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Intrinsic and Extrinsic Spin-orbit Torques from First Principles Light Transition Metal Insertion Layers and Their Impact on Spin-orbit Torque Efficiencies Next Generation Spin Torque Memories Magnetic Memory Technology Advances in Non-volatile Memory and Storage Technology Emerging Low-Power Semiconductor Devices Handbook of Magnetic Materials Spintronics-based Computing Magnetic Nano- and Microwires Spin Current Emerging Non-volatile Memory Technologies Solid State Physics Frontiers in Materials: Rising Stars 2020 Nanomagnetic and Spintronic Devices for Energy-Efficient Memory and Computing 60 Years of YangCMills Gauge Field Theories Emerging Nanoelectronic Devices Applications of Emerging Memory Technology Ultrafast Magnetism I Advances in Optoelectronic Technology and Industry Development Spintronics Topological Structures in Ferroic Materials Memristors for Neuromorphic Circuits and Artificial Intelligence Applications Modern Semiconductor Physics and Device Applications Nanomagnetic Materials Nanoscale Devices Spintronics Handbook, Second Edition: Spin Transport and Magnetism Spintronics Handbook, Second Edition: Spin Transport and Magnetism Time-resolved X-ray Imaging of Magnetization Dynamics in Spin Transfer Torque Devices Fundamentals of Low Dimensional Magnets Magnetic Skyrmions and Their Applications Emerging Applications of Low Dimensional Magnets Solid State Physics Nanoelectronic Materials, Devices and Modeling Neuromorphic Devices for Brain-inspired Computing Multiferroics Curvilinear Micromagnetism Spintronic 2D Materials Collective Excitations in the Antisymmetric Channel of Raman Spectroscopy Magnetic Materials and Magnetic Levitation Nanomagnetism

Intrinsic and Extrinsic Spin-orbit Torques from First Principles 2017 this book offers detailed insights into spin transfer torque stt based devices circuits and memories starting with the basic concepts and device physics it then addresses advanced stt applications and discusses the outlook for this cutting edge technology it also describes the architectures performance parameters fabrication and the prospects of stt based devices further moving from the device to the system perspective it presents a non volatile computing architecture composed of stt based magneto resistive and all spin logic devices and demonstrates that efficient stt based magneto resistive and all spin logic devices can turn the dream of instant on off non volatile computing into reality

Light Transition Metal Insertion Layers and Their Impact on Spin-orbit Torque Efficiencies 2021 stay up to date on the state of mram technology and its applications with this comprehensive resource magnetic memory technology spin transfer torque mram and beyond delivers a combination of foundational and advanced treatments of the subjects necessary for students and professionals to fully understand mram and other non volatile memories like pcm and reram the authors offer readers a thorough introduction to the fundamentals of magnetism and electron spin as well as a comprehensive analysis of the physics of magnetic tunnel junction mtj devices as it relates to memory applications this book explores mram s unique ability to provide memory without requiring the atoms inside the device to move when switching states the resulting power savings and reliability are what give mram its extraordinary potential the authors describe the current state of academic research in mram technology which focuses on the reduction of the amount of energy needed to reorient magnetization among other topics readers will benefit from the book s discussions of an introduction to basic electromagnetism including the fundamentals of magnetic force and other concepts an thorough description of magnetism and magnetic materials including the classification and properties of magnetic thin film properties and their material preparation and characterization a comprehensive description of giant magnetoresistance gmr and tunneling magnetoresistance tmr devices and their equivalent electrical model spin current and spin dynamics including the properties of spin current the ordinary hall effect the anomalous hall effect and the spin hall effect different categories of magnetic random access memory including field write mode mram spin torque transfer stt mram spin orbit torque sot mram and others perfect for senior undergraduate and graduate students studying electrical engineering similar programs or courses on topics like spintronics magnetic memory technology spin transfer torque mram and beyond also belongs on the bookshelves of engineers and other professionals involved in the design development and manufacture of mram technologies

Next Generation Spin Torque Memories 2017-04-07 advances in nonvolatile memory and storage technology second edition addresses recent developments in the non volatile memory spectrum from fundamental understanding to technological aspects the book provides up to date information on the current memory technologies as related by leading experts in both academia and industry to reflect the rapidly changing field many new chapters have been included to feature the latest in rram technology stt ram memristors and more the new edition describes the emerging technologies including oxide based ferroelectric memories mram technologies and 3d memory finally to further widen the discussion on the applications space neuromorphic computing aspects have been included this book is a key resource for postgraduate students and academic researchers in physics materials science and electrical engineering in addition it will be a valuable tool for research and development managers concerned with electronics semiconductors nanotechnology solid state memories magnetic materials organic materials and portable electronic devices discusses emerging devices and research trends such as neuromorphic computing and oxide based ferroelectric memories provides an overview on developing nonvolatile memory and storage technologies and explores their strengths and weaknesses examines improvements to flash technology charge trapping and resistive random access memory

Magnetic Memory Technology 2021-01-07 this book gives insight into the emerging semiconductor devices from their applications in electronic circuits it discusses the challenges in the field of engineering

and applications of advanced low power devices emerging low power semiconductor devices applications for future technology nodes offers essential exposure to low power devices and applications in wireless biosensing and circuit domains this book provides a detailed discussion on all aspects including the current and future scenarios related to the low power device the book also presents basic knowledge about field effect transistor fet devices and introduces emerging and novel fet devices the chapters include a review of the usage of fet devices in various domains like biosensing wireless and cryogenics applications the chapters also explore device circuit co design issues in the digital and analog domains the content is presented in an easy to follow manner that makes it ideal for individuals new to the subject this book is intended for scientists researchers and postgraduate students looking for an understanding of device physics circuits and systems

Advances in Non-volatile Memory and Storage Technology 2019-06-15 handbook of magnetic materials volume 29 highlights new advances in the field with this new volume presenting interesting chapters written by an international board of authors on topics such as spin orbit torque provides the authority and expertise of leading contributors from an international board of authors presents the latest release in the handbook of magnetic materials series

Emerging Low-Power Semiconductor Devices 2022-08-31 this book provides a comprehensive introduction to spintronics based computing for the next generation of ultra low power highly reliable logic it will cover aspects from device to system level including magnetic memory cells device modeling hybrid circuit structure design methodology cad tools and technological integration methods this book is accessible to a variety of readers and little or no background in magnetism and spin electronics are required to understand its content the multidisciplinary team of expert authors from circuits devices computer architecture cad and system design reveal to readers the potential of spintronics nanodevices to reduce power consumption improve reliability and enable new functionality

Handbook of Magnetic Materials 2020-11-29 magnetic nanowires and microwires are key tools in the development ofenhanced devices for information technology memory and data processing andsensing offering the combined characteristics of high density high speed andnon volatility they facilitate reliable control of the motion of magnetic domainwalls a key requirement for the development of novel classes of logic and storagedevices part one introduces the design and synthesis of magnetic nanowires andmicrowires reviewing the growth and processing of nanowires and nanowireheterostructures using such methods as sol gel and electrodepositioncombinations focused electron ion beam induced deposition chemicalvapour transport quenching and drawing and magnetic interactions magneticand transport properties alongside domain walls in nano and microwiresare then explored in part two before part three goes on to explore a widerange of applications for magnetic nano and microwire devices includingmemory microwave and electrochemical applications in addition to thermalspin polarization and configuration magnetocalorific effects and bloch pointdynamics detailed coverage of multiple key techniques for the growth and processing of nanowires and microwires reviews the principles and difficulties involved in applying magnetic nano and microwires to a wide range of applications combines the expertise of specialists from around the globe to give a broad overview of current and future trends

Spintronics-based Computing 2015-05-11 in a new branch of physics and technology called spin electronics or spintronics the flow of electrical charge usual current as well as the flow of electron spin the so called spin current are manipulated and controlled together this book is intended to provide an introduction and guide to the new physics and applications of spin current

Magnetic Nano- and Microwires 2015-05-27 this book offers a balanced and comprehensive guide to the core principles fundamental properties experimental approaches and state of the art applications of two major groups of emerging non volatile memory technologies i e spintronics based devices as well as resistive switching devices also known as resistive random access memory rram the first section presents different types of spintronic based devices i e magnetic tunnel junction mtj domain wall and skyrmion memory devices this section describes how their developments have led to various promising

applications such as microwave oscillators detectors magnetic logic and neuromorphic engineered systems in the second half of the book the underlying device physics supported by different experimental observations and modelling of rram devices are presented with memory array level implementation an insight into rram desired properties as synaptic element in neuromorphic computing platforms from material and algorithms viewpoint is also discussed with specific example in automatic sound classification framework

Spin Current 2017 solid state physics volume 71 provides the latest volume in this long running series this latest volume highlights new advances in the field with this new volume presenting interesting chapters written by an international board of authors provides the authority and expertise of leading contributors from an international board of authors presents the latest release in the solid state physics series offers an updated release that includes the latest information in solid state physics

Emerging Non-volatile Memory Technologies 2021-01-09 the frontiers in materials editorial office team are delighted to present the second edition of the rising stars article collection frontiers in materials rising stars 2020 showcasing the high quality work of internationally recognized researchers in the early stages of their independent careers all rising star researchers featured within this collection were individually nominated by the topic editors in recognition of their potential to influence the future directions of their respective fields the work presented here highlights the diversity of research performed across the entire breadth of the materials science and engineering field and presents advances in theory experimentation and methodology with applications for solving compelling problems this editorial features the corresponding author s of each paper published within this important collection ordered by section alphabetically highlighting them as the great researchers of the future the frontiers in materials editorial office team would like to thank each researcher who contributed their work to this collection we would also like to personally thank the topic editors for their exemplary leadership of this article collection their strong support and passion for this important community driven collection has ensured its success and global impact emily young journal development manager

Solid State Physics 2020-11-12 nanomagnetic and spintronic computing devices are strong contenders for future replacements of cmos this is an important and rapidly evolving area with the semiconductor industry investing significantly in the study of nanomagnetic phenomena and in developing strategies to pinpoint and regulate nanomagnetic reliably with a high degree of energy efficiency this timely book explores the recent and on going research into nanomagnetic based technology key features detailed background material and comprehensive descriptions of the current state of the art research on each topic focuses on direct applications to devices that have potential to replace cmos devices for computing applications such as memory logic and higher order information processing discusses spin based devices where the spin degree of freedom of charge carriers are exploited for device operation and ultimately information processing describes magnet switching methodologies to minimize energy dissipation comprehensive bibliographies included for each chapter enabling readers to conduct further research in this field written by internationally recognized experts this book provides an overview of a rapidly burgeoning field for electronic device engineers field based applied physicists material scientists and nanotechnologists furthermore its clear and concise form equips readers with the basic understanding required to comprehend the present stage of development and to be able to contribute to future development nanomagnetic and spintronic devices for energy efficient memory and computing is also an indispensable resource for students and researchers interested in computer hardware device physics and circuits design

Frontiers in Materials: Rising Stars 2020 2021-07-08 during the last six decades yang mills theory has increasingly become the cornerstone of theoretical physics it is seemingly the only fully consistent relativistic quantum many body theory in four space time dimensions as such it is the underlying theoretical framework for the standard model of particle physics which has been shown to be the correct theory at the energies we now can measure it has been investigated also from many other perspectives

and many new and unexpected features have been uncovered from this theory in recent decades apart from high energy physics the theory has been actively applied in other branches of physics such as statistical physics condensed matter physics nonlinear systems etc this makes the theory an indispensable topic for all who are involved in physics the conference celebrated the exceptional achievements using yang mills theory over the years but also many other truly remarkable contributions to different branches of physics from prof c n yang this volume collects the invaluable talks by prof c n yang and the invited speakers reviewing these remarkable contributions and their importance for the future of physics contents the future of physics revisited c n yang quantum chromodynamics the perfect yang mills gauge field theory david gross maximally supersymmetric yang mills theory the story of n 4 yang mills theory lars brink the lattice and quantized yang mills theory michael creutz yang mills theories at high energy accelerators george sterman yang mills theory at 60 milestones landmarks and interesting questions ling lie chau discovery of the first yang mills gauge particle the gluon sau lan wu yang mills gauge theory and higgs particle tai tsun wu sau lan wu scenario for the renormalization in the 4d yang mills theory l d faddeev statistical physics in the oeuvre of chen ning yang michael e fisher quantum vorticity in nature kerson huang yang mills theory and fermionic path integrals kazuo fujikawa yang mills gauge theory and the higgs boson family ngee pong chang on the physics of the minimal length the questions of gauge invariance lay nam chang djordje minic ahmed roman chen sun tatsu takeuchi generalization of the yang mills theory g savvidy some thoughts about yang mills theory a zee gauging quantum groups yang baxter joining yang mills yong shi wu the framed standard model i a physics case for framing the yang mills theory chan hong mo tsou sheung tsun the framed standard model ii a first test against experiment chan hong mo tsou sheung tsun on the study of the higgs properties at a muon collider mario greco aharonov bohm types of phases in maxwell and yang mills field theories bruce h j mckellar yang mills for historians and philosophers r p crease gauge concepts in theoretical applied physics seng ghee tan mansoor b a jalil yang yang equilibrium statistical mechanics a brilliant method xi wen guan yang yang chen chern simons theory vassiliev invariants loop quantum gravity and functional integration without integration louis h kauffman the scattering equations and their off shell extension york peng yao feynman geometries sen hu andrey losev particle accelerator development selected examples jie wei a new storage ring light source alex chao new contributions to physics by prof c n yang 2009 2011 zhong qi ma brief overview of c n yang s 13 important contributions to physics yu shi readership graduate students and scientists working in high energy physics statistical physics and condensed matter physics

Nanomagnetic and Spintronic Devices for Energy-Efficient Memory and Computing 2016-01-27 emerging nanoelectronic devices focuses on the future direction of semiconductor and emerging nanoscale device technology as the dimensional scaling of cmos approaches its limits alternate information processing devices and microarchitectures are being explored to sustain increasing functionality at decreasing cost into the indefinite future this is driving new paradigms of information processing enabled by innovative new devices circuits and architectures necessary to support an increasingly interconnected world through a rapidly evolving internet this original title provides a fresh perspective on emerging research devices in 26 up to date chapters written by the leading researchers in their respective areas it supplements and extends the work performed by the emerging research devices working group of the international technology roadmap for semiconductors itrs key features serves as an authoritative tutorial on innovative devices and architectures that populate the dynamic world of beyond cmos technologies provides a realistic assessment of the strengths weaknesses and key unknowns associated with each technology suggests guidelines for the directions of future development of each technology emphasizes physical concepts over mathematical development provides an essential resource for students researchers and practicing engineers

60 Years of YangCMills Gauge Field Theories 2016-04-21 the book intends to bring under one roof research work of leading groups from across the globe working on advanced applications of emerging

memory technology nanodevices the applications dealt in the text will be beyond conventional storage application of semiconductor memory devices the text will deal with material and device physical principles that give rise to interesting characteristics and phenomena in the emerging memory device that can be exploited for a wide variety of applications applications covered will include system centric cases such as caches nvsram nvtcam hybrid cmos rram circuits for machine learning in memory computing hardware security rng puf biosensing and other misc beyond storage applications the book is envisioned for multi purpose use as a textbook in advanced ug pg courses and a research text for scientists working in the domain

Emerging Nanoelectronic Devices 2014-11-12 this volume on ultrafast magnetism is a collection of articles presented at the international ultrafast magnetization conference held at the congress center in strasbourg france from october 28th to november 1st 2013 this first conference which is intended to be held every two years received a wonderful attendance and gathered scientists from 27 countries in the field of femtomagnetism encompassing many theoretical and experimental research subjects related to the spins dynamics in bulk or nanostructured materials the participants appreciated this unique opportunity for discussing new ideas and debating on various physical interpretations of the reported phenomena the format of a single session with many oral contributions as well as extensive time for poster presentations allowed researchers to have a detailed overview of the field importantly one could sense that in addition to studying fundamental magnetic phenomena ultrafast magnetism has entered in a phase where applied physics and engineering are playing an important role several devices are being proposed with exciting r d perspectives in the near future in particular for magnetic recording time resolved magnetic imaging and spin polarized transport therefore establishing connections between various aspects of modern magnetism simultaneously the diversity of techniques and experimental configurations has flourished during the past years employing in particular xrays visible infra red and terahertz radiations it was also obvious that an important effort is being made for tracking the dynamics of spins and magnetic domains at the nanometer scale opening the pathway to exciting future developments the concerted efforts between theoretical and experimental approaches for explaining the dynamical behaviors of angular momentum and energy levels on different classes of magnetic materials are worth pointing out finally it was unanimously recognized that the quality of the scientific oral and poster presentations contributed to bring the conference to a very high international standard

Applications of Emerging Memory Technology 2019-07-16 this book presents recent and important developments in the field of photonics and optoelectronics with a particular focus on laser technology optical communications optoelectronic devices and image processing at present photonics and optoelectronics technologies are pivotal to the future of laser displays sensors and communication technologies and currently being developed at an extraordinary rate this book details the theories underlying the mechanisms involved in the relevant photonics and optoelectronics devices such as laser diodes photodetectors and integrated optoelectronic circuits are investigated the reviews by leading experts are of interest to researchers and engineers as well as advanced students

Ultrafast Magnetism I 2014-08-05 discover the latest advances in spintronic materials devices and applications in spintronics materials devices and applications a team of distinguished researchers delivers a holistic introduction to spintronic effects within cutting edge materials and applications containing the perfect balance of academic research and practical application the book discusses the potential and the key limitations and challenges of spintronic devices the latest title in the wiley series in materials for electronic and optoelectronic applications spintronics materials devices and applications explores giant magneto resistance gmr and tunneling magnetic resistance tmr materials spin transfer torque and spin orbit torque materials spin oscillators and spin materials for use in artificial neural networks applications in multi ferroelectric and antiferromagnetic materials are presented as well this book also includes a thorough introduction to recent research developments in the fields of spintronic materials devices and applications comprehensive explorations of skymions magnetic semiconductors

and antiferromagnetic materials practical discussions of spin transfer torque materials and devices for magnetic random access memory in depth examinations of giant magneto resistance materials and devices for magnetic sensors perfect for advanced students and researchers in materials science physics electronics and computer science spintronics materials devices and applications will also earn a place in the libraries of professionals working in the manufacture of optics photonics and nanometrology equipment

Advances in Optoelectronic Technology and Industry Development 2019-09-25 this book provides a state of the art overview of a highly interesting emerging research field in solid state physics nanomaterials science topological structures in ferroic materials topological structures in ferroic materials have received strongly increasing attention in the last few years such structures include domain walls skyrmions and vortices which can form in ferroelectric magnetic ferroelastic or multiferroic materials these topological structures can have completely different properties from the bulk material they form in they also can be controlled by external fields electrical magnetic strain or currents which makes them interesting from a fundamental research point of view as well as for potential novel nanomaterials applications to provide a comprehensive overview international leading researches in these fields contributed review like chapters about their own work and the work of other researchers to provide a current view of this highly interesting topic

Spintronics 2022-07-25 artificial intelligence ai has found many applications in the past decade due to the ever increasing computing power artificial neural networks are inspired in the brain structure and consist in the interconnection of artificial neurons through artificial synapses training these systems requires huge amounts of data and after the network is trained it can recognize unforeseen data and provide useful information the so called spiking neural networks behave similarly to how the brain functions and are very energy efficient up to this moment both spiking and conventional neural networks have been implemented in software programs running on conventional computing units however this approach requires high computing power a large physical space and is energy inefficient thus there is an increasing interest in developing ai tools directly implemented in hardware the first hardware demonstrations have been based on cmos circuits for neurons and specific communication protocols for synapses however to further increase training speed and energy efficiency while decreasing system size the combination of cmos neurons with memristor synapses is being explored the memristor is a resistor with memory which behaves similarly to biological synapses this book explores the state of the art of neuromorphic circuits implementing neural networks with memristors for ai applications

Topological Structures in Ferroic Materials 2016-02-12 this textbook provides a theoretical background for contemporary trends in solid state theory and semiconductor device physics it discusses advanced methods of quantum mechanics and field theory and is therefore primarily intended for graduate students in theoretical and experimental physics who have already studied electrodynamics statistical physics and quantum mechanics it also relates solid state physics fundamentals to semiconductor device applications and includes auxiliary results from mathematics and quantum mechanics making the book useful also for graduate students in electrical engineering and material science key features explores concepts common in textbooks on semiconductors in addition to topics not included in similar books currently available on the market such as the topology of hilbert space in crystals contains the latest research and developments in the field written in an accessible yet rigorous manner

Memristors for Neuromorphic Circuits and Artificial Intelligence Applications 2020-04-09 nanomagnetic materials fabrication characterization and application explores recent studies of conventional nanomagnetic materials in spintronics data storage magnetic sensors and biomedical applications in addition the book also reviews novel magnetic characteristics induced in two dimensional materials diamonds and those induced by the artificial formation of lattice defect and heterojunction as novel nanomagnetic materials nanomagnetic materials are usually based on d and f electron systems

they are an important solution to the demand for higher density of information storage arising from the emergence of novel technologies required for non volatile memory systems advances in the understanding of magnetization dynamics and in the characteristics of nanoparticles or surface of nanomagnetic materials is resulting in greater expansion of applications of nanomagnetic materials including in biotechnology sensor devices energy harvesting and power generating systems this book provides a cogent overview of the latest research on novel nanomagnetic materials including spintronic nanomagnets molecular nanomagnets self assembling magnetic nanomaterials nanoparticles multifunctional materials and heterojunction induced novel magnetism explains manufacturing principles and process for nanomagnetic materials discusses physical and chemical properties and potential industrial applications such as magnetic data storage sensors oscillator permanent magnets power generations and biomedical applications assesses the major challenges of using magnetic nanomaterials on a broad scale

Modern Semiconductor Physics and Device Applications 2021-11-22 the primary aim of this book is to discuss various aspects of nanoscale device design and their applications including transport mechanism modeling and circuit applications provides a platform for modeling and analysis of state of the art devices in nanoscale regime reviews issues related to optimizing the sub nanometer device performance and addresses simulation aspect and or fabrication process of devices also includes design problems at the end of each chapter

Nanomagnetic Materials 2021-06-28 spintronics handbook second edition offers an update on the single most comprehensive survey of the two intertwined fields of spintronics and magnetism covering the diverse array of materials and structures including silicon organic semiconductors carbon nanotubes graphene and engineered nanostructures it focuses on seminal pioneering work together with the latest in cutting edge advances notably extended discussion of two dimensional materials beyond graphene topological insulators skyrmions and molecular spintronics the main sections cover physical phenomena spin dependent tunneling control of spin and magnetism in semiconductors and spin based applications features presents the most comprehensive reference text for the overlapping fields of spintronics spin transport and magnetism covers the full spectrum of materials and structures from silicon and organic semiconductors to carbon nanotubes graphene and engineered nanostructures extends coverage of two dimensional materials beyond graphene including molybdenum disulfide and study of their spin relaxation mechanisms includes new dedicated chapters on cutting edge topics such as spin orbit torques topological insulators half metals complex oxide materials and skyrmions discusses important emerging areas of spintronics with superconductors spin wave spintronics benchmarking of spintronics devices and theory and experimental approaches to molecular spintronics evgeny tsymbal s research is focused on computational materials science aiming at the understanding of fundamental properties of advanced ferromagnetic and ferroelectric nanostructures and materials relevant to nanoelectronics and spintronics he is a george holmes university distinguished professor at the department of physics and astronomy of the university of nebraska lincoln unl director of the unl s materials research science and engineering center mrsec and director of the multi institutional center for nanoferroic devices cnfd igor Žutić received his ph d in theoretical physics at the university of minnesota his work spans a range of topics from high temperature superconductors and ferromagnetism that can get stronger as the temperature is increased to prediction of various spin based devices he is a recipient of 2006 national science foundation career award 2005 national research council american society for engineering education postdoctoral research award and the national research council fellowship 2003 2005 his research is supported by the national science foundation the office of naval research the department of energy and the airforce office of scientific research

Nanoscale Devices 2018-11-16 spintronics handbook second edition offers an update on the single most comprehensive survey of the two intertwined fields of spintronics and magnetism covering the diverse array of materials and structures including silicon organic semiconductors carbon nanotubes graphene

and engineered nanostructures it focuses on seminal pioneering work together with the latest in cutting edge advances notably extended discussion of two dimensional materials beyond graphene topological insulators skyrmions and molecular spintronics the main sections cover physical phenomena spin dependent tunneling control of spin and magnetism in semiconductors and spin based applications *Spintronics Handbook, Second Edition: Spin Transport and Magnetism* 2019-06-26 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

Spintronics Handbook, Second Edition: Spin Transport and Magnetism 2019-05-09 magnetic skyrmions are particle like objects described by localized solutions of non linear partial differential equations up until a few decades ago it was believed that magnetic skyrmions only existed in condensed matter as short term excitations that would quickly collapse into linear singularities the contrary was proven theoretically in 1989 and evidentially in 2009 it is now known that skyrmions can exist as long living metastable configurations in low symmetry condensed matter systems with broken mirror symmetry increasing the potential applications possible magnetic skyrmions and their applications delves into the fundamental principles and most recent research and developments surrounding these unique magnetic particles despite achievements in the synthesis of systems stabilizing chiral magnetic skyrmions and the variety of experimental investigations and numerical calculations there have not been many summaries of the fundamental physical principles governing magnetic skyrmions or integrating those concepts with methods of detection characterization and potential applications magnetic skyrmions and their applications delivers a coherent state of the art discussion on the current knowledge and potential applications of magnetic skyrmions in magnetic materials and device applications first the book reviews key concepts such as topology magnetism and materials for magnetic skyrmions then charactization methods physical mechanisms and emerging applications are discussed covers background knowledge and details the basic principles of magnetic skyrmions including materials characterization statics and dynamics reviews materials for skyrmion stabilization including bulk materials and interface dominated multilayer materials describes both well known and unconventional applications of magnetic skyrmions such as memristors and reservoir computing

Time-resolved X-ray Imaging of Magnetization Dynamics in Spin Transfer Torque Devices 2008 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

Fundamentals of Low Dimensional Magnets 2022-08-29 solid state physics volume 68 provides the latest information on a branch of physics that is primarily devoted to the study of matter in its solid phase especially at the atomic level chapters in this updated volume include new research in the use of phonon polaritons in polar materials to do plasmonic like studies but without the plasmons along with a section on polar oxide interfaces this prestigious serial presents timely and state of the art reviews pertaining to all aspects of solid state physics contains contributions from leading authorities in the study of solid state physics especially at the atomic level informs and updates on all the latest developments in the field presents timely and state of the art reviews pertaining to all aspects of solid state physics

Magnetic Skyrmions and Their Applications 2021-06-03 as cmos scaling is approaching the fundamental physical limits a wide range of new nanoelectronic materials and devices have been proposed and explored to extend and or replace the current electronic devices and circuits so as to maintain progress with respect to speed and integration density the major limitations including low carrier mobility degraded subthreshold slope and heat dissipation have become more challenging to address as the size of silicon based metal oxide semiconductor field effect transistors mosfets has decreased to nanometers while device integration density has increased this book aims to present technical approaches that address the need for new nanoelectronic materials and devices the focus is on new concepts and knowledge in nanoscience and nanotechnology for applications in logic memory sensors photonics and renewable energy this research on nanoelectronic materials and devices will be instructive in finding solutions to address the challenges of current electronics in switching speed power consumption and heat dissipation and will be of great interest to academic society and the industry

Emerging Applications of Low Dimensional Magnets 2022-11-28 explore the cutting edge of neuromorphic technologies with applications in artificial intelligence in neuromorphic devices for brain inspired computing artificial intelligence perception and robotics a team of expert engineers delivers a comprehensive discussion of all aspects of neuromorphic electronics designed to assist researchers and professionals to understand and apply all manner of brain inspired computing and perception technologies the book covers both memristic and neuromorphic devices including spintronic multi terminal and neuromorphic perceptual applications summarizing recent progress made in five distinct configurations of brain inspired computing the authors explore this promising technology s potential applications in two specific areas neuromorphic computing systems and neuromorphic perceptual systems the book also includes a thorough introduction to two terminal neuromorphic memristors including memristive devices and resistive switching mechanisms comprehensive explorations of spintronic neuromorphic devices and multi terminal neuromorphic devices with cognitive behaviors practical discussions of neuromorphic devices based on chalcogenide and organic materials in depth examinations of neuromorphic computing and perceptual systems with emerging devices perfect for materials scientists biochemists and electronics engineers neuromorphic devices for brain inspired computing artificial intelligence perception and robotics will also earn a place in the libraries of neurochemists neurobiologists and neurophysiologists

Solid State Physics 2017-11-18 multiferroics materials with a coexistence of magnetic and ferroelectric order provide an efficient route for the control of magnetism by electric fields the authors cover multiferroic thin film heterostructures device architectures and domain interface effects they critically discuss achievements as well as limitations and assess opportunities for future applications

Nanoelectronic Materials, Devices and Modeling 2019-07-15 this is the first book providing overview of magnetism in curved geometries highlighting numerous peculiarities emerging from geometrically curved magnetic objects such as curved wires shells as well as complex three dimensional structures extending planar two dimensional structures into the three dimensional space has become a general trend in multiple disciplines across electronics photonics plasmonics and magnetics this approach provides the means to modify conventional and even launch novel functionalities by tailoring the local curvature of an object the book covers the theory of curvilinear micromagnetism as well as

experimental studies of geometrically curved magnets including both fabrication and characterization with its coverage of fundamental aspects together with exploration of numerous applications across magnonics bio engineering soft robotics and shapeable magnetoelectronics this edited collection is ideal for all scientists in academia and industry seeking an overview and wishing to keep abreast of advances in the novel field of curvilinear micromagnetism it provides easy but comprehensive access to the field for newcomers and can be used for graduate level courses on this subject

Neuromorphic Devices for Brain-inspired Computing 2021-12-10 spintronic 2d materials fundamentals and applications provides an overview of the fundamental theory of 2d electronic systems that includes a selection of the most intensively investigated 2d materials the book tells the story of 2d spintronics in a systematic and comprehensive way providing the growing community of spintronics researchers with a key reference part one addresses the fundamental theoretical aspects of 2d materials and spin transport while parts two through four explore 2d material systems including graphene topological insulators and transition metal dichalcogenides each section discusses properties key issues and recent developments in addition the material growth method from lab to mass production device fabrication and characterization techniques are included throughout the book discusses the fundamentals and applications of spintronics of 2d materials such as graphene topological insulators and transition metal dichalcogenides includes an in depth look at each materials system from material growth device fabrication and characterization techniques presents the latest solutions on key challenges such as the spin lifetime of 2d materials spin injection efficiency the potential proximity effects and much more

Multiferroics 2021-06-21 this thesis contains three breakthrough results in condensed matter physics firstly broken reflection symmetry in the hidden order phase of the heavy fermion material uru2si2 is observed for the first time this represents a significant advance in the understanding of this enigmatic material which has long intrigued the condensed matter community due to its emergent long range order exhibited at low temperatures the so called hidden order secondly and thirdly a novel collective mode the chiral spin wave and a novel composite particle the chiral exciton are discovered in the three dimensional topological insulator bi2se3 this opens up new avenues of possibility for the use of topological insulators in photonic optoelectronic and spintronic devices these discoveries are facilitated by using low temperature polarized raman spectroscopy as a tool for identifying optically excited collective modes in strongly correlated electron systems and three dimensional topological insulators

Curvilinear Micromagnetism 2022-11-02 magnetic materials are important materials for high tech areas and technological development which are being classified not only based on their origin but also by the nature of processing properties functions and applications this book presents an overview of the different types of new magnetic materials and hybrid structures that exhibit different magnetic phenomena and interesting properties the reported materials are studied theoretically and experimentally which are the building blocks of all technological innovations topics such as magnetic levitation are given for industrial applications the chapters of the book provide a key description of magnetic materials this book is suitable for undergraduate and graduate students and professionals including engineers scientists researchers technicians and technology managers this book gives an idea to readers for scientific innovation in this field

Spintronic 2D Materials 2019-06-15 this first book to focus on the applications of nanomagnetism presents those already realized while also suggesting bold ideas for further breakthroughs the first part is devoted to the concept of spin electronics and its use for data storage and magnetic sensing while the second part concentrates on magnetic nanoparticles and their use in industrial environment biological and medical applications the third more prospective part goes on to describe emerging applications related to spin current creation and manipulation dynamics spin waves and binary logic based on nano scale magnetism with its unique choice of topics and authors this will appeal to academic as well as corporate researchers in a wide range of disciplines from physics via materials science to engineering

chemistry and life science
Collective Excitations in the Antisymmetric Channel of Raman Spectroscopy 2021-12-08
Magnetic Materials and Magnetic Levitation 2021-03-24
Nanomagnetism 2017-03-17

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