrophysics including QED High Magnetic Fields: Science And Technology (In 3 Volumes) - Vol. 2 Fritz Herlach, Noboru Miura, 2003-10-06 This three volume book provides a comprehensive review of experiments in very strong magnetic fields that can only be generated with very special magnets The first volume is entirely devoted to the technology of laboratory magnets permanent superconducting high power water cooled and hybrid pulsed magnets both nondestructive and destructive megagauss fields Volumes 2 and 3 contain reviews of the different areas of research where strong magnetic fields are an essential research tool These volumes deal primarily with solid state physics other research areas covered are biological systems chemistry atomic and molecular physics nuclear resonance plasma physics and astrophysics including QED Emerging Applications of Low Dimensional Magnets Ram K. Gupta, Sanjay R. Mishra, Tuan Anh Nguyen, 2022-11-28 Low dimensional magnetic materials find their wide applications in many areas including spintronics memory devices catalysis biomedical sensors electromagnetic shielding aerospace and energy This book provides a comprehensive discussion on magnetic nanomaterials for emerging applications Fundamentals along with applications of low dimensional magnetic materials in spintronics catalysis memory biomedicals toxic waste removal aerospace telecommunications batteries supercapacitors flexible electronics and many more are covered in detail to provide a full spectrum of their advanced applications This book offers fresh aspects of nanomagnetic materials and innovative directions to scientists researchers and students It will be of particular interest to materials scientists engineers physicists chemists and researchers in electronic and spintronic industries and is suitable as a textbook for undergraduate and graduate studies Frontiers of High Pressure Research II: Application of High Pressure to Low-Dimensional Novel Electronic Materials Hans D. Hochheimer, Bogdan Kuchta, Peter K. Dorhout, Jeffery L. Yarger, 2012-12-06 In recent interactions with industrial companies it became quite obvious that the search for new materials with strong anisotropic properties are of paramount importance for the development of new advanced electronic and magnetic devices The questions concerning the tailoring of materials with large anisotropic electrical and thermal conductivity were asked over and over again It became also guite clear that the chance to

answer these questions and to find new materials which have these desired properties would demand close collaborations between scientists from different fields Modem techniques of controlled materials synthesis and advances in measurement and modeling have made clear that multiscale complexity is intrinsic to complex electronic materials both organic and inorganic A unified approach to classes of these materials is urgently needed requiring interdisciplinary input from chemistry materials science and solid state physics Only in this way can they be controlled and exploited for increasingly stringent demands oftechnology The spatial and temporal complexity is driven by strong often competing couplings between spin charge and lattice degrees offreedom which determine structure function relationships The nature of these couplings is a sensitive function of electron electron electron lattice and spin lattice interactions noise and disorder external fields magnetic optical pressure etc and dimensionality In particular these physical influences control broken symmetry ground states charge and spin ordered ferroelectric superconducting metal insulator transitions and excitations with respect to broken symmetries created by chemical or photo doping especially in the form of polaronic or excitonic self trapping

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

# Magnetism And Structure In Systems Of Reduced Dimension Book Review: Unveiling the Magic of Language

In an electronic era where connections and knowledge reign supreme, the enchanting power of language has be much more apparent than ever. Its capability to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "Magnetism And Structure In Systems Of Reduced Dimension," compiled by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve in to the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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