Scientific Report 2010 - 2011
Table of contents

Foreword 1
Management 2
Staff 3
Locations 6
Contacts 7

Research lines 8
Materials and mechanism of superconductivity and its power application 9
Superconductive and hybrid quantum nanostructures and devices 14
Cooperative phenomena in advanced materials with magnetic and/or dipolar electric ordering 19
Functional materials and novel devices for electronics and energy applications 26
Dynamical, electronic and transport properties of complex systems and functional materials 35

Selected experimental facilities 40
Thin Film Deposition 41
Lithography 47
Bulk material preparation 49
Structural, morphological and chemical properties 50
Optical properties and characterization 52
Electronic and transport properties 54
Computation 56

Projects 57
Highlights 69
Publications 89
Events 112

In memory of Antonio Barone 113
On February 1st, 2010, the Italian CNR Institute INFM (Istituto Nazionale per la Fisica della Materia) was formally closed. On the same day, three new Institutes were created inside CNR (National Research Council). One of these is “SPIN”, an evocative name as well as an acronym for “SuPerconductors, oxides and other INnovative materials and devices”.

SPIN has included four previous INFM structures: Coherentia (Naples), LAMIA (Genova), SUPERMAT (Salerno) and CASTI (l’Aquila). Accordingly, SPIN has now four “Operative Units” (UOS), one in each of these cities. A fifth SPIN location is in Rome.

The Institute headquarters are in Genova, in a CNR building (Villa Balbi-Brignole), the other UOS are hosted inside University locations.

SPIN brings together most of the Italian research groups active in superconductivity, novel oxide and hybrid and nanostructured materials. The Institute derives its strength from the internationally recognized activities in thin film deposition and device realization historically present in the area of Napoli and Salerno due to the pioneering work on the Josephson effect by Prof. Antonio Barone, recently depassed*, as well as the tradition in materials synthesis and in large-scale applications of superconductivity present in the Genova area, originally strongly encouraged by Prof. Carlo Rizzuto.

This Report presents the CNR-SPIN structure, research focus and experimental facilities, as well as the scientific achievements of the first two years of activity.

We are confident that the high level of our researchers, the high qualification of the management structure and the rich set of advanced scientific instrumentation as well as the advice of our International Advisory Board, will make in the next few years CNR-SPIN a relevant European institution in the area of superconductors, oxides and innovative materials, fully open to collaboration with all groups active at international level in these fields.

Ruggero Vaglio
Director, CNR-SPIN

* See “In memory of Antonio Barone” - pag. 113
Management

Director

Ruggero Vaglio

International Advisory Board

Agnes Barthelemy
University of Paris Sud

David Larbalestier
Applied Superconductivity Center, Florida

Petra Rudolf
University of Groningen

Alexey Ustinov
University of Karlsrhue

Jeroen Van Den Brink
Dresden University of Technology

Executive Board

Ruggero Vaglio
Emilio Bellingeri
Alessandro Braggio
Giovanni Cantele
Filippo Giubileo
Stefano Lettieri
Carmine Attanasio
Paolo Calvani
Gianpiero Pepe
Sergio Siri
Francesco Taurino
Researchers

Antonio Ambrosio (NA)
Carmela Aruta (NA)
Mario Barra (NA)
Emilio Bellingeri (GE)
Cristina Bercini (GE)
Francesco Bisio (GE)
Valeria Braccini (GE)
Alessandro Braggio (GE)
Renato Buzzio (GE)
Giovanni Cantele (NA)
Fabio Chiarella (SA)
Alessandro Ciattoni (AQ)
Carla Cirillo (SA)
Mario Cuoco (SA)
Gabriella De Luca (NA)
Emiliano Di Gennaro (NA)
Roberto Felici (RM)
Carlo Ferdeghini (GE)
Annalisa Fierro (NA)
Rosalba Fittipaldi (SA)
Fiona Forte (SA)
Andrea Gerbi (GE)
Paola Gentile (SA)
Filippo Giubile (SA)
Marcello Gombos (SA)
Gaia Grimaldi (SA)
Gianrico Lamura (GE)
Stefano Lettieri (NA)
Procolo Lucignano (NA)
Andrea Malagoli (GE)
Antigone Marino (NA)
Alberto Mario Martinelli (GE)
Nadia Martuccielli (SA)
Annamaria Massone (GE)
Fabio Mileto Granozio (NA)
Riccardo Moroni (GE)
Pasquale Origani (SA)
Ilaria Pallecchi (GE)
Domenico Paparo (NA)
Luca Pellegrino (GE)
Massimo Pica Ciamarra (NA)
Silvia Picozzi (AQ)
Alberto Porzio (NA)
Marco Salluzzo (NA)
Alessandra Stroppa (AQ)
Volodymyr Tkachenko (NA)
Massimo Valentino (NA)
Andrei Varlamov (RM)
Antonio Vecchione (SA)
Xuan Wang (NA)
G.Claudio Ghiringhelli (MI)
Mauro Giovannini (GE)
Giuseppe Iadonisi (NA)
Vincenzo Iannotti (NA)
Luciano Lanotte (NA)
Pasqualino Maddalena (NA)
Pietro Manfrinetti (GE)
Luigi Maritata (SA)
Daniele Marre’ (GE)
Lorenzo Marrucci (NA)
Paola Maselli (RM)
Pier Gianni Medaglia (RM)
Mario Nicodemi (NA)
Angela Nigro (SA)
Domenico Ninno (NA)
Canio Noce (SA)
Alessandra Nucara (RM)
Luca Ottaviano (AQ)
Sandro Pace (SA)
Sergio Pagano (SA)
Andrea Palenzona (GE)
Loredana Parlato (NA)
Fabianna Pellegrini (SA)
Massimiliano Polichetti (SA)
Marina Putti (GE)
Robert Raimondi (GE)
Alfonso Romano (SA)
Paola Romano (SA)
Aniello Saggese (SA)
Maura Sassetti (GE)
Umberto Scotti Di Uccio (NA)
Antonio Sergio Siri (GE)
Francesco Tofani (NA)
Arturo Tagliacozzo (NA)
Antonello Tebano (RM)
Ruggero Vaglio (NA)
Alessandro Verri (GE)
Luciano R. M. Vicari (NA)

Research Associates

Giancarlo Abbate (NA)
Giuseppina Ambrosone (NA)
Salvatore Amoruso (NA)
Antonello Andreone (NA)
Carmine Attanasio (SA)
Giovanni Ausanio (NA)
Giuseppe Balestrino (RM)
Antonio Barone (NA)
Francesco Bloisi (NA)
Fabrizio Bobba (SA)
Lucia Braicovich (MI)
Riccardo Bruzese (NA)
Paolo Calvani (RM)
Giovanni Carapella (SA)
Antonio Cassinese (NA)
Vittorio Cataudella (NA)
Roberta Citro (SA)
Antonio Coniglio (NA)
Giorgio Andrea Costa (GE)
Giovanni Costabile (SA)
Anna Maria Cucolo (SA)
Antonio De Candia (NA)
Giulio De Filippis (NA)
Corrado De Liso (NA)
Roberto Di Capua (NA)
Daniele Di Castro (RM)
Paolo Dore (RM)
Maurizio Ferretti (GE)
Enrico Galleani D’aglano (GE)
Umberto Gambardella (SA)
Staff

Administrative Secretary

Sabrina Poggi (GE)

Administration

Stefania Scotto (GE)
Vincenza Calvisi (AQ)
Cristina Parisi (NA)
Antonia Loffredo (SA)

Management Support

Maria Paola Osteria (NA)
Adriana Santroni (GE)
Vincenzo De Martino (NA)
Gaetana Santoro (SA)

Personnel Management

Daniela Pollio (GE)
Maria Antonietta Gatti (AQ)

Technical Services

Marco Raimondo (GE)
Maurizio Vignolo (GE)
Salvatore Energico (NA)
Francesco Maria Taurino (NA)
Staff

Office of Administrative and Technical Support to the SPIN Institute established in Genova (shared with CNR NANO and IOM Institutes)

General Services
Marco Campani
José Carlos De Almeida Nunes Manganaro
Piero di Lello
Alberto Arnone
Paolo Ciocia

Recruitment of Temporary and Atypical Staff
Liliana Sciaccaluga
Matilde Bolla
Fabio Distefano
Marco Punginelli

Legal Services
Danilo Imperatore
Enrico Camauli
Maria Carla Garbarino
Giovanna Savoldi

Institutional Provisions
Management of Tenders and Contracts

Fund Raising
Italian, EU and International Projects
Barbara Cagnana
Paola Corezzola
Francesca Fortunati
Tatiana Marescalchi
Maria Chiara Andreoli

Industrial and Institutional Agreements
Roberta De Donatis
Monica Dalla Libera

Technology Transfer
Locations

SPIN belongs to the **CNR Material and Devices Department**, directed by Prof. Massimo Inguscio, and includes the following Operative Units:

**Genova** - main focus: superconductivity, innovative materials

Corso F.M. Perrone, 24 16152 Genova, Italy

www.spin.cnr.it

University of Genova Physics Department

Deputy Director: Carlo Ferdeghini

**Napoli** - main focus: superconducting devices/oxide and organic electronics

University of Napoli Federico II Physical Science Department

Deputy Director: Giovanni Piero Pepe

**Salerno** - main focus: superconductivity and magnetic hybrids

University of Salerno Physics Department

Deputy Director: Sergio Pagano

**L’Aquila** - main focus: ferroics and multiferroics

University of L’Aquila Physics Department

Deputy Director: Silvia Picozzi

**Roma** - main focus: oxide thin films/optical properties

University of “Tor Vergata” University of “La Sapienza”

Deputy Director: Giuseppe Balestrino
Contacts

Genova
Corso F.M. Perrone, 24
16152 Genova
Ph. +39 010 6598750
Fax +39 010 6506302
direttore@spin.cnr.it
segreteria@spin.cnr.it

Napoli
University of Napoli Federico II
c/o Department of Physics
Via Cintia
80126 Napoli
gpepe@na.infn.it

Salerno
University of Salerno
c/o Department of Physics
Via Ponte don Mellillo
84084 Fisciano (SA)
sergio.pagano@sa.infn.it

L’Aquila
University of L’Aquila
c/o Department of Physics
Via Vetoio Località Coppito
67100 L’Aquila
silvia.picozzi@spin.cnr.it

Roma
University of Roma La Sapienza
c/o Department of Physics
Piazzale Aldo Moro, 2
00185 Roma
balestrino@uniroma2.it

University of Roma Tor Vergata
c/o Department of Physics
Via Della Ricerca Scientifica, 1
00133 Roma
Research Lines

SPIN mission is the study of superconductors and other innovative materials for electronic devices and for energetics. The research activities span over:

Basic experimental and theoretical studies on superconducting and magnetic materials, strongly correlate oxides and other innovative materials

Material preparation (bulk, single crystals, thin films, multilayers, epitaxial superlattice)

Advanced material characterization based on radiation-matter interactions (also at Syncrotron Radiation Facilities), transport and electronic properties measurements also in presence of high external fields.

Micro/nano superconducting electronic devices (for quantum computation and other applications), electronic devices based on oxides ("oxide electronics") and other innovative materials.

Realization of superconducting cables and tapes for power applications in the fields of biomedicine and high energy physics

The activities are formally organized into five “Activities”:

Materials and mechanisms of superconductivity and its power applications (Activity leader: Marina Putti)

Superconductive and hybrid quantum nanostructures and devices (Activity leader: Francesco Tafuri)

Cooperative phenomena in advanced materials with magnetic and/or dipolar electric ordering (Activity leader: Antonio Vecchione)

Functional materials and novel devices for electronics and energy applications (Activity leader: Daniele Marre’)

Dynamical, electronic and transport properties of complex systems and functional materials (Activity leader: Vittorio Cataudella)
Materials and mechanism of superconductivity and its power application

Activity leader: Marnia Putti

General description

The discovery of superconductivity in cuprates, borocarbides, diborides and pnictides has brought the attention on the importance of non conventional pairing mechanisms, multiband effects and the coexistence of superconductivity and antiferromagnetic ordering. These features offer new opportunities for understanding of high-temperature superconductivity, and also limitations and advantages of non conventional superconductors. Thanks to the skills developed in sample synthesis, as well as in theoretical and experimental investigations the SPIN researchers established a fruitful network of national and international research collaborations: all started with the cuprates, later with MgB2 and finally with the newly discovered Fe-based superconductors (FeSC).

The recent discovery of novel superconducting materials is going to offer new challenges in the understanding of the mechanisms, the development of new preparation techniques and the exploring of potential in view of applications. The activities of this commessa cover all these aspects. The synthesis of superconducting materials in form of bulks, single crystals, thin films and multilayers. The theoretical and experimental investigation of superconducting and normal state properties. The development and test of wires and cables for power applications.

The commessa activities range over the preparation of materials in the form of bulk, thin films and tapes, wide-range investigation of the properties, development and test of cables for power applications. All these activities will be carried on in two research units in strong connection each others, being aware that only a full control of the preparation techniques, a in-depth knowledge of material properties will allow significant step improvements for future application.
Materials and mechanism of superconductivity and its power application

Activity leader: Marina Putti

1.1 Superconductivity: materials, mechanisms and technological transfer (Genoa)

Researchers of the Genoa unit belong both to the physics and chemistry fields and have long tradition and competence in material science. The activities range over: material preparation: bulks and single crystals synthesis, thin film deposition, superconducting tape and wire manufacturing; structural and chemical characterization by XRD, neutron diffraction and synchrotron radiation experimental investigations by thermal, transport, magnetic, optical properties measurements and muon spin spectroscopy; theoretical modelling: ab-initio calculations, phenomenological models and fluctuoscopy of superconductors.

At present the research is focused on MgB2 and FeSC. FeSC are investigated with the twofold aim of understanding the coupling mechanisms and exploring their potential for application. Research on MgB2 is devoted to the improvements of cable performances for application like MRI systems and fault current limiters.

Contact person: Marina Putti (putti@fisica.unige.it)

Researchers:
C. Bernini, V. Braccini, C. Ferdeghini, G. Lamura, A. Malagoli, A. Martinelli, I. Pallecchi (50%), A. Varlamov (50%), M. Vignolo, G. Romano, M. Tropeano, F. Gagliardi

Associate researchers:
M. Giovannini, P. Manfrinetti, A. Palenzona, M. Putti, A. Siri (50%), E. Galleani D'agliano, P. Dore, V. Palmieri, A. Provino
Materials and mechanism of superconductivity and its power application

Activity leader: Marina Putti

References:

Giant Nernst effect due to fluctuating Cooper pairs in superconductors, M.N.Serbin, M.A.Skvortsov, A.A.Varlamov, Viktor Galitski, PHYSICAL REVIEW LETTERS, 102, 067001, (2009)

Role of the Grain Oxidation in Improving the In-Field Behaviour of MgB2 Ex-Situ Tapes, Vignolo M, Romano G, Malagoli A, et al., IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY 19, 2718-2721 (2009)

T-c=21 K in epitaxial FeSe0.5Te0.5 thin films with biaxial compressive strain, Bellingeri E, Pallecchi I, Buzio R, A. Gerbi, D. Marrè, M. R. Cimberle, M. Tropeano, M. Putti, A. Palenzona, and C. Ferdeghini, APPLIED PHYSICS LETTERS 96, 102512 (2010)


Pressure Effects in the Isolelectronic REFe0.85Ir0.15AsO System, Maroni, B Di Castro, D; Hanfland, M; Boby, J;Vercesi, C; Mozzati, MC; Weyeneth, S; Keller, H; Khasanov, R; Drathen, C; Dore, P; Postorino, P; Malavasi, L, JOURNAL OF THE AMERICAN CHEMICAL SOCIETY 133, 3252 (2011)
1.2 Static and dynamic properties of type-II superconductors, and their functional use for energy applications (Salerno)

Superconducting materials offer a huge potential applicability due to the high current carrying capability in high magnetic fields. Electric and magnetic properties in type-II superconductors play a crucial role in determining energy losses and critical currents and fields available for applications. Dissipations occur whenever vortices move through the pinning potential due to material defects, so to preserve lossless superconducting state the dynamic interaction between vortices and defects should be investigated. On the other hand, the stability of the superconducting state has to be pursued in most superconducting devices for energy: MRI, SMES, FCL, magnetic levitation, electric motors. Quenching, flux jumping and vortex instability due to electronic and/or thermomagnetic instability afflict all high field superconductors. Research activities in Salerno focus on bulk fabrication and characterization of innovative materials: transport, magnetic, thermal and electric noise measurements.

Contact person: Gaia Grimaldi (gaia.grimaldi@spin.cnr.it)

Researchers:
M. Gombos, G. Grimaldi, D. Zola, C. Barone (50%)

Associate researchers:
U. Gambardella, G. Filatrella, S. Pace, M. Polichetti, A. Saggese
Research Lines

Materials and mechanism of superconductivity and its power application

Activity leader: Marina Putti

References:

Granularity and vortex dynamics in LaFeAsO0.92F0.08 probed by harmonics of the ac magnetic susceptibility, M. Polichetti, M.G. Adesso, D. Zola, J. Luo, G.F. Chen, Z. Li, N.L Wang, C. Noce, S. Pace, PHYSICAL REVIEW B 78, 224523 (2008)

Impact of the starting powder composition on GdSr2RuCu2O8 melt-textured processes, R. Ciancio, M. Gombos, G. Grimaldi, A. Nigro, A. Vecchione, S. Pace, IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY 19, 2945 (2009)


Weak localization and 1/f noise in NdCeCuO thin films, C. Barone, A. Guarino, A. Nigro, A. Romano, and S. Pagano, PHYSICAL REVIEW B 80, 224405 (2009)

Evidence for low-field crossover in the vortex critical velocity of type-II superconducting thin films, G. Grimaldi, A. Leo, D. Zola, A. Nigro, S. Pace, F. Laviano, E. Mezzetti, PHYSICAL REVIEW B 82, 024512 (2010)
The research activity is focused on fundamental aspects of superconductivity and possible applications. Junctions, hybrid nanostructures and nanowires of both traditional and unconventional superconductors (including high-Tc cuprates) are investigated. Mesoscopic hybrid structures and nanowires are engineered as particle and radiation sensors. Quantum coherence is the target of experimental activities on macroscopic quantum phenomena in Josephson junctions and on optical systems.

Quantum suppression of superconductivity in nanowires, the phase diagram of the superconductor-insulator transition, the dissipative dynamics induced by phase slips mechanism, for instance, are not only the bridge to novel physics, but also the key for a new generation of particle and radiation sensors. In addition transport studies of nanoscale devices can be instrumental in discerning the nature of the ground state of unconventional materials, and especially of strongly correlated systems. Studies on quantum properties of Josephson junctions respond to the wide-spread need of expanding quantum technologies and in particular of developing quantum computation. In solid state qubit architectures, superconducting junctions can be considered as “atoms with wires”, which display energy-level quantization and strongly interact with electromagnetic environment.
2.1 Quantum and non-equilibrium effects in junctions and hybrid nanostructures (Naples)

Within the general lines outlined above, the activity of the Naples node is more specifically directed:

- to realize and measure the properties of superconducting hybrid devices, to study transport mechanisms in Josephson junctions and to evaluate applicative impact;
- of mesoscopic devices and nanostructures;
- of superconducting and optical devices for quantum computation, to study macroscopic quantum effects in Josephson junctions, coherence and dissipation issues;
- to study non equilibrium superconductivity, radiation and particle sensors;
- to the physics of high critical temperature superconductivity through nano scale experiments
- to experiments aimed to optical entanglement and to realize hybrid superconducting/optical systems
- to perform non destructive evaluation tests on nanostructured materials.

Part of these activities are carried out in collaboration with prestigious National (NEST SNS) and International Institutions (IBM, Chalmers, Columbia,...).

Contact person: Francesco Tafuri (tafuri@na.infn.it)

Researchers:
P. Lucignano, A. Porzio, M. Valentino, D. Stornaiuolo, V. Pagliarulo

Associate researchers:
Superconductive and hybrid quantum nanostructures and devices

Activity leader: Francesco Tafuri

References:


Enabling Strategies in Organic Electronics Using Ordered Block Copolymer Nanostructures, Claudio De Rosa, Finizia Auriemma, Rocco Di Girolamo, Giovanni Piero Pepe, Teresa Napolitano, Rossana Scaldaferrri, Advanced Materials 22, 5414 (2010)
2.2 Superconducting and hybrid materials devices (Salerno)

The research activity focuses on both superconducting and innovative materials, with the twofold goal of deepening the knowledge of fundamental physics and of designing new devices. The study is performed on thin films and nanostructures based on traditional but also non-conventional superconductors. In this respect great effort has been devoted to the investigation of hybrid structures consisting of superconductors and ferromagnets. The research also covers the field of innovative materials, such as carbon nanotubes and graphene.

The unit has a well known experience in the fabrication and in the characterization of these materials, whose application of the analysed materials covers the field of superconducting and organic electronics, spintronics and radiation detectors. More specifically some of the main activities are:

- electrical transport measurements on thin superconducting films and hybrid nanostructures
- design of nanostructured superconducting devices (valves, diodes, radiation and macromolecules detectors)
- low frequency voltage-noise-spectral density analysis on innovative materials, such as Fe based superconductors
- low temperature and high field local scale scanning probe microscopy (AFM, STM, MFM) on both unconventional superconductors and heterostructures
- field emission from carbon nanotubes and graphene flakes

Contact person: Carla Cirillo (carla.cirillo@spin.cnr.it)

Researchers:
C. Cirillo, F. Giubileo, N. Martucciello

Associate researchers:
Superconductive and hybrid quantum nanostructures and devices

Activity leader: Francesco Tafuri

References:


Thermal and voltage activated excess 1/f noise in FeTe0.5Se0.5 epitaxial thin films C. Barone, S. Pagano, I. Pallecchi, E. Bellingeri, M. Putti, and C. Ferdeghini Physical Review B 83, 134523 (2011)
Cooperative phenomena in advanced materials with magnetic and/or dipolar electric ordering

Activity leader: Antonio Vecchione

The activity is focused on materials where the coupling of spin, charge, and orbital degrees of freedom emerging from the electron-electron and electron-lattice interaction leads to electrical and magnetic unconventional properties strongly depending on cooperative phenomena of coexistence and/or competition of different types of long-range orderings. The research associated with these topics is carried out through the synthesis, analysis and modeling of advanced materials based on these phenomena. Systems of interest are the manganites, ferroics (including oxides, fluorides, sulphides), multiferroics and magnetoelectrics materials, oxides of copper, titanium, manganese, ruthenium and their associated features (high-temperature and triplet superconductivity, dielectric/ferroelectricity and magnetic orderings).

Research Lines

General Description

Advanced materials with magnetic and/or dipolar electric ordering (eventually based on transition metal oxides) have been attracting an ever-increasing interest, due to the wide variety of physical properties that they exhibit, including unconventional superconductivity, piezo- and ferroelectricity, colossal magnetoresistance, multiferroicity and a number of exotic magnetic, charge and orbital orderings. Furthermore, interface made of those materials can show properties at the nanometer scale that are qualitatively different from their single building blocks, allowing to engineer novel functionalities by resorting to the controlled growth of epitaxial heterostructures.

Within these activities the aim is to face the scientific challenge behind the complexity of these kind of advanced materials. Then, by exploiting the available expertise of the groups belonging to the present Commessa, we realize high quality samples in the different shapes of epitaxial thin films and single crystals also integrated together in complex heterostructures. Advanced material characterizations based on matter-light interaction, on scanning probe techniques and on magnetoelectric transport measurements joined to theoretical modelling and advanced multiscale computation are employed to analyze and get insight into different physical properties of materials with magnetic and/or dipolar electric ordering.
3.1 Realization and study of materials with strong spin, charge and orbital correlations (Salerno)

The present activity points to the synthesis of material systems, within different methods of growth, such as thin films, single crystals and oriented samples in massive shape, that present strong correlations of spin, charge and orbital degrees of freedom and to their study by using ab-initio techniques, many-body approaches and numerical simulation techniques for the determination of the structural, magnetic, electronic and ferroelectric properties. Systems that will be the focus of the research activities include oxides based on transition metals, multiferroic perovskites and hybrid combination of them.

For the latter, ferromagnet hybrid structures (or normal metal) interfaced with a variety of systems that show the coexistence of magnetic and other type of orderings will be at the centre of investigation too.

Contact person: Antonio Vecchione (antonio.vecchione@spin.cnr.it)

Researchers:
M. Cuoco, A. Vecchione, P. Lucignano (50%)

Associate researchers:
A. Avella, A. Nigro, C. Noce, A. Romano, R. Fittipaldi, F. Forte, P. Gentile, V. Granata, A. Guarino
Research Lines

Cooperative phenomena in advanced materials with magnetic and/or dipolar electric ordering

Activity leader: Antonio Vecchione

References:

Electronic structure trends in the Sr$n+1$RunO$n+1$ family ($n=1,2,3$), M. Malvestuto, E. Carleschi, R. Fittipaldi, E. Gorelov, E. Pavarini, M. Cuoco, Y. Maeno, F. Parmigiani, and A. Vecchione, Physical Review B83, 165121 (2011)


Cooperative phenomena in advanced materials with magnetic and/or dipolar electric ordering

Activity leader: Antonio Vecchione

3.2 Growth and characterization of epitaxial and nanostructured films, and interfaces: pulsed laser deposition, in-situ analysis, optical, magnetic and transport properties (Naples)

The study of physical properties and technological applications of innovative materials, like thin films of ‘half metal’ oxides or magnetic nanoparticles, high electronic mobility interfaces between insulating oxides and heterostructures with different functionalities (dielectric, ferroelectric, superconductive), require a fine control of the fabrication process as well as the use of advanced characterization techniques.

The samples will be grown by means of pulsed laser ablation, in the ns as well as fs time regime. The growth will be monitored in real time through different complementary techniques, capable of probing both the generated plasma and the surface. The ‘in situ’ characterization of the samples will be performed by means of photoemission spectroscopy, electronic diffraction and surface second harmonic generation (SSHG). The study of the electronic, magnetic, optical and structural properties of the fabricated samples will exploit several advanced characterization techniques: SSHG, transport measurements in external fields, magnetization measurements, THz spectroscopy, and advanced spectroscopies at large scale facilities.

Contact person: Domenico Paparo (paparo@na.infn.it)

Researchers:
C. Aruta, A. Marino (50 %), F. Miletto, D. Paparo, Xuan Wang

Associate researchers:
S. Amoroso, G. Ausanio, R. Bruzzese, A. Caramico D’Auria, V. Iannotti, L. Lanotte, L. Marrucci, U. Scotti di Uccio
Cooperative phenomena in advanced materials with magnetic and/or dipolar electric ordering

Activity leader: Antonio Vecchione

References:


Cooperative phenomena in advanced materials with magnetic and/or dipolar electric ordering

Activity leader: Antonio Vecchione

3.3 Structural, electronic and vibrational properties of strongly-correlated systems (L’Aquila -Rome)

The activity deals with the study of materials in which there are strong electronic correlations and/or electron-phonon interactions (e.g., manganites, superconductors in the normal state) both by means of modeling of the properties of interest and through sub-THz, infrared and optical spectroscopy. The systems of interests are mainly multiferroics (materials showing at the same time ferroelectricity and magnetism) and charge-ordered compounds (hole-doped manganites, iron oxides etc).

Understanding the microscopic mechanisms underlying the observed phenomena and the quantitative estimate of the properties of interest, are the main objectives of our activity, available through an accurate comparison between theoretical predictions and experimental results. In particular, the research is focused on the interplay between structural and electronic (charge, spin or orbital) degrees of freedom and the consequences that these interactions have on the relevant properties (ferroelectricity, spin configuration, metal-insulator transitions, etc.).

Contact person: Silvia Picozzi (silvia.picozzi@spin.cnr.it)

Researchers:
S. Picozzi, A. Stroppa, P. Barone

Associate researchers:
Cooperative phenomena in advanced materials with magnetic and/or dipolar electric ordering

Activity leader: Antonio Vecchione

References:

Ferroelectricity due to Orbital Ordering in E-Type Undoped Rare-Earth Manganites, Paolo Barone, Kunihiko Yamauchi, and Silvia Picozzi, Physical Review Letters 106, 077201 (2011)

High-Tc Ferroelectricity Emerging from Magnetic Degeneracy in Cupric Oxide, Gianluca Giovannetti, Sanjeev Kumar, Alessandro Stroppa, Jeroen van den Brink, Silvia Picozzi, and José Lorenzana, Physical Review Letters 106, 026401 (2011)


Optical Properties of (SrMnO3)n/(LaMnO3)2n Superlattices: An Insulator-to-Metal Transition Observed in the Absence of Disorder, Andrea Perucchi, Leonetta Baldassarre, Alessandro Nucara, Paolo Calvani, Carolina Adamo, Darrell G. Schlom, Pasquale Orgiani, Luigi Maritato, and Stefano Lupi, Nano Letters 10, 4819 (2010)
The integration of innovative functional materials, such as transition metal or organic compounds, in the existing technologies is expected to be at the basis of future advances in crucial fields of electronics and energy. In order to prepare the ground for applications, fundamental properties of such innovative functional materials must be:
- studied and understood
- tailored to a specific application.
Together with the development of new technologies for devices realization and new approaches to electronics based on spin or lattice excitations, these are the main tasks of the “commessa”.

General Description

Transition metal compounds (oxides, calcogenides,...), organic and hybrid (Org./Inorg.) materials offer a rich spectrum of physical properties which encompasses ferromagnetism, ferroelectricity, superconductivity, very high-k dielectric, semiconducting and metallic behaviour. These properties turn out to be very sensitive to external parameters such as electric and magnetic fields, pressure, doping, etc. opening the possibility of creating new classes of sensors or devices adding new functionalities to existing technologies.

The research within the commessa aims to investigate innovative materials, achieve the control at atomic scale of their physical properties and tailor them to selected applications in the fields of (opto)electronics, sensors, spintronics, photonics and energy.
To this goal, we synthesize materials in form of bulk, nanoparticles and thin films, study their physical, morphological and structural properties and realize heterostructures and prototypes of novel (nano)devices.
The activity involves 33 researchers among chemists, physicists and material scientists plus several post docs and PhD students.
4.1 Functional materials and novel devices for electronics and energy (Genoa)

The research carried out in Genoa is markedly committed to the realization of prototypical innovative devices based on transition metal compounds and to the development of new techniques to realize and characterize them. Nonetheless, fundamental studies on such materials are also performed.

More specifically some of the main investigated topics are:

- Interface phenomena in complex oxides heterostructures: 2DEG at oxide interfaces
- Optical and magnetic properties of transition metal nanoparticles and ultra-thin films
- Influence of strain, doping and external fields on transition metal compound films
- Fabrication and characterization of All-Oxides micro and nanodevices such as:
  - MEMS
  - Spin valve and spin torque devices
  - FET and MOSFET
  - μ-Fuel Cells
- Synthesis of oxide nanoparticles by in-liquid PLD
- Epitaxial Thin film and heterostructures growth by PLD
- Ink-jet deposition of chalcogenides for photovoltaic applications
- AFM nanopatterning of complex oxides
- Low temperature STM/STS

Contact person: Daniele Marrè (daniele.marre@spin.cnr.it or marre@fisica.unige.it)

Researchers:
E. Bellingeri, F. Bisio, R. Buzio, R. Moroni, I. Pallecchi, L. Pellegrino, M. Biasotti, A. Gerbi, N. Manca

Associate researchers:
G. Costa, M. Ferretti, D. Marrè, S. Siri, L. Anghinolfi, V. Caratto, A. Gadaleta
Functional materials and novel devices for electronics and energy applications

Activity leader: Daniele Marrè

References:


All-Oxide Crystalline Microelectromechanical Systems: Bending the Functionalities of Transition-Metal Oxide Thin Films, Pellegrino, L., Biasotti, M., Bellingeri, E., Bernini, C., Siri, AS., Marré, D., ADVANCED MATERIALS (2009), vol 21, 2377

Cu2O as a nonmagnetic semiconductor for spin transport in crystalline oxide electronics, Pallecchi, I.,Pellegrino, L.,Banerjee, N.,Cantoni, M.,Gadaleta, A.,Siri, AS.,Marré, D., PHYSICAL REVIEW B (2010), vol 81, 165311


4.2 Fundamental properties of functional materials suitable for application in energetics (Rome and Salerno)

The growing demand for miniaturized systems for energy conversion and storage has required extensive research aimed at manufacturing of new solid-state devices in the form of thin films. In this respect, the recent developments of the thin film deposition techniques, such as molecular beam epitaxy (MBE) and pulsed laser deposition (PLD), have allowed the manipulation of these materials at the atomic level, opening the possibility of investigating and using their physical properties for the different engineering applications.

The activity of this "modulo" focuses on the study of physical properties of thin films of various materials for different fields of application (spintronics, optoelectronics, electronic) and with particular attention to the possible repercussions in energetics, exploiting the ability to control various extrinsic parameters (such as stoichiometry of heavy ions, the oxygen content of multiple materials, heterostructures strain induced by substrate, and others).

Contact person: Pasquale Orgiani (pasquale.orgiani@spin.cnr.it)

Researchers:
P. Orgiani, A. Varlamov (50%)

Associate researchers:
G. Balestrino, D. Di Castro, L. Maritato, P. Medaglia, A. Tebano, A. Galdi
Functional materials and novel devices for electronics and energy applications

Activity leader: Daniele Marrè

References:


Optical properties of (SrMnO3)n/(LaMnO3)2n superlattices: an insulator-to-metal transition observed in the absence of disorder, A.Perrucchi, L.Baldassarre, A.Nucara, P.Calvani, C.Adamo, D.G.Schlom, P.Orgiani, L.Maritato, S.Lupi, Nano Letters 10, 4819 (2010).


4.3 Emerging routes for the control of the (opto)electronic properties of multifunctional materials and devices (Naples)

The activities are focused on the emerging routes for control and analysis of electronic properties of innovative materials, systems and devices going beyond the conventional chemical and physical techniques.

They concern materials presenting sensitivity to the strain, light, electric or magnetic field, chemical and electrical doping or present charge transfer or phase transition:

- **a)** Organic: p- or n-type oligomer (6T, Pentacene, perlene) and polymers (azo-benzene, polythiophene)
- **b)** Oxides: conductive and semiconductive conventional oxides (ITO; ZnO, TiO2), strongly correlated oxides like manganites (LSMO), cuprates (NBCO), multiferroics

These studies include the realization of organic and oxide heterostructures such as T6/perlene or LAO/STO heterostructures. The techniques used are also based on advanced spectroscopies: RIXS and XAS by synchrotron radiation, impedance spectroscopy, SPM, SHG, SNOM, and use different deposition techniques such as evaporation, sputtering, PLD and MAPLE.

Contact person: Antoni Cassinese (antonio.cassinese@spin.cnr.it or cassines@na.infn.it)

**Researchers:**
A. Ambrosio, M. Barra, S. Lettieri, M. Salluzzo

**Associate researchers:**
References:


Research Lines

Functional materials and novel devices for electronics and energy applications

Activity leader: Daniele Marrè

4.4 Novel materials and devices for electronics, plasmonics and photonics (Naples and L’Aquila)

The activity aims at theoretically and experimentally investigating the unconventional electromagnetic properties of artificial materials comprising metal, dielectric and metallo-dielectric micro and nanostructures. Examples of such artificial materials are metamaterials, photonic band gap materials, hybrid materials, etc.

The main target of the activity research is to exploit the novel electromagnetic features of these artificial materials to designing suitable devices for manipulating electromagnetic radiation from THz to visible frequencies. We focus our attention on optical devices characterized by micrometric and nanometric size.

Main research themes are:
1) Metamaterials with negative (\(e,m\));
2) Highly nonlinear media with very small \(e\);
3) Design and manufacturing of hybrid metamaterials with active components;
4) Metallic periodic nanostructures;
5) Photonics crystals and quasi-crystals;

Contact person: Alessandro Ciattoni (alessandro.ciattoni@spin.cnr.it)

Researchers:
A. Ciattoni, A. Marino 50%, V. Tkachenko, E. Di Gennaro

Associate researchers:
G. Abbate, A. Andreone, C. Rizza, Thankamani Prya Rose
Research Lines

Functional materials and novel devices for electronics and energy applications

Activity leader: Daniele Marrè

References:

All-optical active plasmonic devices with memory and power-switching functionalities based on epsilon-near-zero nonlinear metamaterials, A. Ciattoni, C. Rizza and E. Palange, Physical Review A 83, 043813 (2011)


Experimental evidence of cut-wire-induced enhanced transmission of transverse-electric fields through sub-wavelength slits in a thin metallic screen, E. Di Gennaro, I. Gallina, A. Andreone, G. Castaldi, and V. Galdi, Optics Express 18, 26769 (2010)


Research Lines

Dynamical, electronic and transport properties of complex systems and functional materials

Activity leader: Vittorio Cautadella

The integration of innovative functional materials, such as transition metal or organic compounds, in the existing technologies is expected to be at the basis of future advances in crucial fields of electronics and energy.

In order to prepare the ground for applications, fundamental properties of such innovative functional materials must be:
- studied and understood
- tailored to a specific application.
Together with the development of new technologies for devices realization and new approaches to electronics based on spin or lattice excitations, these are the main tasks of the “commessa”.

General Description

The recent advances of materials and devices fabrication have allowed to address unprecedented properties and phenomena facing the demand for materials with new functionalities and the need for molecular-scale electronic devices. Insights in such complex systems can be obtained exploiting the synergy among different approaches able to describe material properties at different length scales (multi-scale approach), ranging from the microscopic (first-principles electronic structure calculations) to the mesoscopic (analytic methods of quantum field theory) to the macroscopic (Monte Carlo and molecular dynamics approaches, numerical methods for the analysis and image reconstruction) level.

The final goal is the understanding/prediction of the magnetic, optical, transport, and thermal properties of systems as correlated oxides, graphene and carbon nanotubes, hybrid surfaces and interfaces, nano-mechanical devices with emphasis on the control of quantum state (information). Our focus will also be on the complex behavior of “classical” systems such as granular media, colloids and polymers with the ambition to propose new functionalities and to model processes of interest for the science of life borrowing methods of statistical mechanics.
Research Lines

Dynamical, electronic and transport properties of complex systems and functional materials

Activity leader: Vittorio Cautadella

5.1 Models and first-principles approaches for functional materials and complex systems (Naples)

This sub-activity will mainly focus on the following themes:

- study of disordered soft materials, based on mesoscopic elementary components, exhibiting unconventional thermodynamic, mechanical and rheological properties (polymers, colloids and granular particles)
- first-principles studies of multifunctional materials for electronics and optics (graphene, carbon-based nanostructures, nanostructured oxides in presence of organic adsorbates for photovoltaic cells, complex surfaces and interfaces)
- model studies of underdoped cuprates: phonon and electron spectral functions, optical conductivity
- (spin) transport properties in interacting nanostructures (quantum dots, OFET, hetero-structures F/S, molecular electronic devices)
- statistical mechanics models for systems of biological interest: X chromosome inactivation; chromosome 3D organization
- multi-scale approach to molecular transport including the coupling with the lattice degrees of freedom
- development of new theoretical tools (computer software and models).

Contact person: Vittorio Cautadella (cataudella@na.infn.it)

Researchers:
G. Cantele, A. Fierro, M. Pica Ciamarra

Associate researchers:

graphene nanoribbon on a metallic surface
Research Lines

Dynamical, electronic and transport properties of complex systems and functional materials

Activity leader: Vittorio Cautadella

References:


Research Lines

Dynamical, electronic and transport properties of complex systems and functional materials

Activity leader: Vittorio Cautadella

5.2 Quantum nano devices and complex systems (Genoa)

This sub-activity will focus mainly on the following themes:

- nano-devices based on Hall effect: calculations based on models of current, noise and study of interference effects
- modelling of dynamical effects on quantum nano-electromechanical devices (NEMS) out of equilibrium
- transport properties in suspended carbon nanotubes
- development of ‘image enhancement’ techniques for magnetic resonance data in order to improve the signal-noise ratio
- development of methods of source modeling applied to Electro-encephalography (EEG) and magneto-encephalography (MEG) data
- applications of pattern recognition methods to the analysis of RHEED images obtained during the film growth.

Contact person: Maura Sassetti (sassetti@fisica.unige.it)

Researchers:
A. Braggio, A. M. Massone

Associate researchers:
Research Lines

Dynamical, electronic and transport properties of complex systems and functional materials

Activity leader: Vittorio Cautadella

References:


Relevance of Multiple Quasiparticle Tunneling between Edge States at $\nu=p/(2np+1)$ D. Ferraro, A. Braggio, M. Merlo, N. Magnoli, and M. Sassetti, Phys. Rev. Lett. 101, 166805 (2008)
Selected experimental facilities

SPIN is endowed with a large set of advanced scientific equipments, including nearly 20 thin film deposition systems, 3 clean rooms, 3 low temperature - high field STM systems, numerous laser sources emitting form IR to UV and ranging form CW mode to femtosecond pulses.

SPIN equipments can be grouped into the following homogeneous AREAS:

- **Thin film Deposition** (Resp. Giuseppe Balestrino)
- **Lithography** (Resp. Nadia Martucciello)
- **Bulk material preparation** (Resp. Alberto Martinelli)
- **Structural, morphological and chemical properties** (Resp. Umberto Scotti di Uccio)
- **Optical properties and characterization** (Resp. Domenico Paparo)
- **Electronic and transport properties** (Resp. Luigi Maritato)
- **Computation** (Resp. Mario Cuoco)

The role of the AERA Responsible is to guarantee the optimal use of the Institute equipments and to promote new acquisitions to improve the Institute potentialities in the specific area.
Selected experimental facilities

Thin Film Deposition

**Deposition system PLD 700 mJ “oxides”**

*Contact: Emilio Bellingeri (GE)*

Pulsed laser deposition system Pressure down to 10-9 mBar and substrate temperature up to 900°C also in O2 atmosphere. Fast entry system for sample loading, differentially pumped RHEED working up to 10-2Mbar O2; Pulsed gas inlet synchronized with laser pulses; 6 targets; HV sample manipulation by wooblestick. The system is specifically designed for oxide thin films deposition and is interfaced with a cryogenic STM by a HV transfer chamber.

**Deposition system PLD 700 mJ “metals”**

*Contact: Emilio Bellingeri (GE)*

Pulsed laser deposition system Pressure down to 10-11 mBar and up to 10-5 mBar O2; substrate temperature up to 1200°C. Fast entry system for sample loading, RHEED; 4 targets; UHV sample manipulation by wooblestick. The system is specifically designed for intermetallic thin films deposition and is interfaced with a cryogenic STM by a UHV transfer chamber.

**Experimental set-up for the deposition of ultrathin metallic films by MBE**

*Contact: Riccardo Moroni (GE)*

UHV chamber equipped with: electron-beam deposition sources for the growth of ultrathin metallic films; ion gun for sputter cleaning; UHVcompatible 5 degree-of-freedom sample manipulator; variable temperature sample holder (130–800 K). The UHV chamber also features an Auger electron spectrometer (AES) and a low-energy electron diffraction (LEED) set-up.
Selected experimental facilities

Thin Film Deposition

MODA: Modular facility for Oxide Deposition and Analysis system

Contacts: Fabio Miletto / Marco Salluzzo (NA)

Surface Analysis Chamber

The MODA surface Analysis chamber is equipped with several experimental techniques aimed to the study of the chemical, structural and electronic properties of thin films and single crystals.

A manipulator with independent 5 degrees of freedom allows XPS, UPS analysis of the samples in a temperature range from 300K to 1200K (upgradable 20K-1200K).

Pulsed Laser Deposition chamber

UHV chamber for Pulsed Laser Deposition with in-situ control of the growth process by high pressure Reflection High Energy Electron Diffraction (RHEED). Heterostructures and superlattices can be grown thanks to a multi target carrousel where up to six different targets can be mounted. The deposition is performed with an KrF excimer laser (Compex Pro 205) at 248 nm wavelength, delivering laser pulses of 25 ns duration, maximum energy 800mJ.

The substrate is placed on a heater which can heat up to 850°C, also in Oxygen atmosphere. The final vacuum of about 10-9 mbar is obtained by a turbopump. The system is also equipped with two load-lock chambers to transfer the substrates and the targets without breaking the vacuum conditions. The samples can be in-situ transferred in UHV conditions to the analysis chamber for the surface characterizations by XPS, UPS, SPA-LEED, STM, AFM. The ICCD camera can be also installed to study the plume expansion dynamics.
Thin Film Deposition

**UHV XPS/UPS**

The substrate is placed on a heater which can heat up to 850°C, also in Oxygen atmosphere. The final vacuum of about 10-9 mbar is obtained by a turbopump. The system is also equipped with two load-lock chambers to transfer the substrates and the targets without breaking the vacuum conditions. The samples can be in-situ transferred in UHV conditions to the analysis chamber for the surface characterizations by XPS, UPS, SPA-LEED, STM, AFM. The ICCD camera can be also installed to study the plume expansion dynamics.

**UHV STM/AFM plus Surface Analysis Chamber**

The UHV Omicron VT-AFM system is designed to operate as scanning tunneling microscope, atomic force microscope, and hybrid scanning probe microscopes, in a temperature range between 300K-1000K (20K-1000K upgradable). This instrument is especially intended to the characterization of clean crystalline surfaces, in particular thin films prepared in-situ either by PLD or other deposition techniques, or single crystals (cleaved or annealed).

The max scan area is 8x8 μm² with a spatial resolution below 0.1 nm. The vertical resolution is 0.01nm. The VT-AFM is capable to operate in a variety of spectroscopic modes: I-V and G(V) (conductance) spectroscopy in STM and contact AFM modes Electrostatic force microscopy Magnetic force microscopy Kelvin probe microscopy Piezoforce microscopy

The UHV (P<10-11mbar) surface analysis chamber is equipped a manipulator having 5 degrees of freedom, heatable up to 1000°C.

**UHV SPA-LEED**

The Spot Profile Analysis Low Energy Electron Diffraction instrument (SPA-LEED) is a special LEED designed to allow high resolution reciprocal space mapping of ordered surfaces. This LEED is used for the thorough analysis of defect structures on single crystal surfaces. The technique enables precise quantitative analysis of lateral and vertical lattice constants, terrace/islands size and height distribution, ordering parameters in phase transitions etc. The main part of the SPA LEED is an octopole which enables the scanning of the diffracted beam over a detection assembly, thus improving the signal to noise ratio and resolution compared to conventional, screen and camera based systems.
Selected experimental facilities

Thin Film Deposition

Multi Chamber sputtering deposition system
Contact: Marco Salluzzo (NA)

The Multi-chamber UHV sputtering system is designed for the growth of very thin oxide thin films on area up to 2 inches. It is equipped by a chamber dedicated to the growth of HTS cuprate superconductors (NdBCO, YBCO, LSCO), a chamber dedicated to the deposition of ferroelectric and multiferroic thin films (BiMnO3, SrMnO3) and by a chamber for the in-situ growth of metal contacts (joule evaporator and sputtering) with suitable geometry by shadow mask. All-in-situ field effect prototipes and stacked HTS / dielectric / metal structure can be realized in this system.

Sputtering system for materials and junctions
Contact: Loredana Parlato (NA)

Three chambers ultra-high vacuum system: one of these, equipped with three DC and RF 2.0” sputtering magnetrons, is connected to the other two, both with independent access. The second chamber is equipped with an etching ion gun and a self-made substrate cooling system based on N2 gas flow, while the third one has a 2” DC and RF sputtering magnetron and a substrate holder with a distance that can be changed without breaking vacuum.

Deposition system for hybrid (organic/inorganic) materials and devices
Contact: Antonio Cassinese (NA)

Thin-film deposition system consisting of two deposition chambers connected by a load lock and equipped with a flash evaporation system and 2 knudsen cells allowing deposition of organic material and metals.
Selected experimental facilities

Thin Film Deposition

PLD system for nanoparticles and thin films deposition (Fs-PLD)
Contact: Xuan Wang (NA)

PLD system for ultrafast laser ablation, nanoparticle generation and nanoparticle assembled film deposition. The laser spourse is a Light Conversion Nd:glass Twinkle (3mJ/1054 nm/850 fs; 1 mJ/527 nm/300 fs; 0.25mJ/266nm/300 fs). The PLD system is equipped with a vacuum chamber with accessories and feedthroughs.

MAPLE thin film deposition system
Contact: Francesco Bloisi (NA)

MAPLE (Matrix Assisted Pulsed Laser Evaporation) system for biomaterials and polymeric thin film deposition composed by a vacuum chamber (pressure down to 10^-7 mbar) and a Qswitched Nd:YAG pulsed (7ns, 0.5-10Hz) laser operating in IR (1064nm, 1.17eV, 500mJ/pulse) VIS (532nm, 2.33eV, 100mJ/pulse) or UV (355nm, 3.49eV, 90mJ/pulse) with in place target refrigeration (liquid nitrogen, 77K) and substrate heating (up to ~470K)

PLD thin films deposition system with in situ RHEED diagnostics
Contact: Antonello Tebano (RM)

It is a system equipped with an excimer laser. The apparatus has a multitarget system for oxide heterostructures and superlattices deposition. A Reflection High Energy Electron Diffraction (RHEED) system allows the in-situ growth diagnostics. It is also possible to use an oxygen deposition atmosphere enriched with 12% of ozone.
Selected experimental facilities

Thin Film Deposition

Molecular Beam Epitaxy deposition system
Contact: Pasquale Orgiani (SA)

The system consists of a UHV Chamber equipped with different effusive cells inferred (by DCA) to the evaporation of individual materials. The system is equipped with e-gun STAIB for the analysis of in-situ growth (RHEED). It is also equipped with a pre-Chamber for loading the samples without breaking the vacuum conditions in the main Chamber. This last room is also equipped with an independent pumping system.

RF Sputtering
Contact: Giovanni Carapella (SA)

Magnetron Rf sputtering (13 MHz, 1.5 KW) with three 6 inch deposition sources and one sputter etch cathode. Cryopumped deposition chamber and turbo-pumped load lock. Used for deposition of superconducting (Nb, Al), insulators (SiO2), normal (Cu, Mg), and magnetic (Co, Cr, NiFe, CoFe, FeMn) thin films. The load lock is also used for growth of very thin films of Al2O3 by thermal oxidation of Al. Used for Ferromagnet-Superconductor devices or nanoscale superconducting devices.

Three sources UHV sputtering
Contact: Carla Cirillo (SA)

UHV dc magnetron sputtering equipped with a load-lock chamber. The systems has 3 sources, one especially designed for the fabrication of ferromagnetic materials. The deposition chamber is equipped with a movable protecting shutter driven by a pc controlled step motor, in order to fabricate up to 8 samples in the same deposition run. This solution allows the realization of different layered hybrid structures under identical deposition conditions.
Selected experimental facilities

Lithography

**Photolitographic Laboratory**
Contact: Antonio Cassinese (NA)

Photolitographic room and substrate treatment room allowing processes with a resolution of 1μm. The room is dedicated to activities concerning oxide materials of interest for electronics and soft – lithography technique for the realization of PDMS microchannel.

**Photolithography laboratory**
Contact: Nadia Martucciello (SA)

Laboratory dedicated to optic lithography in class 1000 Clean Room, with Mask Aligner Karl Suss with UV lamp, spinner Cammax and spinner Laurell, drying oven, chemical bench, optical transmission and reflection microscope.
Selected experimental facilities

Lithography

**Ion milling system**  
Contact: Loredana Parlato (NA)

High vacuum chamber equipped with ion gun for etching process and a self-made substrate cooling system based on N2 gas flow. The substrate’s temperature can be monitored during the process.

**SIMC-SA (Station for Ion-Milling and Contact deposition)**  
Contact: Pasquale Orgiani (SA)

UHV Riber system allows milling of thin films using argon ions with energies of 300eV-500eV and current density near 1mA/cm2. The sample is kept fixed, also inclined with respect to the ionic beam. In addition, the system is equipped with an 3-crucibles e-beam RIBER for in-situ deposition of metal contacts in the form of pure materials and/or alloys.

**Electron Beam Lithography**  
Contact: Giovanni Carapella (SA)

Electron Beam Lithography with beam control system and Raith software for writing. Resolution 100 nm. The system is installed in class 10000 Clean Room.
Selected experimental facilities

Bulk material preparation

**Isostatic Press**
*Contact: Alberto Martinelli (GE)*

Isostatic Press for the preparation of powder greens with different morphologies. Maximum pressure: 1000 bar; chamber diameter 10 cm. The powders to be sintered are put inside a rubber mould, that is inserted within the oil contained in the chamber. By applying a pressure in the chamber it is possible to obtain powder compacts (green) with minimum porosity.

**Glove Box**
*Contact: Alberto Martinelli (GE)*

Glove-box working under a controlled atmosphere with H2O and O2 < 1ppm.

**Infrared image furnace**
*Contact: Antonio Vecchione (SA)*

The main equipment related to the single crystal growth activity is the infrared image furnace installed in 2005. This was the first time an instrument of this kind was used in Italy. It is a two mirror system, where the light from the two halogen bulbs is focused by the semi-ellipsoidal mirrors onto a central zone. The efforts of the SPIN researchers involved in the field of single crystal growth are focused on the growth of large superconducting and magnetic oxides. Single crystals of high Tc superconducting oxides, pure and eutectic strontium ruthenates and multiferroics are regularly produced and made available to collaborators within the Italy and abroad.
Selected experimental facilities

Structural, morphological and chemical properties

**Theta-2theta diffractometer for thin films and powders**

*Contact: Emilio Bellingeri (GE)*

![Theta-2theta diffractometer](image)

Bragg Brentano diffractometer for powders and thin films. The theta angle movement is independent from 2theta. The setup allows low angle measurements so that it can be used for thin films thickness measurements (range 10-100nm). It mounts $1^\circ, 1/2^\circ, 1/4^\circ, 1/30^\circ$ slits on the incident beam. $1^\circ, 1/2^\circ, 1/4^\circ$ slits, Ni filter and graphite monochromator are on the diffracted beam side.

**4-circles diffractometer**

*Contact: Emilio Bellingeri (GE)*

![4-circles diffractometer](image)

4-circle (theta, omega, phi and chi) automatic diffractometer equipped with quartz monochromator on the diffracted beam (presently to be substituted by a Ni/C parabolic monochromator on the incident beam). The setup allows phase analysis (theta-2theta) and preferential orientation (rocking curve, phi scan, polar maps reciprocal lattice maps) measurements. Equipped with steady or oscillating bulk-sample holder and goniometric head for thin films and single crystals, with telescopic laser alignment.

**AFM**

*Contact: Renato Buzio (GE)*

![AFM](image)

AFM with 50um x 50um or 5um x 5um maximum scaningsample capabilities. It is equipped with an optical microscope with lateral resolution of 5um. It operates under ambient conditions or within a liquid cell - with temperatures up to 150°C - in standard contact mode and dynamic modes. Control unit allows to acquire 2 simultaneous maps. STM, Kelvin, conductive, capacitive and force-volume modes are readily available. AFM can also be used for constant-current electrochemical nanolithography.
Selected experimental facilities

Structural, morphological and chemical properties

**SEM**
Contact: Antonio Vecchione (SA)

The electron microscopy facility is constituted by a tungsten/LaB6 scanning electron microscope (SEM) (LEO EVO 50) with a secondary electron detector for surface imaging and a 4-quadrant back-scatter electron detector for density imaging detector. The analytical instrumentation is comprised of an Oxford Instruments INCA ENERGY (EDX) x-ray analysis system, INCA WAVE (WDX) wavelength dispersive x-ray spectrometer and INCA CRYSTAL (EBSD) electron back-scatter diffraction.

---

**High Resolution X-ray Diffraction**
Contact: Antonio Vecchione (SA)

The high resolution x-ray diffractometer (Panalytical X’Pert MRD PRO) is a highly advanced, versatile materials characterization system. Interchangeable PreFIX incident and diffracted beam optics can be configured for optimal measurement of high resolution scans and reflectivity experiments. By combining incident (with graded parabolic x-ray mirror and four-bounce Ge(220) monochromator) and diffracted (with triple axis setup using a three bounce (022) channel cut Ge crystal) beam optics, high resolution configuration can be applied to highly ordered crystals and epitaxial thin films.
Selected experimental facilities

Optical properties and characterization

**Variable temperature UHV MOKE magnetometer**
*Contact: Riccardo Moroni (GE)*

In-situ UHV magneto-optical Kerr effect (MOKE) magnetometer working with laser diodes at 670 and 532 nm. Lock-in detection of the Kerr signal to achieve extreme sensitivity. Longitudinal and polar MOKE configurations can be implemented for the measurement of the in-plane and out-of-plane components of the magnetization. Sample temperature from 130 to 800 K. Maximum magnetic field 1000 Oe.

**Interferometer for infrared spectroscopy**
*Contact: Paolo Calvani (RM)*

BRUKER 66V model, equipped for measurements under vacuum of reflectivity, diffuse reflectivity, and transmittance, from 30 to about 20000 cm⁻¹, with spectral resolution up to 0.2 cm⁻¹. It is also equipped with a cryostat working between 8 and 300 K, and an infrared microscope BRUKER IRscope I with lateral resolution 10 microns.
Selected experimental facilities

Optical properties and characterization

**Surface Second Harmonic Generation Apparatus**
*Contact: Domenico Paparo (NA)*

Experimental apparatus for phase-resolved second harmonic generation from surfaces for characterization of surfaces and buried interfaces. The set-up is based on a Nd:YAG laser system delivering pulses of 30 ps of duration at a repetition rate of 10 Hz and energy per pulse up to 60 mJ. The laser is provided with crystals for frequency duplication and triplication. The apparatus is completed with acquisition electronics based on a Gated Integrator for increasing the signal-to-noise ratio and permitting, hence, operation in the photon-counting regime.

**Spectroscopic ellipsometer**
*Contacts: Volodymir Tkanchenko (NA)*

Spectroscopic ellipsometer for linear optical characterization of thin films and multi-layers (spectral range 270-1700nm)

**Surface Second Harmonic Generation Apparatus**
*Contact: Antonio Ambrosio (NA)*

Home-made Confocal Microscope equipped with a high-resolution 3D piezo-scanner and a spectrograph. Two light sources are included, an Ar+ laser (514 and 488nm wavelengths) and a Helium-Neon laser (632.8nm). So far, the system has been used for high-resolution spectral imaging of different samples; lithography on azobenzene-containing polymers; high-resolution imaging, by means of gold nanoparticles, of the field distribution in the focal plane of high numerical aperture aplanatic lenses.
Electronic and transport properties

Selected experimental facilities

Cryo-Probe
Contact: Mario Barra (NA)

The Probe station system is suited for electrical measurements both in DC and AC regimes (up to 1 MHz). Electrical contacts are realized by three metallic tips mounted on micrometric slides. Probe station is equipped with a vacuum chamber to perform measurements in controlled atmosphere. It is possible to carry out variable temperature measurements in the range between 5K and room temperature by using cryogenic liquids. The temperature of the samples is monitored by two thermometers.

Cryogenic STM
Contact: Renato Buzio (GE)

STM for the morphological and spectroscopic characterization of conductive samples under UHV at ambient temperature and cryogenic temperatures (80K – 140K and 5K-65K). Tunnelling current varies in the range 5pA -300nA. Scanning area is 10 um x 10um x 1um at room temperature and 1.8um x 1.8um x 0.2um at 5K.

A tailored samples holder allows to perform in situ 4-wires transport measurements on the studied specimens. AFM with 50um x 50um or 5um x 5um maximum scanning sample capabilities. It is equipped with an optical microscope with lateral resolution of 5um. It operates under ambient conditions or within a liquid cell - with temperatures up to 150°C - in standard contact mode and dynamic modes. Control unit allows to acquire 2 simultaneous maps. STM, Kelvin, conductive, capacitive and force-volume modes are readily available. AFM can also be used for constant-current electrochemical nanolithography
Selected experimental facilities

Electronic and transport properties

PPMS – Physical Properties Measurement System
Contact: Massimiliano Polichetti (SA)

PPMS is a system for modular measurements, that schematically is constituted by a 9 Tesla superconducting magnet, a cryostate for the sample temperature control, electronics needed to manage through PC all present sensors and devices, and a series of interchangeable inserts appropriately designed to measure different physical quantities.

Cryomagnet + 300 mK insert
High magnetic field 3He-4He cryostat
Contact: Carla Cirillo (SA)

The cryostat consists in a nitrogen shielded 4He low loss dewar, equipped with a superconducting magnet up to 11 Tesla. The system operates in the temperature range 1.8 - 300 K. A HelioxVL vacuum loaded 3He insert enables temperatures down to 300mK to be achieved.

High field low temperature STM-AFM
Contact: Fabrizio Bobba (SA)

UHV low temperature (5K - 300K), high field (7 Tesla), STM-AFM . The system can operate in STM microscopy and spectroscopy modes, contact and tapping microscopy modes AFM, magnetic force microscopy (MFM) and electrostatic force microscopy (EFM)
Selected experimental facilities

Computation

NANOMAT
Contact: Annalisa Fierro (NA)

Cluster multiprocessors for advanced computation and high performance made of 38 nodes biprocessors (Intel Xeon with multicore technology, clock from 2.8 to 3.2 GHz), with 8 to 48 GB RAM per node. The overall number of cores and RAM is 200, 624 GB. The nodes are connected with Infiniband to have high speed data transfer.

CLUES
Contact: Giovanni Cantele (NA)

99 biprocessors Athlon 2800+ with Gigabit ethernet, NAS (network attached storage) by 1 Terabyte in RAID5.
### SPIN Active Projects

<table>
<thead>
<tr>
<th>Type of Project</th>
<th>Coordinator</th>
<th>Title</th>
<th>SPIN Leader</th>
<th>UOS</th>
<th>Grant (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU FP7</td>
<td>SPIN Genova</td>
<td>Exploring the potential of Iron-based Superconductors</td>
<td>Marina Putti</td>
<td>GE</td>
<td>500,877,00</td>
</tr>
<tr>
<td></td>
<td>SPIN Aquila</td>
<td>Breaking Inversion Symmetry in Magnets: Understand via Theory</td>
<td>Silvia Picozzi</td>
<td>AQ</td>
<td>684,000,00</td>
</tr>
<tr>
<td></td>
<td>SPIN Salerno</td>
<td>Unlocking research potential for multifunctional advanced materials and nanoscale phenomena</td>
<td>Mario Cuoco</td>
<td>SA</td>
<td>2,400,00,00</td>
</tr>
<tr>
<td></td>
<td>Weizman Inst.</td>
<td>Macroscopic interference devices for atomic and solid-state systems: quantum control of supercurrents</td>
<td>Antonio Barone</td>
<td>NA</td>
<td>217,865,00</td>
</tr>
<tr>
<td></td>
<td>Univ. de Liege</td>
<td>Engineering Exotic Phenomena at Oxide Interfaces</td>
<td>Daniele Marrè</td>
<td>GE</td>
<td>354,797,00</td>
</tr>
<tr>
<td></td>
<td>Lancaster Univ.</td>
<td>Nanoelectronics: concepts, theory and modelling</td>
<td>Maurizio Sassetti</td>
<td>GE</td>
<td>266,838,90</td>
</tr>
<tr>
<td></td>
<td>Univ. Carlo III de Madrid</td>
<td>Magnetic-Superconductor Cryogenic Non-contact Harmonic Drive</td>
<td>Carlo Ferdeghini</td>
<td>GE</td>
<td>255,258,00</td>
</tr>
<tr>
<td></td>
<td>Leibniz Institute</td>
<td>Establishing the basic science and technology for Iron-based superconducting electronics applications</td>
<td>Sergio Pagano</td>
<td>SA</td>
<td>288,136,20</td>
</tr>
<tr>
<td>FIRB - FUTURO IN RICERCA</td>
<td>SPIN Napoli</td>
<td>Transizione di unjamming nei materiali granulari e precursori sismici: teoria, esperimenti e simulazioni</td>
<td>Massimo Pica Ciamarra</td>
<td>NA</td>
<td>209,990,00</td>
</tr>
<tr>
<td>PRIN 2008</td>
<td>Univ. Napoli</td>
<td>Establishing the basic science and technology for Iron-based superconducting electronics applications</td>
<td>Domenico Paparo</td>
<td>NA</td>
<td>48,498,00</td>
</tr>
<tr>
<td>PRIN 2008</td>
<td>Univ. Bologna</td>
<td>Studio, definizione e sviluppo di un cavo in MgB2 con proprietà elettriche e termiche adatte al suo utilizzo in un limitatore di corrente</td>
<td>Carlo Ferdeghini</td>
<td>GE</td>
<td>21,683,90</td>
</tr>
<tr>
<td>PRIN 2008</td>
<td>Univ. Genova</td>
<td>Studio teorico e con tecniche spettroscopiche degli effetti del disordine e della presenza di più bande nei pnictidi superconductor Fe-As</td>
<td>Andrei Varlamov</td>
<td>RM</td>
<td>26,200,30</td>
</tr>
<tr>
<td>N. 5 REGIONAL projects - (LEX 5)</td>
<td>SPIN Napoli Salerno</td>
<td>Argomenti vari: Superconduitori, Ossidi, Organici</td>
<td>Organi, Gombos, Sulluzzo, Perroni, Aruta</td>
<td>NA</td>
<td>52,000,00</td>
</tr>
<tr>
<td>REGIONAL project (CAMPANIA)</td>
<td>ORION</td>
<td>Sistemi innovativi integrati di Analisi di gas prodotti da scarichi industriali</td>
<td>Pasqualino Maddalena</td>
<td>NA</td>
<td>67,200,00</td>
</tr>
<tr>
<td>FONDAZIONE CARIPLO</td>
<td>Politecnico Milano</td>
<td>Electronic Control of Magnetization in Spintronic Devices</td>
<td>Silvia Picozzi</td>
<td>AQ</td>
<td>50,000,00</td>
</tr>
<tr>
<td>FONDAZIONE CARIGE</td>
<td>SPIN Genova</td>
<td>Potenziamento della strumentazione per le ricerche nel settore dei nuovi materiali superconduttori</td>
<td>Carlo Ferdeghini</td>
<td>GE</td>
<td>55,000,00</td>
</tr>
<tr>
<td>FONDAZIONE CARIGE</td>
<td>SPIN Genova</td>
<td>Materiali e tecnologie per celle fotovoltaiche a basso costo</td>
<td>Daniele Marrè</td>
<td>GE</td>
<td>40,000,00</td>
</tr>
</tbody>
</table>
Projects

Main industrial partners

ASG Spa
CSM Spa
Columbus Superconductors Spa
Thin Film Equipment Srl
KME Italy Spa
Piaggio AeroIndustries Spa
Cooper Standard Automotive Italy Spa
Fibre Ottiche Sud Spa
Magaldi Techno Sas
Criotec Impianti Srl
Projects

Distribution of the origin of income
Main Projects

<table>
<thead>
<tr>
<th>Title</th>
<th>Breaking Inversion Symmetry in Magnets: Understand via Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronym</td>
<td>BISMUTH</td>
</tr>
<tr>
<td>Source of funding</td>
<td>EC FP7 through European Research Council</td>
</tr>
<tr>
<td>Specific funding program</td>
<td>2007 ERC Starting Grant within the call “IDEAS”</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Silvia Picozzi, SPIN AQ</td>
</tr>
<tr>
<td>Other partners</td>
<td>//</td>
</tr>
</tbody>
</table>

**Project objectives**

Multiferroics (i.e. materials where ferroelectricity and magnetism coexist) are presently drawing enormous interests, due to their technologically-relevant multifunctional character and to the astoundingly rich playground for fundamental condensed-matter physics they constitute. BISMUTH puts forward several concepts on how to break inversion symmetry and achieve sizable ferroelectricity in magnets; our approach is corroborated via first-principles calculations as tools to quantitatively estimate relevant ferroelectric and magnetic properties as well as to reveal ab-initio the main mechanisms behind the dipolar and magnetic orders.

In closer detail, we focus on the interplay between ferroelectricity and electronic degrees of freedom in magnets, i.e. on those cases where spin- or orbital- or charge-ordering can be the driving force for a spontaneous polarization to develop. Antiferromagnetism is considered as a primary mechanism for lifting inversion symmetry; however, the effects of charge disproportionation and orbital ordering are also studied by examining a wide class of materials, ranging from transition metal oxides to organic-inorganic hybrids.
Projects

Main Projects

Title
Unlocking research potential for multifunctional advanced materials and nanoscale phenomena

Acronym
MAMA

Source of funding
EC

Specific funding program
FP7-REGPOT-2010-1

Coordinator
Mario Cuoco, SPIN SA

Other partners
Kamerlingh Onnes Laboratory, Leiden
School of Physics & Astronomy, St. Andrews
IFW, Institute for Theoretical Solid State Physics, Dresden
Institut für Festkörperforschung and Institute for Advanced Simulation, Jülich
University of Twente, Twente
University of Geneve, DPMC, Geneve
Risø National Laboratory, Roskilde
Bonn University, Bonn
IMDEA, Madrid
Chalmers University of Technology, Chalmers

Project objectives
The project aims to unlock the research potential on the growth, the characterization and the theoretical modelling of multifunctional advanced materials and to improve the coordination of research activities in the area of complex multifunctional materials. In particular the project will focus on the acquisition of new enabling technologies and expertise for the study and for the application of the unconventional properties of transition metal oxides (TMO’s), allowing the team of MAMA researchers to acquire a leading position in the growth, the characterization and the theoretical modelling of single crystals, epitaxial thin films, complex all oxide heterostructures and hybrid organic-inorganic structures based for example on TMO’s and organic functional materials. This objective will be achieved by:
- the improvement of know-how and human resource potential via recruitment, exchange.
- the reinforcement of the visibility of the research capacity.
- the involvement of 10 prestigious groups with a high reputation in the appropriate fields.
- the reinforcement of research potential by recruiting new researchers, by the acquisition of tools for fabricating and characterizing the materials and computation of multifunctional advanced materials.
# Projects

## Main Projects

<table>
<thead>
<tr>
<th>Title</th>
<th>Macroscopic Interference Devices for Atomic and Solid-State Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronym</td>
<td>MIDAS</td>
</tr>
<tr>
<td>Source of funding</td>
<td>EC</td>
</tr>
<tr>
<td>Specific funding program</td>
<td>STREP</td>
</tr>
<tr>
<td>Project Coordinator</td>
<td>Prof. Gershon Kurizki, Weizmann Institute, IL</td>
</tr>
<tr>
<td>SPIN Coordinator</td>
<td>Prof. Antonio Barone. SPIN NA</td>
</tr>
<tr>
<td>Other partners</td>
<td>TU Vienna (TUW) Austria - Heidelberg University (UHEI) Germany</td>
</tr>
<tr>
<td></td>
<td>CEA Saclay (CEA) France - Erlangen University (FAU) Germany</td>
</tr>
<tr>
<td></td>
<td>SPIN CNR Naples Italy - Chalmers University (Chalmers) Sweden</td>
</tr>
<tr>
<td></td>
<td>CNRS (Grenoble+Paris) (CNRS) France - TU Delft (TUD) The Netherlands</td>
</tr>
</tbody>
</table>

## Project objectives

Quantum physics has been fundamental to our understanding of nature and consequently central to physical research for the past 80 years. Yet, only in recent years have we begun to grasp its tremendous potential for technological applications. Our response to the formidable challenge of expanding the range of quantum-technologies is to capitalize on the remarkable analogies that have recently emerged between two previously unrelated classes of quantum systems with potentially fascinating applications: ultracold-atom (UCA) degenerate gases and solid-state superconductors (SC). These analogies stem from the notion of macroscopic quantum-coherent transport known as Josephson supercurrent, common to both fields. This project will create a unified base for genuinely quantum regimes of operation in both fields. This unified base will serve a twofold purpose: (a) It will allow substantial improvement in the state-of-the-art of both fields: our ability to exploit the properties of macroscopic quantum coherence/supercurrents in novel UCA- and SC-based devices will greatly benefit from active cooperation between leading teams in the two fields. (b) It will be used to explore the feasibility of integrating the two types of devices. Significant progress towards this ambitious goal will create a principally new quantum technology suitable for various applications. The project will draw upon several landmarks achieved thus far in the realm of Josephson junctions (JJs), the basic schemes of supercurrent flow:

a) The striking demonstrations of supercurrent effects and JJ physics for atomic Bose-Einstein condensates (BECs) in double-well and periodic potentials, pioneered by our Heidelberg and Vienna partners, have opened a new vista onto SC-UCA supercurrent analogies. Other such analogies have been revealed by experiments on 2d supercurrent vorticity in BEC, by our CNRS Paris partners and others.

b) Macroscopic quantum dynamics and coherence in SC-based JJs has been demonstrated. Our Saclay and CNRS-Grenoble, as well as Naples-Chalmers partners have been among the leaders of this research, using low-TC (LTS) and high-TC (HTS) SC materials, respectively.

c) Two-state artificial-atom SC circuits, “qubits”, and their pairwise entanglement allowing quantumgate operations have been developed. Our Saclay and CNRS-Grenoble, as well as Naples-Chalmers partners have been among the leaders of this research, using low-TC (LTS) and high-TC (HTS) SC materials, respectively.

d) Observations of quantum-nonlinear (soliton) properties in long SC JJs have been pioneered by our Erlangen partner.

e) A crucial step towards hybridization of SC and UCA (BEC) elements has been pioneered by our Vienna partner, through the development of the solid-state Atom Chip, which allows coherent micro-manipulations of UCA gases. Current work in the US and Japan has diversified the methods of BEC trapping and interference near low-temperature and superconducting chips.
### Main Projects

<table>
<thead>
<tr>
<th>Title</th>
<th>Engineering Exotic Phenomena at Oxide Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronym</td>
<td>OXIDES</td>
</tr>
<tr>
<td>Source of funding</td>
<td>EC</td>
</tr>
<tr>
<td>Specific funding program</td>
<td>FP7</td>
</tr>
<tr>
<td>Project Coordinator</td>
<td>Philippe Ghosez (Université de Liège)</td>
</tr>
<tr>
<td>SPIN Coordinator</td>
<td>Daniele Marrè, SPIN GE</td>
</tr>
<tr>
<td>Other partners</td>
<td>Consejo Superior de Investigaciones Científicas Barcelona, Universidad de Cantabria, Universität Ausburg, Université de Genève, PHASIS (SME)</td>
</tr>
</tbody>
</table>

#### Project objectives

The field of oxide interfaces is still at an incipient stage and evolving from recent fundamental discoveries to applications and designing optimized structures based on these concepts is still a major challenge requiring combined theoretical and experimental progress. We need a deep understanding of the microscopic phenomena at oxide interfaces, the design and realization of optimized heterostructures exhibiting such effects, and the demonstration that useful devices based on such materials can be produced. All these issues are at the heart of OxIDes – Oxide Interface Design –, a project aiming at engineering exotic phenomena at oxide interfaces and at exploring their potentialities to yield new applications and devices. The scientific and technological objectives of OxIDes are:

- the development of a set of multi-scale theoretical tools going beyond present capabilities and appropriate for the predictive modelling of properties of complex and realistic oxide interfaces;
- the application of such techniques, in collaboration with experimentalists, to design a new generation of artificially layered oxides with unique and experimentally-confirmed properties;
- the evaluation of the possible integration of such new materials into devices, including application-oriented characterisation of specific interfaces and of a microbalance prototype.

OxIDes will generate new fundamental knowledge concerning:

- theory level: the first-principles description of correlated electron systems and the applicability and predictive power of different models (H eff, BBT, BDR) in complex oxides;
- materials level: the microscopic origin of interfacial phenomena in oxide heterostructures and how to take advantage of them to obtain new properties;
- application level: the potential inclusion of advanced oxide materials into devices. OxIDes will investigate the possibility of engineering new properties at three types of oxide interfaces, each of them motivated by a simple fundamental physical concept, targeting a specific technological application and requiring specific theoretical developments:
  - insulating interfaces between insulating oxides, where novel couplings between structural instabilities can lead to unusual phenomena such as improper ferroelectricity;
  - conducting interfaces between insulating oxides, where an interfacial 2-dimensional electron gas can be induced that might, for example, exhibit large thermoelectric power;
  - interfaces between metallic and insulating oxides, where interfacial screening and depolarizing fields are key issues for ferroelectric capacitor and ferroelectric tunnel junction memory devices.
Main Projects

Title
Exploring the potential of Iron-based Superconductors

Acronym
SUPER-IRON

Source of funding
EC

Specific funding program
FP7-NMP-2011-Eu-Japan

Coordinator
Marina Putti, SPIN GE

Other partners
J Karpiski (Institute of Condensed Matter Physics)
B. Holtzapfel (Institute for Solid State and Materials Research-IFW)
D. Johrendt (Ludwig-Maximilians-Universität München)
M. Eisterer (Vienna University of Technology)
J.-I. Shimoyama (University of Tokyo)
T. Kiss (Kyushu University)
Y.Takano (NIMS)
H.Eisaki (National Institute for Materials Science)

Project objectives
In 2008 the group of Prof. Hosono discovered the superconductivity in a new compound containing FeAs planes, thus opening the age of Fe-based superconductors (FeSC). Several different phases were rapidly discovered and today the FeSCs show the second high Tc behind the high-Tc superconductors and very high critical fields. These characteristics suggested that FeSCs can be candidates for power application. Within SUPER-IRON we depict the roadmap for exploring and exploiting the potentialities of these materials: 1) understanding the fundamental mechanisms of superconductivity and their implication, 2) control material quality, 3) manipulate superconducting properties, 4) assess the potential of FeSCs with respect to other superconductors, 5) identify application fields, where FeSCs lead to a step-like change with respect to the current state of the art.

To cover this road SUPER-IRON has joined the efforts of the leader groups involved in the investigation of FeSCs throughout EU and Japan. Different phases of FeSCs and also the new pnictide oxides SC, in form of single crystals, polycrystals, thin films, tapes and wires will be realized by using different synthesis methods. Superconducting properties will be investigated also under high magnetic field and/or pressure and visualization of local electric field and current will be carried out with sophisticated techniques. This wide variety of experimental activities will be supported by an intense theoretical work including ab-initio calculations and theoretical modelling. The achievement of the planned objectives through synergic and coordinated activities will set the basis for future collaborations between Japan and EU.
Main Projects

Title: Magnetic-Superconductor Cryogenic Non-contact Harmonic Drive

Acronym: MAGDRIVE

Source of funding: EC

Specific funding program: FP7 Collaborative Project. Small or medium-scale focused research project

Project Coordinator: Prof. José Luis Pérez Diaz, Universidad Carlos III de Madrid, Spain

SPIN Coordinator: Carlo Ferdeghini, SPIN GE

Other partners: Università degli Studi di Cassino, Italy, CNR-SPIN, Italy, CAN Superconductor, Czech Republic, BPE Germany, LIDAX, Spain, Fundacao da Faculdade de Ciencias da Universidade de Lisboa, Portugal

Project objectives:
The objective of this project is to design, build and test a harmonic drive able to work at low temperatures for space application. The Harmonic Drive (HD) mechanism is a power transmission capable of developing high ratios, providing a high positional precision to the assembly, with relatively low weight/volume ratio, high torque capability and near zero backlash. It was invented by Musser (1955) for aerospace applications, but it is widely used now in robotics, medical equipment, printing presses, vehicles or military industry. The application of HD mechanisms at low temperature (T<100 K) is limited by lubrication. Any kind of oil or grease freezes at cryogenic conditions, losing all the lubricant properties. Other dry lubricants present also problems like grating, clutching, rapid wear out, instability of friction coefficient, formation of cold weld centres and losses or decomposition of the lubricant at cryogenic conditions. In addition, fatigue due to the intrinsic flexural functioning of the HD also limits its effective work life.

The objective of this project is to design, build and test a magnetic-superconductor cryogenic non contact harmonic drive. This harmonic drive will be a mechanism provided with an input axle and an output hub with a great reduction ratio and it will be able to function at cryogenic temperatures. It will be based on a non-contact interaction between magnets, soft magnetic materials and superconductors. Therefore the drive has not any wearing neither fatigue and it will not need any lubrication. It will greatly increase the life time of the drives. As drives are profusely used in many different fields the result of this project is a qualitative jump that will open many opportunities.

This harmonic drive will be based on “non-contact magnetic teeth” instead of fitting teeth on a flexural wave as conventional harmonic drives are based on. Non-contact magnetic teeth may be activated by a magnetic wave (similar to an electrical engine) and stabilized by the use of superconductor materials. This would solve the problems of contact wearing and mechanical fatigue. Superconductors will be also used for non-contact bearings and for shielding the magnetic fields to avoid electromagnetic interferences or emission.
# Projects

## Main Projects

<table>
<thead>
<tr>
<th>Title</th>
<th>Nanoelectronics: Concepts, Theory and Modelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronym</td>
<td>NanoCTM</td>
</tr>
<tr>
<td>Source of funding</td>
<td>EC</td>
</tr>
<tr>
<td>Specific funding program</td>
<td>Initial Trainign Network, FP7, Marie Curie Action</td>
</tr>
<tr>
<td>Project Coordinator</td>
<td>Prof. Colin Lambert, Lancaster University UK</td>
</tr>
<tr>
<td>SPIN Coordinator</td>
<td>Maura Sassetti, SPIN GE</td>
</tr>
</tbody>
</table>

## Project objectives

The NanoCTM network will tackle major challenges in the theory of nanoelectronics. Internationally-leading European theory-of-condensed-matter groups have joined forces, combining theoretical expertise in nanowires, quantum dots, carbon-based electronics, and spintronics, along with interaction and proximity effects in small dimensions. Our highly-integrated approach to nanoscale transport will represent a major step towards the realisation of future scalable nanotechnologies and processes. In the longer term, the insights gained will contribute to the fabrication of novel functional nanoscale architectures and their integration into a higher hierarchical level.

The training dimension of the NanoCTM network is reflected in a series of high-priority actions specifically aimed at early stage researchers (ESRs). These include: education and knowledge dissemination through the organisation of Thematic Workshops, Tutorial Courses, Annual Network Meetings, Summer Schools and Mobility Programmes. The network has a strong focus on interdisciplinary training, builds on several fruitful collaborations between the partners and seeks to close an existing educational gap in the European Research Arena.
Projects

Main Projects

<table>
<thead>
<tr>
<th>Title</th>
<th>Unjamming transition in granular systems and earthquake precursors: theory, experiments and simulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronym</td>
<td>UTGM</td>
</tr>
<tr>
<td>Source of funding</td>
<td>MIUR</td>
</tr>
<tr>
<td>Specific funding program</td>
<td>FIRB 2008</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Massimo Pica Ciamarra, SPIN NA</td>
</tr>
<tr>
<td>Other partners</td>
<td>CNR-ISC (Dr. Fergal O’Daltuin) Sec. University of Naples (Dr. Eugenio Lippiello)</td>
</tr>
<tr>
<td>Project objectives</td>
<td>When the applied shear stress overcomes a threshold, the yield stress, a material start flowing. While it is known that in crystals this occurs because of the presence of dislocations, which are the ‘weak points’, much less is known regarding how disordered solids loses their mechanical strength, and whereas it is possible to understand how close a system is to its failure point. These questions are relevant to a number of different fields, ranging from soft matter science where it is important to control the viscosity and the moduli of complex liquids, to geophysical phenomena such as earthquakes and avalanches. The objective of this project is to understand how a disordered solids looses its mechanical rigidity, and whereas it is possible to identify precursors. The project aims to achieve these goals via a combined theoretical, numerical and experimental study of different models. It will also experimentally and numerically investigate a model system of a fault, illustrated in the figure, where granular particles, representing the fault gouge, are enclosed between two shearing plates. The projects exploits recent theoretical tools and methods developed in the study of the slow dynamics of viscous liquids.</td>
</tr>
</tbody>
</table>
Projects

Main Projects

Title
Establishing the basic science and technology for Iron-based superconducting electronics applications

Acronym
IRONSEA

Source of funding
EC

Specific funding program
NMP.2011.2.2-6 Fundamental properties of novel superconducting materials (coordinated call with Japan)

Project Coordinator
Leibniz-Institut Fuer Festkoerper- Und Werkstoffforschung Dresden E.V.
IFW Dresden Germany

SPIN Coordinator
Domenico Paparo, SPIN NA

Other partners
Friedrich-Schiller-Universitaet Jena FSU Jena Germany
Univerzita Komenskeho V Bratislave Bratislava Slovakia
Politecnico di Torino Italy
Consiglio Nazionale Delle Ricerche - Istituto SPIN Italy
Universiteit Twente Netherlands

Project objectives
Recent investigations on iron-based superconductors have revealed a lot of similarities to MgB2 and the cuprates, for instance, a multiband nature, high upper critical fields and a short coherence length. Now immediate interest of a new class of materials would be exploring potential electronics applications such as Josephson devices and SQUIDs. In this project, we will address the feasibility of electronics applications by establishing the fundamentals of the iron-based superconductors. Examining the Josephson effect and SQUIDs, the so-called phase-sensitive experiment, also paves the way to understanding fundamental properties such as order parameters symmetry and energy gap, which is one of the main objective in this project. Investigations by point contact spectroscopy, infrared spectroscopy and transport properties are also conducted within the same frame of this work. Such fundamental studies may find unique physical properties, which lead to exploring new kinds of devices and applications. Since the iron-based superconductors are multi-band natures, comparative studies to MgB2 are also carried out.

CNR will contribute to several activities using expertise and facilities available in various locations. The Genoa SPIN section will be mainly involved in preparation of Fe-based (11) thin films on ordinary and bicrystal substrates and their morphologic and transport characterization. The Salerno SPIN section will fabricate high quality MgB2 thin films, will perform noise spectroscopy and fast photo-response measurement, and will design and characterise innovative nanowire devices. The Naples SPIN section will deposit trilayers for hybrid (S-N and S-S’) junctions and perform pump probe measurements for characterisation of non-equilibrium processes in the materials and devices developed, and will fabricate and characterize bilayer devices with SC/M and SC/N. The researchers at ICIB will pattern hybrid junctions; fabricate bicrystal grain boundary junctions and characterize both hybrid and bicrystal grain boundary junctions and innovative devices, and develop theoretical modeling of Josephson processes.
Optical Properties of (SrMnO$_3$)$_n$/ (LaMnO$_3$)$_{2n}$ Superlattices: An Insulator-to-Metal Transition Observed in the Absence of Disorder

Perucchi A.$^1$, Baldassarre L.$^1$, Nucara A.$^2$, Calvani P.$^2$, Adamo C.$^3$, Schalom D.G.$^3$, Orgiani P.$^4$, Maritato L.$^4$, Lupi S.$^5$

$^1$Sincrotrone Trieste, Area Science Park, Trieste, Italy
$^2$CNR-SPIN and Dip.to di Fisica, Università di Roma La Sapienza, Piazzale Aldo Moro 2, Rome, Italy
$^3$Department of Materials Science and Engineering, Cornell University, Ithaca, New York, USA
$^4$CNR-SPIN and Dip.to di Matematica ed Informatica, Università di Salerno, Baronissi, Salerno, Italy
$^5$CNR-IOM and Dip.to di Fisica, Università di Roma La Sapienza, Piazzale Aldo Moro 2, Rome, Italy


The insulator-to-metal transition (IMT) coupled to ferromagnetic ordering in hole-doping compounds is understood through the double-exchange mechanism, once the localization tendency due to polaron formation has been taken into account. However, quenched disorder weakens long-range order and causes ferromagnetism to break up into clusters, an essential ingredient of the observed Colossal Magneto-Resistance effect. We measure the optical conductivity, $\sigma_1(\omega)$, of (SrMnO$_3$)$_n$/ (LaMnO$_3$)$_{2n}$ superlattices (SL) for $n=1$, 3, 5, and 8 and 10 $<$ $T$ $<$ 400 K: these heterostructures offer the opportunity to observe the IMT in the absence of the disorder due to chemical doping.

Our data show a $T$-dependent insulator to metal transition for $n < 3$, where eventually the charge reaches a uniform distribution throughout the film; the transition is driven by the softening of a polaronic mid-infrared band, more evident in the $n=1$ sample. At $n = 5$ the softening of the polaronic band is incomplete, while at the largest-period $n = 8$ compound the mid-infrared band is independent of $T$ and the SL remains insulating, thus suggesting a strong localization of the charges at the interfaces. Unsuccessful reconstruction of the SL optical properties from those of the original bulk materials suggests that (SrMnO$_3$)$_n$/ (LaMnO$_3$)$_{2n}$ heterostructures give rise to a novel electronic state.

In the present collaboration, the SPIN groups have provided and partly characterized the samples, and have participated both to the infrared data collection, and to the delicate phase of data analysis.

Panel (a): $\sigma_1(\omega)$ at $T = 10$ K for the $n=1$, 3, 5, 8 compounds, showing the Mott transition induced by the proximity between the layers. $\sigma_1(\omega)$ at $T = 300$ K, for $n = 16$ is reported as well. Data on single crystals of LaMnO$_3$ and La$_{0.5}$Sr$_{0.5}$MnO$_3$ and on SrMnO$_3$ at 10 K are also shown for comparison. Panels (b-e): $\sigma_1(\omega)$ at different $T$ for $n = 8, 5, 3, and 1$, respectively. Low-$T$ conductivity of cleaved La$_{0.625}$Sr$_{0.175}$MnO$_3$ single crystals and La$_{0.5}$Sr$_{0.5}$MnO$_3$ films is also reported for comparison in panel e.
Highlights

2010

Interplay between Charge Order, Ferroelectricity, and Ferroelasticity:
Tungsten Bronze Structures as a Playground for Multiferroicity

Kunihiiko Yamauchi and Silvia Picozzi
CNR-SPIN L’Aquila, Italy


Charge order is proposed as a driving force behind ferroelectricity in iron fluoride K_{0.6}Fe_{0.6}^{II}Fe_{0.4}^{III}F_{3}. By means of density functional theory, we propose several noncentrosymmetric d5/d6 charge-ordering patterns, each giving rise to polarization with different direction and magnitude. Accordingly, we introduce the concept of “ferroelectric anisotropy” (peculiar to improper ferroelectrics with polarization induced by electronic degrees of freedom), denoting the small energy difference between competing charge-ordered states.

Moreover, we suggest a novel type of charge-order-induced ferroelasticity: a monoclinic distortion is induced by a specific charge-ordering pattern, which, in turn, determines the direction of polarization. K_{0.6}Fe_{0.6}^{II}Fe_{0.4}^{III}F_{3} therefore emerges as a prototypical compound, in which the intimately coupled electronic and structural degrees of freedom result in a peculiar multiferroicity.

Fig. Perspective view of charge-orbital order of t2g minority-spin states in iron-fluoride K0.6FeF3
Highlights

Sharp Transition for Single Polarons in the One-Dimensional Su-Schrieffer-Heeger Model

D. J. J. Marchand¹, G. De Filippis², V. Cataudella², M. Berciu¹, N. Nagaosa³, N. V. Prokof’ev⁴, A. S. Mishchenko⁵,⁶, and P. C. E. Stamp¹

¹Dept of Physics and Astronomy, University of British Columbia, Vancouver, BC, Canada, V6T 1Z1
²CNR-SPIN and Dip.to di Scienze Fisiche, Università di Napoli Federico II, I-80126 Napoli, Italy
³Dept of Applied Physics, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113, Japan
⁴Dept of Physics, University of Massachusetts, Amherst, Massachusetts 01003, USA
⁵Cross-Correlated Materials Research Group (CMRG), ASI, RIKEN, Wako 351-0198, Japan
⁶RRC “Kurchatov Institute,” 123182 Moscow, Russia


Polarons have been of broad interest in physics ever since they were introduced in 1933 and, apart from their central role in solid state physics, they exemplify in quantum field theory the passage from weak to strong coupling in a non trivial model of a single particle coupled to a bosonic field. In the paper we have studied a single polaron in the Su-Schrieffer-Heeger (SSH) model by using four different techniques (three numerical and one analytical). We show that the model exhibits sharp transition, at a critical coupling strength λc, between states with zero and nonzero momentum of the ground state. This results is unexpected since polarons show a smooth crossover from weak to strong coupling, as a function of the electron-phonon coupling strength λ, in all models where this coupling depends only on phonon momentum q.

Our result prove that in models where the coupling depends also on the electron momentum k, as in the SSH model, the physics of the intermediate regime is very different. This result is representative of all polarons with coupling depending on k and q, and can have important experimental consequences (e.g., in angle-resolved photoemission spectroscopy and conductivity experiments). Within this collaboration, in particular CNR-SPIN research unit developed the Limited Phonon Basis Exact Diagonalization that has been successfully applied also to other models in different contexts.

Derivative of the GS energy with respect to α, (b) Z factor of the GS, (c) wave vector of the GS, and (d) the ratio m₀/m* of the bare and effective polaronic masses at KGS for ωph=0.5. Red triangles, green rhombi, black squares, and blue circles correspond to LPBED, MA, DMC, and BDMC methods, respectively. The vertical dashed line indicates the critical coupling λc.
Highlights

2010

High proton conduction in grain-boundary-free yttrium-doped barium zirconate films grown by pulsed laser deposition

Daniele Pergolesi1,2, Emilianna Fabbri1,2, Alessandra D'Epifanio3, Elisabetta Di Bartolomeo1, Antonello Tebano1, Simone Sanna1, Silvia Licoccia2, Giuseppe Balestrino1, Enrico Traversa1,2

1NAST Center & Dip.to di Scienze e Tecnologie Chimiche, University of Roma 'Tor Vergata', Rome, Italy
2International Research Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Tsukuba, Ibaraki, Japan
3CNR-SPIN and Dipartimento di Ingegneria Meccanica, University of Roma 'Tor Vergata', Rome, Italy

High quality, grain-boundary free, thin films of yttrium-doped barium zirconate (BaZr0.8Y0.2O3-δ, BZY) were produced using the pulsed laser deposition apparatus available at the CNR-SPIN "Tor Vergata" laboratories. These films exhibited the largest proton conductivity values ever reported for BZY samples, namely 0.11 S/cm at 500°C and 0.01 S/cm at temperatures as low as 350°C. These conductivity values are substantially larger than those attained by the La0.8Sr0.2Ga0.2O3 (LSGM) and Ce0.8Gd0.2O1.9-δ (GDC) that were presently considered to be the oxygen ion conductors with the highest conductivity in the same temperature range. The high conductivity values of the BZY films, in the intermediate temperature range, mean that the this proton conductor maybe thought of as a possible substitute for the oxygen-ion conductor electrolytes conventionally used in solid oxide fuel cells (SOFCs). Common to other proton conductors the BZY also offers the important advantage that the water exhaust is produced at the cathode side, avoiding fuel dilution with water and improving efficiency. In order to be used in a wide range of applications it is mandatory for the SOFCs to exhibit a decrease in operating temperature to below 700°C and more specifically to below 450°C for their use in portable electronic devices (laptop, mobile phone, etc.) to substitute Li-ions batteries. The absence of charge-discharge cycles and a larger energy density are the main benefits offered by the SOFCs with respect to Li-ions batteries. Our results demonstrated that the highly ordered BZY films without grain boundaries, obtained by pulsed laser deposition, are one of the most performing electrolytes ever developed for SOFC use and open new perspectives in the development of miniaturized SOFCs for a wide range of electronic device applications.

Electrical conductivity comparisons. (a) Comparison between the electrical conductivity and activation energy values of the BZY films grown on MgO and sapphire, and of BZY sintered pellets, measured in the intermediate temperature range, with the bulk conductivity values of BZY pellets measured at low temperature. The differences in the measured activation energy values with the literature data indicate some structural and/or chemical differences between the bulk of the samples prepared using PLD and ceramic processing. (b) Comparison between the electrical conductivity values of the BZY film grown on MgO, and of BZY and BCY sintered pellets, measured in the intermediate temperature range. Conductivity values of the most performing oxygen ion conducting materials, La0.8Sr0.2Ga0.2Mg0.8O3 (LSGM) and Ce0.8Gd0.2O1.9-δ (GDC), are also reported.
Since their discovery in 1986, the research on superconducting cuprates has been focused on their "low-temperature" properties, like the superconductivity and the so-called pseudogap, while the high-T properties of the cuprates have been scarcely investigated up to now. The present work is, to our knowledge, the first optical study of two Bi-based cuprates at optimum doping, from their critical temperature $T_c$ to 500 K. We have measured their optical conductivity $\sigma(\omega)$ and their spectral weight $W(\Omega,T)$ up to a cut-off frequency $\Omega$. The T-dependence of the carrier kinetic energy (which is proportional to $W(T)$) is described in terms of the Sommerfeld expansion, which is usually limited to the first term in $T^2$. We have found that, above 300 K, $W(T)$ deviates from the $T^2$ behavior in both compounds, even though the extrapolation to a dc conductivity $\sigma(\omega \to 0)$ remains well far from the Ioffe-Regel limit. As shown in the Figure, the deviation is well described by the second term of the Sommerfeld expansion, namely that in $T^4$. This shows that, despite all the anomalies encountered in the behavior of high-$T_c$ superconductors, a Fermi-liquid picture works well up to such a high $T$. However, the coefficients of both the $T^2$ and the $T^4$ term are much enhanced by strong correlations, as shown by our dynamical mean field theory (DMFT) calculations. All measurements have been done by CNR-SPIN and CNR-IOM personnel, using the apparatus of the CNR-SPIN laboratory at University La Sapienza.
Magnetism in C- or N-doped MgO and ZnO: A Density Functional Study of Impurity Pairs

Hua Wu, Alessandro Stroppa, Sung Sakong, Silvia Picozzi, Matthias Scheffler, and Peter Kratzer

1II. Physikalisches Institut, Universität zu Köln, Germany
2Department of Physics, Fudan University, Shanghai, China
3CNRSPIN, L’Aquila, Italy
4Fakultät für Physik and Center for Nanointegration (CeNIDE), Universität DuisburgEssen, Duisburg, Germany
5FritzHaberInstitut der Max Planck Gesellschaft, Berlin, Germany


It is shown that substitution of C or N for O recently proposed as a way to create ferromagnetism in otherwise nonmagnetic oxide insulators is curtailed by formation of impurity pairs, and the resultant C2 spin=1 dimers as well as the isoelectronic N2+ interact antiferromagnetically in ptype MgO. For Cdoped ZnO, however, we demonstrate using the Heyd-Scuseria-Ernzerhof hybrid functional that a resonance of the spinpolarized C2 ppπ* states with the host conduction band results in a longrange ferromagnetic interaction. Magnetism of openshell impurity molecules is proposed as a possible route to d0-ferromagnetism in oxide spintronic materials.
Highlights

2010

**Suppression of the critical temperature in NdFeAs(OF) single crystal by Kondo-like scattering induced by irradiation**

C. Tarantini$^1$, M. Putti$^3$, A. Gurevich$^1$, Y. Shen$^2$, R.K. Singh$^2$, J.M. Rowell$^2$, N. Newman$^2$, D.C. Larbalestier$^1$, Peng Cheng$^4$, Ying Jia$^4$, Hai-Hu Wen$^4$

$^1$National High Magnetic Field Laboratory, Florida State University, Tallahassee, FL, USA
$^2$Dept of Materials Science and Engineering, Arizona State University, Tempe, AZ, USA
$^3$CNR-SPIN and Dept of Physics, University of Genova, Italy
$^4$Institute of Physics and National Laboratory of Condensed Matter Physics, Chinese Academy of Sciences, Beijing, China


The paper report the first comprehensive investigation of the suppression of the critical temperature $T_c$ of NdFeAs(OF) single crystal by disorder induced by $\alpha$-particle irradiation. Our data indicate that irradiation defects produce both nonmagnetic and magnetic scattering, resulting in the Kondo-like excess resistance $\Delta\rho(T)\propto\ln T$ over 2 decades in temperatures above $T_c$.

Despite high densities of irradiation defects, the dose at which $T_c$ is suppressed to zero is comparable to that for MgB$_2$ but is well above the corresponding values for cuprates. Such remarkably weak $T_c$ suppression by strong magnetic and nonmagnetic disorder may reveal novel features of superconductivity and magnetism in pnictides.
Unjamming Dynamics: The Micromechanics of a Seismic Fault Model

M. Pica Ciamarra, CNR-SPIN, U.O.S. Napoli
E. Lippiello, Sec. University of Naples, Dep. of Environmental Sicences
C. Godano, Sec. University of Naples, Dep. of Environmental Sicences
L. de Arcangelis, Sec. University of Naples, Dep. of Information Engineering

The unjamming transition of granular systems is investigated in a seismic fault model via three dimensional molecular dynamics simulations. A two-time force-force correlation function, and a susceptibility related to the system response to pressure changes, allow us to characterize the stick-slip dynamics, consisting in large slips and microslips leading to creep motion. The correlation function unveils the micromechanical changes occurring both during microslips and slips. The susceptibility encodes the magnitude of the incoming microslip.

The figure shows the response of the system to perturbations of different intensities, as a function of time, across small and large slips. Before a slip of size \( \Delta X \), the susceptibility reaches a maximum \( \chi_\alpha \). The inset illustrates that these two quantities are correlated. This implies that by measuring the system’s response to external perturbations it is possible to infer the size of the next slip, i.e. the amount of energy the system will release.
Evidence for a minigap in YBCO grain boundary Josephson Junctions

P. Lucignano\textsuperscript{1,2}, D. Stornaiuolo\textsuperscript{1}, F. Tafuri\textsuperscript{3,1}, B. L. Al'tshuler\textsuperscript{4} and A. Tagliacozzo\textsuperscript{1,5}

\textsuperscript{1}CNR-SPIN, Napoli, Italy
\textsuperscript{2}International School for Advanced Studies (SISSA/ISAS), Trieste, Italy
\textsuperscript{3}Dip.to Ingegneria dell’Informazione, II Università di Napoli, Aversa (CE), Italy
\textsuperscript{4}Physics Department, Columbia University, New York, USA
\textsuperscript{5}Dip.to di Scienze Fisiche, Università di Napoli Federico II, Italy


Future information technology and new generation of fast computing rely on tailoring and designing of quantum devices. Nanolithography provides scale reduction of devices at an unprecedented pace, but it will soon come to its physical limit. Superconductivity of dissipationless electron pairs realizes macroscopic quantum states (MQS). Josephson junctions represent a unique system to measure and manipulate MQS. High Tc cuprates are recent materials with novel properties common to strongly correlated systems, waiting to be exploited. In the last years hybrid systems are being syntetized at an intermediate, mesoscopic scale, in which sample dependent quantum behavior at low temperatures turns into robust emerging universal responses (independent of the disorder) under electronic control which allows for applications in metrology and quantum computing. One of the goals of our CNR-SPIN group is to investigate the interplay between superconducting coherence and mesoscopic disorder. The nature of HTS promotes an intriguing length scale hierarchy where the mesoscopic normal state coherence prevails over the superconducting order induced in the barrier of grain boundary nanocontacts. It is found that conduction channels are secured, in which high energy anti-nodal quasi-particles coherently interfere with surprisingly long decay times. This provides further understanding for the appearance of Macroscopic Quantum Tunneling in YBCO Josephson Junctions, as measured in our devices at low temperatures. In our paper, the experimental observation of another mesoscopic property is reported, i.e. a minigap in the excitation spectrum of a Grain Boundary HTS Josephson Junction, which has been quite elusive to observation in transport measurements, up to now. More is to expect from the confluence of HTS and nanophysics.
Highlights

2010

Persistent currents and quantized vortices in a polariton superfluid

D. Sanvitto\textsuperscript{1}, F. M. Marchetti\textsuperscript{2}, M. H. Szymańska\textsuperscript{3,4}, G. Tosi\textsuperscript{1}, M. Baudisch\textsuperscript{1}, F. P. Laussy\textsuperscript{5}, D. N. Krizhanovskii\textsuperscript{6}, M. S. Skolnick\textsuperscript{6}, L. Marrucci\textsuperscript{7}, A. Lemaître\textsuperscript{8}, J. Bloch\textsuperscript{8}, C. Tejedor\textsuperscript{2} and L. Viña\textsuperscript{1}

\textsuperscript{1}Departamento de Física de Materiales, Universidad Autónoma de Madrid, Spain
\textsuperscript{2}Departamento de Física Teórica de la Materia Condensada, Universidad Autónoma de Madrid, Spain
\textsuperscript{3}Department of Physics, University of Warwick, UK
\textsuperscript{4}London Centre for Nanotechnology, London, UK
\textsuperscript{5}School of Physics and Astronomy, University of Southampton, UK
\textsuperscript{6}Department of Physics and Astronomy, University of Sheffield, UK
\textsuperscript{7}Dipartimento di Scienze Fisiche, Università di Napoli Federico II and CNR-SPIN, Napoli, Italy
\textsuperscript{8}LPN/CNRS, Route de Nozay, Marcoussis, France


After the discovery of zero viscosity in liquid helium, other fundamental properties of the superfluidity phenomenon have been revealed. One of them, irrotational flow, gives rise to quantized vortices and persistent currents. Those are the landmarks of superfluidity in its modern understanding. Recently, a new variety of dissipationless fluid behavior has been found in microcavities under the optical parametric regime. In this paper, the authors report the observation of metastable persistent polariton superflows sustaining a quantized angular momentum, $m\hbar$, after applying a 2-ps laser pulse carrying a vortex state. The latter was prepared by diffraction of an input Gaussian beam on suitable holograms specifically developed in CNR-SPIN. Different holograms were used for injecting different values of angular momentum $m$, or to obtain more complex superposition states. In all cases, the authors observe a transfer of angular momentum to the steady-state condensate, which then sustains vorticity for as long as it can be tracked.

The stability of quantized vortices with $m = 2$ was also investigated. The appearance of secondary vortices of various signs around the injected vortex was finally observed and explained (in follow-up studies) thanks also to theoretical insights from researchers of CNR-SPIN. All experiments were analyzed using a generalized two-component Gross–Pitaevskii equation. These results demonstrate the control of metastable persistent currents and show the peculiar superfluid character of non-equilibrium polariton condensates.

False-colors image of a metastable polariton superfluid vortex. The “x” labels the vortex core.
Intense paramagnon excitations in a large family of high-temperature superconductors


Max Planck Institute for Solid State Research, Stuttgart, Germany,
CNR-SPIN, Dipartimento di Fisica, Politecnico di Milano, Italy,
Quantum Matter Institute, University of British Columbia, Vancouver, Canada,
Swiss Light Source, Paul Scherrer Institut, Villigen PSI, Switzerland,
CNR-SPIN, Napoli, Italy

Nature Physics 2041 (2011)

In the search for the mechanism of high-temperature superconductivity, intense research has been focused on the evolution of the spin excitation spectrum on doping from the antiferromagnetic insulating to the superconducting state of the cuprates. Because of technical limitations, the experimental investigation of doped cuprates has been largely focused on low-energy excitations in a small range of momentum space. Here we use resonant inelastic X-ray scattering to show that a large family of superconductors, encompassing underdoped YBa$_2$Cu$_3$O$_8$ and overdoped YBa$_2$Cu$_3$O$_7$, exhibits damped spin excitations (paramagnons) with dispersions and spectral weights closely similar to those of magnons in undoped cuprates. The comprehensive experimental description of this surprisingly simple spectrum enables quantitative tests of magnetic Cooper pairing models. A numerical solution of the Eliashberg equations for the magnetic spectrum of YBa$_2$Cu$_3$O$_7$ reproduces its superconducting transition temperature within a factor of two, a level of agreement comparable to that of Eliashberg theories of conventional superconductors.
High-T(c) Ferroelectricity Emerging from Magnetic Degeneracy in Cupric Oxide

Giovannetti G\textsuperscript{1,2}, Kumar S\textsuperscript{3,4}, Stroppa A\textsuperscript{5}, van den Brink J\textsuperscript{3}, Picozzi S\textsuperscript{1}, Lorenzana J\textsuperscript{2}

\textsuperscript{1}CNR-SPIN L’Aquila;  
\textsuperscript{2}ISC-CNR, Dip. Fisica, Universita “La Sapienza”, Roma  
\textsuperscript{3}Institute for Theoretical Solid State Physics, Dresden  
\textsuperscript{4}Indian Institute of Science Education and Research Mohali, Chandigarh  
\textsuperscript{5}CNISM-Dip. Fisica, University of L’Aquila

Cupric oxide is multiferroic at unusually high temperatures. The CNR-SPIN group of L’Aquila, by performing high accurate density functional calculations have confirmed for the first time, that the low-T magnetic phase is paraelectric, and the higher-T one is ferroelectric with a size and direction of polarization in good agreement with experiments. By mapping the ab initio results on to an effective spin model, we show that the system has a manifold of almost degenerate ground states. In the high-T magnetic state noncollinearity and inversion symmetry breaking stabilize each other via the Dzyaloshinskii-Moriya interaction. This leads to an unconventional mechanism for multiferroicity, with the particular property that non-magnetic impurities enhance the effect.

In the ICM phase, the CuO becomes multiferroic, with a finite and switchable Pb along the b axis (Fig. adapted from http://www.zeitnews.org/)
Highlights

2011

Electric Control of Magnetization and Interplay between Orbital Ordering and Ferroelectricity in a Multiferroic Metal–Organic Framework

A. Stroppa\textsuperscript{1}, P. Jain\textsuperscript{2}, P. Barone\textsuperscript{1}, M. Marsman\textsuperscript{3}, J.M Perez-Mato\textsuperscript{4}, A. K. Cheetham\textsuperscript{5}, H. W. Kroto\textsuperscript{2}, S. Picozzi\textsuperscript{1}

\textsuperscript{1}CNR SPIN, L’Aquila (Italy)
\textsuperscript{2}Dept of Chemistry and Biochemistry, Florida State University, Tallahassee, FL 32306 (USA)
\textsuperscript{3}Univ. of Vienna, Faculty of Physics and Center for Computational Materials Science (Austria)
\textsuperscript{4}Dept de Fisica de la Materia Condensada, Facultad de Ciencia y Tecnologia, UPV/EHU, Bilbao (Spain)
\textsuperscript{5}Department of Materials Science and Metallurgy, University of Cambridge (UK)

Metal Organic Frameworks (MOFs) are hybrid crystalline materials made up of both inorganic and organic structural elements. They are driving enormous interest not only for many interesting properties, but also owing to the large variety of structural topologies, modifications of the organic units, useful for functionalizing specific materials properties. A class of dense MOFs having a ABX3 topology where A is an organic linker, B is a metal atom, and X is a carboxylic acid, is particularly appealing since shows eye-catching properties in areas that have traditionally been dominated by inorganic materials, like magnetism and ferroelectricity. The coexistence of magnetic and ferroelectric order in the same material, i.e. multiferroicity (MF), is of great technological and fundamental importance, in particular when both orders are coupled, i.e. magneto-electric coupling. Despite the large activity devoted to multiferroics, most of the past and current studies have focussed on inorganic compounds, mainly in the family of perovskite-like oxides. On the other hand, there is a growing expectation that MF in MOFs should show unprecedented properties, not fully realized in standard inorganic compounds, opening a cornucopia of new horizons. A few experimental studies on multiferroic MOFs started to emerge, but theoretical simulations are an almost totally unexplored field. The CNR-SPIN group in l’Aquila performed a pioneering study based on ab-initio calculations of a Cu based MOF compound showing that i) It should be a multiferroic, i.e. it is both a ferroelectric and a weak-ferromagnet. ii) It should also be magneto-electric coupling. Despite the large activity devoted to multiferroics, most of the past and current studies has focussed on inorganic compounds, mainly in the family of perovskite-like oxides. On the other hand, there is a growing expectation that MF in MOFs should show unprecedented properties, not fully realized in standard inorganic compounds, opening a cornucopia of new horizons. A few experimental studies on multiferroic MOFs started to emerge, but theoretical simulations are an almost totally unexplored field. The CNR-SPIN group in l’Aquila performed a pioneering study based on ab-initio calculations of a Cu based MOF compound showing that i) It should be a multiferroic, i.e. it is both a ferroelectric and a weak-ferromagnet. ii) It should also be magneto-electric coupling. Therefore allowing the electrical control of magnetic properties. iii) The above ferroelectric polarization emerges from a subtle interplay between Jahn Teller distortions (which are nonpolar in common inorganic perovskite compounds) and organic A-groups through hydrogen bonding. This is a unique mechanism and demonstrates the rich field for the development of new physics in this class of materials, which have not yet been characterized theoretically.
Recent experiments carried out at the Weizmann Institute of Science have shown that the fractionalization of tunneling charges unexpectedly occurs in a variety of forms. In particular noise measurements suggest an increasing of the carrier charge in tunneling of a quantum point contact at the lowest temperatures. In our paper we fit very convincingly two independent experimental quantities such as the current and the excess noise in the quantum point contact (see the figure) for filling factor 5/2. The most accredited low-energy effective field theory for the edges states was used. In particular we found that two are the main excitations: the "single-quasiparticle", charge e/4 and non-Abelian statistics, and the "2-agglomerate", charge e/2 and Abelian statistics, with e the electron charge. A crucial ingredient, to explain the experiment, was the inclusion of renormalization effects determined by the coupling of the edge states with external degrees of freedoms (such as unavoidable 1/f noise and dissipative baths). At low enough temperature, the 2-agglomerates becomes the protagonist, with a charge twice that of the fundamental quasiparticle. This result could have deep consequences because only non-Abelian excitations, such as the single-quasiparticles, could be used to encode the topological quantum computation.
Highlights

2011

Giant Nernst-Ettingshausen Oscillations in Semiclassically Strong Magnetic Fields

I.A. Luk'yanchuk - Laboratory of Condensed Matter Physics, Univ. of Picardie Jules Verne, Amiens, France
A.A. Varlamov - CNR-SPIN, Viale del Politecnico 1, Rome, Italy
A.V. Kavokin - Physics and Astronomy School, University of Southampton, Highfield, Southampton, UK

In the present work we consider the NE effect in the presence of semiclassically strong magnetic fields for a quasi-two dimensional system with a parabolic or linear dispersion of carriers. We show that the occurring giant oscillations of the NE coefficient are coherent with the recent experimental observation in graphene, graphite and bismuth. In the 2D case we find the exact shape of these oscillations and show that their magnitude decreases/increases with enhancement of the Fermi energy for Dirac fermions/normal carriers. With a crossover to 3D spectrum the phase of oscillations shifts, their amplitude decreases and the peaks become asymmetric.

Physical Review Letter 107 Issue: 1 Article Number: 016601 (2011)

The Nernst-Ettingshausen (NE) effect is a thermoelectric counterpart of the Hall effect. It consists in induction of an electric field $E_y$ normal to the mutually perpendicular magnetic field $H_z$ and temperature gradient $\nabla T$. Quantitatively, the effect is characterized by the NE coefficient $\gamma = \frac{(-\nabla T)H_z}{E_y}$ which varies by several orders of magnitude in different materials ranging from about 7 mV/ (KT) in bismuth up to 10-5 mV/(KT) in some metals. NE effect was discovered in 1886 and remained poorly understood until 1948 when Sondheimer in the framework of the transport equation calculated for a degenerated electron system. Its study became a powerful tool in investigation of the character of scattering mechanisms in semiconductors, but did not find its special role in metals. At the beginning of 2000 Ong discovered the giant growth of NE signal approaching $T_c$ in pseudogap phase of HTC materials, later the colossal growth of the NE coefficient was detected by Behnia in Nb$_{0.25}$S$_{0.75}$ above $T_c$, the experiments on graphene demonstrated the giant oscillations of the NE signal with growth of magnetic field. In order to explain the physical essence of all these anomalies and to learn how to extract from them the useful information in SPIN was developed the new general approach to the description of the NE effect, where is expressed in terms of the temperature derivatives of the chemical potential and magnetization of the charge carriers system. In the previous publications [1,2] this method was successfully probed on explanation of the NE anomalies in conventional and HTC superconductors, being used side by side with the rigorous calculus of the NE coefficient in the framework of the diagrammatic Matsubara technique.

In the present work we consider the NE effect in the presence of semiclassically strong magnetic fields for a quasi-two dimensional system with a parabolic or linear dispersion of carriers. We show that the occurring giant oscillations of the NE coefficient are coherent with the recent experimental observation in graphene, graphite and bismuth. In the 2D case we find the exact shape of these oscillations and show that their magnitude decreases/increases with enhancement of the Fermi energy for Dirac fermions/normal carriers. With a crossover to 3D spectrum the phase of oscillations shifts, their amplitude decreases and the peaks become asymmetric.

Highlights

2011

Retention of the tetragonal to orthorhombic structural transition in F-substituted SmFeAsO: a new phase diagram for SmFeAs(O$_{1-x}$F$_x$)

A. Martinelli$^1$, A. Palenzona$^1$, M. Tropeano$^1$, M. Putti$^{1,2}$, C. Ferdeghini$^1$, G. Profeta$^3$, E. Emerich$^4$

$^1$ SPIN-CNR, corso Perrone 24, 16152 Genova - Italy
$^2$ Dipartimento di Fisica, Università di Genova, via Dodecaneso 33, 16146 Genova – Italy
$^3$ CNR and Dipartimento di Fisica, Universita’ de L’Aquila, Via Vetoio, 10 I-67010 Coppito – Italy
$^4$ SNBL at ESRF, 6 rue Jules Horowitz, 38043 Grenoble – France

Physical Review Letters 106 227001 (2011)

Fe-based superconductors were intensively studied during the very last years. Whatever their composition, they are structurally based on planar layers of edge-sharing tetrahedra, centred by Fe, and stacked along the c-axis. Compounds characterized by a LnFeAsO chemical formula (Ln: lanthanide) belong to the so-called 1111-type family where superconductivity can be induced both by hole or electron doping. Around ~150 K undoped and faintly doped compounds undergo a tetragonal to orthorhombic structural transition that is followed by an antiferromagnetic ordering of Fe spins at a slight lower temperature. Many investigations report that both structural and magnetic transitions are suppressed above a critical value of electron doping induced by F substitution; in addition the natures of the structural transition and magnetic ordering are still debated and related to different physical phenomena, such as magnetic frustration, spin density wave, nematic correlations and orbital ordering.

Integrating these results with those obtained by muon spin rotation on the same samples we drew a new phase diagram for the system SmFeAs(O$_{1-x}$F$_x$). These findings relate the AFM transition on a different ground with respect to the structural one and suggests that orbital ordering could be the driving force for symmetry breaking.
Highlights

2011

Microfluidics analysis of red blood cell membrane viscoelasticity

Tomaiouolo G1, Barra M2, Preziosi V1, Cassinese A2, Rotoli B3, Guido S1

1 Dipartimento di Ingegneria chimica, Università di Napoli Federico II,  
2 CNR-SPIN and Department of Physics Science, Università di Napoli Federico II, Napoli, Italy,  
3 Dipartimento di Biochimica e Biotecnologie mediche, Università di Napoli Federico II, Napoli, Italy.

Lab on Chip 11, 449-454 (2011)

A microfluidic system to investigate the flow behavior of red blood cells in a microcirculation-mimicking network of PDMS microchannels with thickness comparable to cell size is presented. In collaboration with the group of S. Guido of the University of Naples, we provide the first quantitative description of cell velocity and shape as a function of the applied pressure drop in such devices. Based on these results, a novel methodology to measure cell membrane viscoelastic properties in converging/diverging flow is developed. In particular, in the diverging channel the effect of RBC surface viscosity is dominant with respect to shear elasticity.

The role of the researcher of CNR-SPIN and of the Physics Departments of Naples University was mainly devoted, by using soft lithography techniques to the realization of the devices that perfectly mimics a network of human blood vessels.
Dynamical Correlation Length and Relaxation Processes in a Glass Former

R. Pastore, CNR-SPIN
M. Pica Ciamarra, CNR-SPIN
A. de Candia, Univ. di Napoli Federico II, Dep. of Physics, and CNR-SPIN
A. Coniglio, Univ. di Napoli Federico II, Dep. of Physics, and CNR-SPIN


We investigate the relaxation process and the dynamical heterogeneities of the kinetically constrained Kob-Andersen lattice glass model and show that these are characterized by different time scales. The dynamics is well described within the diffusing defect paradigm, which suggests that we relate the relaxation process to a reverse-percolation transition. This allows for a geometrical interpretation of the relaxation process and of the different time scales.

The figure shows the particles of the investigated model system which have not moved in the time interval 0-t. These particles are correlated space over a distance known as the dynamical correlation length. Different theories predict this length to be the one governing the slow dynamics of the system. Our work proved that in this model system this is not the case, and therefore challenges existing theories of the structural glass transition.
Correlated trends of coexisting magnetism and superconductivity in optimally electron-doped oxy-pnictides

S. Sanna¹, P. Carretta¹, P. Bonfà¹, G. Prando¹,² G. Allodi³, R. De Renzi³, T. Shiroka,⁴,⁵ G. Lamura⁶, A. Martinelli⁷ and M. Putti⁶

¹Dipartimento di Fisica A. Volta" and Unita CNISM di Pavia, I-27100 Pavia, Italy
²Dipartimento di Fisica E. Amaldi", Università di Roma3-CNISM, I-00146 Roma, Italy
³Dipartimento di Fisica and Unita CNISM di Parma, I-43124 Parma, Italy
⁴Laboratorium fur Festkörperforschung, ETH-Honggerberg, CH-8093 Zurich, Switzerland
⁵Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland
⁶CNR-SPIN and Università di Genova, via Dodecaneso 33, I-16146 Genova, Italy
⁷CNR-SPIN Corso Perrone 24, I-16146 Genova, Italy


Superconductivity and magnetism are shown to be tightly related to two distinct well defined local electronic environments of the FeAs layers. The two transition temperatures, Tc and TM, controlled by the isoelectronic and diamagnetic Ru substitution, scale with the volume fraction of the corresponding environments. This is evidence that superconductivity is assisted by magnetic fluctuations, which are frozen where short range static order appears, and totally disappear above the magnetic dilution threshold xc ~ 0.6.

The paper reports on the recovery of short range static magnetic order and on the concomitant degradation of the superconducting state in optimally F-doped SmFe₁₋ₓRuₓAsO₀.₈₅F₀.₁₅ for 0.1 ≤ x ≤0.5 synthesized at CNR-SPIN. The two reduced order parameters coexist within nanometer-size domains in the FeAs layers and finally disappear around a common critical threshold xc ~ 0.6.
Ferroelectricity due to orbital ordering in E-type undoped rare-earth manganites

Paolo Barone, Kunihiko Yamauchi, and Silvia Picozzi
CNR-SPIN L’Aquila, Italy

Physical Review Letters 106, 077201 (2011)

Among other multiferroic materials, orthorhombic rare-earth manganites RMnO$_3$ (R belonging to lanthanum series) represent an important class of “improper multiferroics”, where the ferroelectricity is not only coexisting with, but also intrinsically related to some kind of magnetic order. For small rare-earth cations, such as Ho or Tm, the ground state displays an E-type antiferromagnetism characterized by zigzag ferromagnetic chains antiferromagnetically coupled. This collinear magnetic ordering has been predicted to induce a ferroelectric polarization via an exchange-striction mechanism, where the double-exchange interaction between Mn $e_{1g}$ electrons in the symmetry-broken $↑↑↓↓$ spin configuration is responsible for polar atomic displacements of oxygens bridging Mn ions. Ab-initio calculation partially confirmed this picture, but also pointed out a comparable contribution to polarization having a purely quantum mechanical origin, possibly related to the AFM-E-induced asymmetric electron hopping of orbitally polarized $e_{1g}$ states. Aim of this Letter is to set a clear correspondence between the electronic polarization and the onset of orbital ordering on the background of the magnetic AFM-E configuration. In the framework of the degenerate double-exchange model relevant for manganites, we evaluated the Berry phase of the orbitally polarizable Bloch electrons, which allows to directly measure the electronic contribution to polarization, as the orbital ordering is tuned either by Jahn-Teller electron-lattice coupling or by electron-electron interaction. In the orbital-ordered state, Bloch electrons acquire a phase depending on the clockwise or counterclockwise motion around each site. Similarly, a phase change in electronic wavefunctions arises along each chain from the direction dependence of hopping amplitudes. The interplay of these two phases, realized only in the presence of both the E-type magnetic order and of the orbital ordering is responsible for the appearence of a purely electronic polarization.
Publications

2010

Curlik, I; Reiffers, M; Giovannini, M; Gazo, E; Sebek, J; Santava, E
Strong Electronic Correlations in a New Yb-Based Compound: YbCu4Ni
ACTA PHYSICA POLONICA A 118 (5), 919-921 (2010)

De Rosa, C; Aurierma, F; Di Girolamo, R; Pepe, GP; Napolitano, T; Scaldaferrì, R
Enabling Strategies in Organic Electronics Using Ordered Block Copolymer Nanostructures
ADVANCED MATERIALS 22 (4), 5414 (2010)

Brand, S; Ciamarra, MP; Nicodemi, M
Complex flow in granular media
ADVANCES IN COMPLEX SYSTEMS 13 (3), 339-347 (2010)

Sanz, M; Castillejo, M; Amoruso, S; Ausanio, G; Bruzzese, R; Wang, X
Ultra-fast laser ablation and deposition of TiO2

Amoruso, S; Schou, J; Lunney, J
Energy balance of a laser ablation plume expanding in a background gas

Coscia, U; Ambrosone, G; Basa, DK; Tresso, E; Chiiodoni, A; Pinto, N; Murri, R
Morphological and structural modifications induced in a-Si1-x C (x) :H films by excimer laser annealing
APPLIED PHYSICS A-MATERIALS SCIENCE & PROCESSING 100 (4), 1163-1168 (2010)

Donnelly, T; Lunney, JG; Amoruso, S; Bruzzese, R; Wang, X; Ni, X
Angular distributions of plume components in ultrafast laser ablation of metal targets
APPLIED PHYSICS A-MATERIALS SCIENCE & PROCESSING 100 (2), 569-574 (2010)

Aruta, C; Amoruso, S; Bruzzese, R; Wang, X; Maccariello, D; Granazio, FM; di Uccio, US
Pulsed laser deposition of SrTiO3/LaGaO3 and SrTiO3/LaAlO3: Plasma plume effects
APPLIED PHYSICS LETTERS 97 (25), (2010)

Perna, P; Maccariello, D; Radovic, M; di Uccio, US; Pallecchi, I; Codda, M; Marre, D; Cantoni, C; Gazquez, J; Varela, M; Pennycook, SJ; Granazio, FM
Conducting interfaces between band insulating oxides: The LaGaO3/SrTiO3 heterostructure
APPLIED PHYSICS LETTERS 97 (25), (2010)

Piccirillo, B; D'Ambrosio, V; Slussarenko, S; Marrucci, L; Santamato, E
Photon spin-to-orbital angular momentum conversion via an electrically tunable q-plate
APPLIED PHYSICS LETTERS 97 (24), (2010)

Biasotti, M; Pellegrino, L; Bellingeri, E; Manca, N; Siri, AS; Marre, D
Strain response of La0.7Sr0.3CoO3 epitaxial thin films probed by SrTiO3 crystalline microcantilevers
APPLIED PHYSICS LETTERS 97 (22), (2010)

Barone, C; Pagano, S; Neitzert, HC
Effect of concentration on low-frequency noise of multiwall carbon nanotubes in high-density polyethylene matrix
APPLIED PHYSICS LETTERS 97 (15), (2010)

Perna, P; Maccariello, D; Radovic, M; di Uccio, US; Pallecchi, I; Codda, M; Marre, D; Cantoni, C; Gazquez, J; Varela, M; Pennycook, SJ; Granazio, FM
Conducting interfaces between band insulating oxides: The LaGaO3/SrTiO3 heterostructure
APPLIED PHYSICS LETTERS 97 (15), (2010)

Marrocco, N; Pepe, GP; Capretti, A; Parmalo, L; Pagliarulo, V; Peluso, G; Barone, A; Cristiano, R; Ejrnaes, M; Casaburi, A; Kashiyazaki, N; Taino, T; Myoren, H; Sobolewski, R
Strong critical current density enhancement in NiCu/NbN superconducting nanostripes for optical detection
APPLIED PHYSICS LETTERS 97 (9), (2010)

Cantoni, M; Petti, D; Bertacco, R; Pallecchi, I; Marre, D; Colizzi, G; Filippetti, A; Fiorentini, V
Band alignment at Cu2O/La0.7Sr0.3MnO3 interface: A combined experimental-theoretical determination
APPLIED PHYSICS LETTERS 97 (3), (2010)
Publications

2010

Bellingeri, E; Pallecchi, I; Buzio, R; Gerbi, A; Marre, D; Cimberle, MR; Tropeano, M; Putti, M; Palenzona, A; Ferdeghini, C
T-c=21 K in epitaxial FeSe0.5Te0.5 thin films with biaxial compressive strain
APPLIED PHYSICS LETTERS 96 (10), (2010)

Tebano, A; Orsini, A; Di Castro, D; Medaglia, PG; Balestrino, G
Interplay between crystallographic orientation and electric transport properties in La2/3Sr1/3MnO3 films
APPLIED PHYSICS LETTERS 96 (9), (2010)

Yamapi, R; Filatrella, G; Aziz-Alaoui, MA
Global stability analysis of birhythmicity in a self-sustained oscillator
CHAOSS 20 (1), (2010)

Maselli, P; Nicoletti, D; Nucara, A; Vitucci, FM; Iriwaka, A; Shoji, K; Namba, T; Calvani, P
Pressure-temperature phase diagram of charge ordering in Nd1/2Sr1/2MnO3
EPL 92 (4), (2010)

De Filippis, G; Catalaudella, V; Citro, R; Perroni, CA; Mishchenko, AS; Nagaosa, N
Multi-gap superconductivity in a BaFe1.84Co0.16As2 film from optical measurements at terahertz frequencies

Perucchi, A; Baldassarre, L; Lupi, S; Jiang, J; Weiss, JD; Hellstrom, EE; Lee, S; Bark, CW; Eom, CB; Putti, M; Pallecchi, I; Marini, C; Dore, P

Dynamical behavior of a lattice glass model on a random graph: Comparison with the Mode Coupling Theory
EPL 90 (4), (2010)

Perucchi, A; Baldassarre, L; Lupi, S; Jiang, J; Weiss, JD; Hellstrom, EE; Lee, S; Bark, CW; Eom, CB; Putti, M; Pallecchi, I; Marini, C; Dore, P
Multi-gap superconductivity in a BaFe1.84Co0.16As2 film from optical measurements at terahertz frequencies

Ying, ZJ; Cuoco, M; Noce, C; Zhou, HQ
Phase diagram and deformed phase separation for a trapped Fermi gas with population imbalance and BCS pairing interaction

Bonavolonta, C; Barone, AC; Valentino, M; Rabuffo, I
Quantum-like criticality for a classical transverse Ising model in 4-epsilon dimensions

Barra, M; Di Girolamo, FV; Chiarella, F; Salluzzo, M; Chen, Z; Facchetti, A; Anderson, L; Cassinese, A
Transport Property and Charge Trap Comparison for N-Channel Perylene Diimide Transistors with Different Air-Stability
JOURNAL OF PHYSICAL CHEMISTRY C 114 (48), 20387-20393 (2010)

Amoruso, S; Schou, J; Lunney, JG
Ablation Plume Dynamics in a Background Gas
INTERNATIONAL SYMPOSIUM ON HIGH POWER LASER ABLATION 1278, 665-676 (2010)

Barra, M; Di Girolamo, FV; Chiarella, F; Salluzzo, M; Chen, Z; Facchetti, A; Anderson, L; Cassinese, A
Transport Property and Charge Trap Comparison for N-Channel Perylene Diimide Transistors with Different Air-Stability
JOURNAL OF PHYSICAL CHEMISTRY C 114 (48), 20387-20393 (2010)

Bisio, F; Prato, M; Cavalleri, O; Barborini, E; Mattera, L; Canepa, M
Interaction of Liquids with Nanoporous Cluster Assembled Au Films
JOURNAL OF PHYSICAL CHEMISTRY C 114 (41), 17591-17596 (2010)
Publications

2010

Iacomino, A; Cantele, G; Trani, F; Ninno, D

**DFT Study on Anatase TiO2 Nanowires: Structure and Electronic Properties As Functions of Size, Surface Termination, and Morphology**

JOURNAL OF PHYSICAL CHEMISTRY C 114 (29), 12389-12400 (2010)

Bellomo, B; De Pasquale, A; Gualdi, G; Marzolino, U

**A tomographic approach to non-Markovian master equations**

JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL 43 (39)

Barone, C; Aruta, C; Galdi, A; Orgiani, P; Quaranta, O; Maritato, L; Pagano, S

**Spin-polarized current effects in disordered La0.7Ba0.3MnO3 half-metal thin films**

JOURNAL OF PHYSICS D-APPLIED PHYSICS 43 (24), (2010)

Baldassarre, L; Perucchi, A; Lupi, S; Dore, P

**Far infrared properties of the rare-earth scandate DyScO3**

JOURNAL OF PHYSICS-CONDENSED MATTER 22 (35), (2010)

Gambardella, A; Salluzzo, M; Di Capua, R; Affronte, M; Gimenez-Saiz, C; Gomez-Garcia, CJ; Coronado, E; Vaglio, R

**Scanning tunnelling spectroscopy study of paramagnetic superconducting beta '-ET4[(H3O)Fe(C2O4)(3)]center dot C6H5Br crystals**

JOURNAL OF PHYSICS-CONDENSED MATTER 22 (17), (2010)

Giovannini, M; Hadwig, M; Pasero, R; Bauer, E; Hilscher, G; Reissner, M; Rogl, P; Michor, H

**Phase formation and ground state properties of CeCo9Si4**

JOURNAL OF PHYSICS-CONDENSED MATTER 22 (13), (2010)

Buono, D; Nocerino, G; D'Arria, V; Porzio, A; Olivares, S; Paris, MGA

**Quantum characterization of bipartite Gaussian states**


Tkachenko, V; Marino, A; Abbate, G

**Studying nematic liquid crystals by spectroscopic ellipsometry**


Barone, A; Lombardi, F; Rotoli, G; Tafuri, F

**Macroscopic quantum phenomena in Josephson structures**

LOW TEMPERATURE PHYSICS 36, 876-883 (2010)

Tkachenko, V; Marino, A; Abbate, G

**Study of Nematic Liquid Crystals by Spectroscopic Ellipsometry**

MOLECULAR CRYSTALS AND LIQUID CRYSTALS 527, 80-91 (2010)

Chiccoli, C; Pasini, P; Abbate, G; Marino, A; Zannoni, C

**Computer Simulations and Experimental Dynamical Characterization of a Composite Liquid Crystal-Polymer System**

MOLECULAR CRYSTALS AND LIQUID CRYSTALS 527, 119-129 (2010)

Perucchi, A; Baldassarre, L; Nucara, A; Calvani, P; Adamo, C; Schlom, DG; Orgiani, P; Maritato, L; Lupi, S

**Optical Properties of (SrMnO3)(n)/(LaMnO3)(2n) Superlattices: An Insulator-to-Metal Transition Observed in the Absence of Disorder**

NANO LETTERS 10 (12), 4819-4823 (2010)

De Marco, P; Nardone, M; Del Vitto, A; Alessandri, M; Santucci, S; Ottaviano, L

**Rapid identification of graphene flakes: alumina does it better**

NANOTECHNOLOGY 21 (25), (2010)

Di Bartolomeo, A; Rinzan, M; Boyd, AK; Yang, YF; Guadagno, L; Giubileo, F; Barbara, P

**Electrical properties and memory effects of field-effect transistors from networks of single- and double-walled carbon nanotubes**

NANOTECHNOLOGY 21 (11), (2010)
Publications

2010

Pergolesi, D; Fabbri, E; D’Epifanio, A; Di Bartolomeo, E; Tebano, A; Sanna, S; Licoccia, S; Balestrino, G; Traversa, E
High proton conduction in grain-boundary-free yttrium-doped barium zirconate films grown by pulsed laser deposition
NATURE MATERIALS 9 (10), 846-852 (2010)

Schimka, L; Harl, J; Stroppa, A; Gruneis, A; Marsman, M; Mittendorfer, F; Kresse, G
Accurate surface and adsorption energies from many-body perturbation theory
NATURE MATERIALS 9 (9), 741-744 (2010)

Sanvitto, D; Marschetti, FM; Szymanska, MH; Tosi, G; Baudisch, M; Laussy, FP; Krizhanovskii, DN; Skolnick, MS;
Marrucci, L; Lemaitre, A; Bloch, J; Tejedor, C; Vina, L
Persistent currents and quantized vortices in a polariton superfluid
NATURE PHYSICS 6 (7), 527-533 (2010)

Stroppa, A; Marsman, M; Kresse, G; Picozzi, S
The multiferroic phase of DyFeO3: an ab initio study
NEW JOURNAL OF PHYSICS 12, (2010)

Lin, WC; Winkelmann, A; Chiang, CT; Bisio, F; Kirschner, J
Spin-polarized multi-photon photoemission and surface electronic structure of Cu(001)
NEW JOURNAL OF PHYSICS 12, (2010)

Di Gennaro, E; Gallina, I; Andreone, A; Castaldi, G; Galdi, V
Experimental evidence of cut-wire-induced enhanced transmission of transverse-electric fields through sub-wavelength slits in a thin metallic screen
OPTICS EXPRESS 18 (26), 26769-26774 (2010)

Slussarenko, S; D’Ambrosio, V; Piccirillo, B; Marrucci, L; Santamato, E
The Polarizing Sagnac Interferometer: a tool for light orbital angular momentum sorting and spin-orbit photon processing
OPTICS EXPRESS 18 (26), 27205-27216 (2010)

Ciattoni, A; Rizza, C; Palange, E
Transverse power flow reversing of guided waves in extreme nonlinear metamaterials
OPTICS EXPRESS 18 (11), 11911-11916 (2010)

Ciattoni, A; Rizza, C; Palange, E
Transmissivity directional hysteresis of a nonlinear metamaterial slab with very small linear permittivity
OPTICS LETTERS 35 (13), 2130-2132 (2010)

Rose, TP; Di Gennaro, E; Andreone, A; Abbate, G
Low index-contrast periodically ordered photonic quasicrystals for the development of isotropic photonic band-gap devices
PHOTONIC CRYSTAL MATERIALS AND DEVICES IX 7713, (2010)

Avella, A; Mancini, F; Plekhanov, E
COM framework for d-wave superconductivity in the 2D Hubbard model
PHYSICA C-SUPERCONDUCTIVITY AND ITS APPLICATIONS 470, 5930-5931 (2010)

Leo, A; Grimaldi, G; Nigro, A; Pace, S; Verellen, N; Silhanek, AV; Gillijns, W; Moshchalkov, VV; Metlushko, V; Ilic, B
Pinning effects on the vortex critical velocity in type-II superconducting thin films
PHYSICA C-SUPERCONDUCTIVITY AND ITS APPLICATIONS 470 (19), 904-906 (2010)

Grimaldi, G; Leo, A; Nigro, A; Pace, S
Vortex lattice ordering in the flux flow state of Nb thin films
PHYSICA C-SUPERCONDUCTIVITY AND ITS APPLICATIONS 470 (19), 911-913 (2010)

Giubileo, F; Piano, S; Scarfato, A; Bobba, F; Di Bartolomeo, A; Cucolo, AM
Study of the pairing symmetry in the electron-doped cuprate Pr1-xLaxCuO4-y by tunneling spectroscopy
PHYSICA C-SUPERCONDUCTIVITY AND ITS APPLICATIONS 470 (19), 922-925 (2010)
Publications

2010

Dell’Anno, F; De Siena, S; Adesso, G; Illuminati, F
Teleportation of squeezing: Optimization using non-Gaussian resources
PHYSICAL REVIEW A 82 (6), (2010)

Karimi, E; Leach, J; Slussarenko, S; Piccirillo, B; Marrucci, L; Chen, LX; She, WL; Franke-Arnold, S; Padgett, MJ; Santamato, E
nSpin-orbit hybrid entanglement of photons and quantum contextuality
PHYSICAL REVIEW A 82 (2), (2010)

Crepin, F; Citro, R; Simon, P
Incompressible states of a two-component Fermi gas in a double-well optical lattice
PHYSICAL REVIEW A 82 (1), (2010)

Nagali, E; Sansoni, L; Marrucci, L; Santamato, E; Sciarrino, F
Experimental generation and characterization of single-photon hybrid ququarts based on polarization and orbital angular momentum encoding
PHYSICAL REVIEW A 81 (5), (2010)

Ciattoni, A; Rizza, C; Palange, E
Extreme nonlinear electrodynamics in metamaterials with very small linear dielectric permittivity
PHYSICAL REVIEW A 81 (4), (2010)

Provino, A; Gschneidner, KA; Manfrinetti, P
Structure and thermal stability of the RMgPb rare earth compounds, and the anomalous melting behaviour of SmMgPb

Russo, T; Gloria, A; D’Anto, V; D’Amora, U; Ameratano, G; Bollino, F; De Santis, R; Ausanio, G; Catauro, M; Rengo, S; Ambrosio, L
Poly(epsilon-caprolactone) reinforced with sol-gel synthesized organic-inorganic hybrid fillers as composite substrates for tissue engineering
JOURNAL OF APPLIED BIOMATERIALS & BIOMECHANICS 8 (3), 146-152 (2010)

Amoruso, S; Bruzzese, R; Wang, X; O’Connell, G; Lunney, JG
Multidagnostic analysis of ultrafast laser ablation of metals with pulse pair irradiation
JOURNAL OF APPLIED PHYSICS 108 (11), (2010)

De Luca, R
Quantum behavior of a superconducting loop interrupted by a double-barrier Josephson junction
JOURNAL OF APPLIED PHYSICS 108 (11), (2010)

Annunziata, AJ; Quaranta, O; Santavicca, DF; Casaburi, A; Frunzio, L; Ejnmaes, M; Rooks, MJ; Cristiano, R; Pagano, S; Friedman, A; Prober, DE
Reset dynamics and latching in niobium superconducting nanowire single-photon detectors
JOURNAL OF APPLIED PHYSICS 108 (8), (2010)

Sabatino, P; Cirillo, C; Carapella, G; Trezza, M; Attanasio, C
High field vortex matching effects in superconducting Nb thin films with a nanometer-sized square array of antidots

Bonettini, S; Prato, M
Nonnegative image reconstruction from sparse Fourier data: a new deconvolution algorithm
INVERSE PROBLEMS 26 (9), (2010)

Amoruso, S; Aruta, C; Bruzzese, R; Maccariello, D; Maritato, L; Granazio, FM; Orgiani, P; di Uccio, US; Wang, X
Optimization of La0.78Ba0.3MnO3-delta complex oxide laser ablation conditions by plume imaging and optical emission spectrometry
Publications

2010

Donnelly, T; Lunney, JG; Amoruso, S; Bruzzese, R; Wang, X; Ni, X
Dynamics of the plumes produced by ultrafast laser ablation of metals

Stornaiuolo, D; Rotoli, G; Cedergren, K; Born, D; Bauch, T; Lombardi, F; Tafuri, F
Submicron YBaCuO epitaxial Josephson junctions: d-wave effects and phase dynamics
JOURNAL OF APPLIED PHYSICS 107 (11), (2010)

Di Girolamo, FV; Barra, M; Capello, V; Oronzio, M; Romano, C; Cassinese, A
Bias stress instability in organic transistors investigated by ac admittance measurements
JOURNAL OF APPLIED PHYSICS 107 (11), (2010)

Ambrosio, A; Camposeo, A; Carella, A; Borbone, F; Pisignano, D; Roviello, A; Maddalena, P
Realization of submicrometer structures by a confocal system on azopolymer films containing photoluminescent chromophores
JOURNAL OF APPLIED PHYSICS 107 (8), (2010)

Marino, A; Tkachenko, V; Santamato, E; Bennis, N; Quintana, X; Oton, JM; Abbate, G
Measuring liquid crystal anchoring energy strength by spectroscopic ellipsometry
JOURNAL OF APPLIED PHYSICS 107 (7), (2010)

D’Auria, V; de Lisio, C; Porzio, A; Solimeno, S; Anwar, J; Paris, MGA
Non-Gaussian states produced by close-to-threshold optical parametric oscillators: Role of classical and quantum fluctuations
PHYSICAL REVIEW A 81 (3), (2010)

Tebano, A; Orsini, A; Medaglia, PG; Di Castro, D; Balestrino, G; Freelon, B; Bostwick, A; Chang, YJ; Gaines, G; Rotenberg, E; Saini, NL
Preferential occupation of interface bands in La2/3Sr1/3MnO3 films as seen via angle-resolved photoemission
PHYSICAL REVIEW B 82 (21), (2010)

De Luca, GM; Ghiringhelli, G; Sala, MM; Di Matteo, S; Haeverkort, MW; Berger, H; Bisogni, V; Cezar, JC; Brookes, NB; Salluzzo, M
Weak magnetism in insulating and superconducting cuprates
PHYSICAL REVIEW B 82 (21), (2010)

Orgiani, P; Galdi, A; Aruta, C; Cataudella, V; De Filippis, G; Perroni, CA; Ramaglia, VM; Ciancio, R; Brookes, NB; Sala, MM; Ghiringhelli, G; Maritato, L
Multiple double-exchange mechanism by Mn2+ doping in manganese compounds
PHYSICAL REVIEW B 82 (20), (2010)

Busby, Y; De Seta, M; Capellini, G; Evangelisti, F; Ortolani, M; Virgilio, M; Grosso, G; Pizzi, G; Calvani, P; Lupi, S; Nardone, M; Nicotra, G; Spinella, C
Near- and far-infrared absorption and electronic structure of Ge-SiGe multiple quantum wells
PHYSICAL REVIEW B 82 (20), (2010)

Profeta, G; Franchini, C; Gamalath, KAILW; Continenza, A
First-principles investigation of BaFe2As2(001)
PHYSICAL REVIEW B 82 (19), (2010)

De Filippis, G; Cataudella, V; Fratini, S; Ciuchi, S
Interface polaron formation in organic field-effect transistors
PHYSICAL REVIEW B 82 (20), (2010)

Lucignano, P; Fabrizio, M; Tagliacozzo, A
Suppression of Kondo-assisted cotunneling in a spin-1 quantum dot with spin-orbit interaction
PHYSICAL REVIEW B 82 (16), (2010)

Romeo, F; Citro, R
Parasitic pumping currents in an interacting quantum dot
PHYSICAL REVIEW B 82 (16), (2010)
Publications

2010

Brotto, P; Pallecchi, I; Putti, M; D’Agliano, EG
Interband and intraband effects in the upper critical field of disordered MgB2
PHYSICAL REVIEW B 82 (13), (2010)

Kulkarni, PD; Dhar, SK; Provino, A; Manfrinetti, P; Grover, AK
Self-magnetic compensation and shifted hysteresis loops in ferromagnetic samarium systems
PHYSICAL REVIEW B 82 (14), (2010)

Forte, F; Cuoco, M; Noce, C
Field-induced orbital patterns in ferromagnetic layered ruthenates
PHYSICAL REVIEW B 82 (15), (2010)

Flindt, C; Novotny, T; Braggio, A; Jauho, AP
Counting statistics of transport through Coulomb blockade nanostructures: High-order cumulants and non-Markovian effects
PHYSICAL REVIEW B 82 (15), (2010)

Perroni, CA; Ramaglia, VM; Cataudella, V
Behavior of quantum entropies in polaronic systems
PHYSICAL REVIEW B 82 (10) (2010)

Maroni, B; Malavasi, I; Mozzati, MC; Grandi, MS; Hill, AH; Chermisi, D; Dore, P; Postorino, P
Structural and physical properties of SmFe1-xIrxAsO (0 <= x <= 0.275) obtained by synchrotron x-ray diffraction, Raman spectroscopy, and magnetization measurements
PHYSICAL REVIEW B 82 (10) (2010)

Ferraro, D; Braggio, A; Magnoli, N; Sassetti, M
Charge tunneling in fractional edge channels
PHYSICAL REVIEW B 82 (8), (2010)

Sanna, S; De Renzi, R; Shirotaka, T; Lamura, G; Prando, G; Carretta, P; Putti, M; Martinelli, A; Cimberle, MR; Tropeano, M; Palenzona, A
Nanoscopic coexistence of magnetic and superconducting states within the FeAs layers of CeFeAsO1-xFx
PHYSICAL REVIEW B 82 (6), (2010)

Sorgente, A; Romeo, F; Citro, R
Adiabatic quantum pumping, magnification effects, and quantum size effects of spin torque in magnetic tunnel junctions
PHYSICAL REVIEW B 82 (6), (2010)

Romeo, F; Citro, R
Memory effects in adiabatic quantum pumping with parasitic nonlinear dynamics
PHYSICAL REVIEW B 82 (8), (2010)

Ranninger, J; Romano, A
Anomalous S-like dispersion of in-gap single-particle excitations in the pseudogap state of cuprate superconductors
PHYSICAL REVIEW B 82 (5), (2010)

Grimaldi, G; Leo, A; Zola, D; Nigro, A; Pace, S; Laviano, F; Mezzetti, E
Evidence for low-field crossover in the vortex critical velocity of type-II superconducting thin films
PHYSICAL REVIEW B 82 (2), (2010)

Anghinolfi, L; Bisio, F; Canepa, M; Mattera, L
Exchange bias anisotropy versus antiferromagnet thickness in uniaxial Cr/Fe bilayers
PHYSICAL REVIEW B 81 (22), (2010)

Tropeano, M; Cimberle, MR; Ferdeghini, C; Lamura, G; Martinelli, A; Palenzona, A; Pallecchi, I; Sala, A; Sheikin, I; Bernardini, F; Monni, M; Massidda, S; Putti, M
Isoelectronic Ru substitution at the iron site in SmFe(1-x)RuxAsO(0.85)F(0.15) and its effects on structural, superconducting, and normal-state properties
PHYSICAL REVIEW B 81 (18), (2010)
Publications

2010

Rigato, F; Piano, S; Foerster, M; Giubileo, F; Cucolo, AM; Fontcuberta, J
Andreev reflection in ferrimagnetic CoFe2O4 spin filters
PHYSICAL REVIEW B 81 (17), (2010)

Linder, J; Cuoco, M; Sudbo, A
Spin-active interfaces and unconventional pairing in half-metal/superconductor junctions
PHYSICAL REVIEW B 81 (17), (2010)

Braicovich, L; Sala, MM; Ament, LJP; Bisogni, V; Minola, M; Balestrino, G; Di Castro, D; De Luca, GM; Salluzzo, M;
Ghiringhelli, G; van den Brink, J
Momentum and polarization dependence of single-magnon spectral weight for Cu L-3-edge resonant inelastic x-ray scattering from layered cuprates
PHYSICAL REVIEW B 81 (17), (2010)

Vitucci, FM; Nucara, A; Nicoletti, D; Sun, Y; Li, CH; Soret, JC; Schade, U; Calvani, P
Infrared study of the charge-ordered multiferroic LuFe2O4
PHYSICAL REVIEW B 81 (19), (2010)

Cavaliere, F; Mariani, E; Leturcq, R; Stampfer, C; Sassetti, M
Asymmetric Franck-Condon factors in suspended carbon nanotube quantum dots
PHYSICAL REVIEW B 81 (20), (2010)

Ejrnaes, M; Casaburi, A; Mattioli, F; Leoni, R; Pagano, S; Cristiano, R
Time-resolved observation of fast hotspot dynamics in superconducting nanowires
PHYSICAL REVIEW B 81 (13), (2010)

Lagrange, P; Cahen, S; Emery, N; Herold, C; Rida, H; Mareche, JF; Lamura, G
Polysynthetic nature of stage-one graphite-metal intercalation compounds prepared from graphite single crystals
PHYSICAL REVIEW B 81 (15), (2010)

Pallecchi, I; Pellegrino, L; Banerjee, N; Cantoni, M; Gadaleta, A; Siri, AS; Marre, D
Cu2O as a nonmagnetic semiconductor for spin transport in crystalline oxide electronics
PHYSICAL REVIEW B 81 (16), (2010)

Perucchi, A; Nicoletti, D; Ortolani, M; Marin, C; Sopracase, R; Lupi, S; Schade, U; Putti, M; Pallecchi, I; Tarantini, C;
Ferretti, M; Ferdeghini, C; Monni, M; Bernardini, F; Massidda, S; Dore, P
Multiband conductivity and a multigap superconducting phase in V3Si films from optical measurements at terahertz frequencies
PHYSICAL REVIEW B 81 (9), (2010)

Martinelli, A; Palenzona, A; Tropeano, M; Ferdeghini, C; Putti, M; Cimberle, MR; Nguyen, TD; Affronte, M; Ritter, C
From antiferromagnetism to superconductivity in Fe1+yTe1-xSex (0 <= x <= 0.20): Neutron powder diffraction analysis
PHYSICAL REVIEW B 81 (9), (2010)

Carillo, F; Papari, G; Stornaiuolo, D; Born, D; Montemurro, D; Pingue, P; Beltram, F; Tafuri, F
Little-Parks effect in single nanoscale YBa2Cu3O6+x rings
PHYSICAL REVIEW B 81 (5), (2010)

Romano, A; Cuoco, M; Noce, C; Gentile, P; Annunziata, G
Field-induced transition from chiral spin-triplet to mixed-parity Fulde-Ferrell-Larkin-Ovchinnikov superconductivity
PHYSICAL REVIEW B 81 (6), (2010)

Barone, A; Gasperini, M; Rotoli, G
Macroscopic quantum tunneling and the "cosmic" Josephson effect
PHYSICAL REVIEW D 82 (8), (2010)

Filatrella, G; Pierro, V
Detection of noise-corrupted sinusoidal signals with Josephson junctions
PHYSICAL REVIEW E 82 (4), (2010)
Publications

2010

Wu, H; Stroppa, A; Sakong, S; Picozzi, S; Scheffler, M; Kratzer, P
Magnetism in C- or N-doped MgO and ZnO: A Density-Functional Study of Impurity Pairs
PHYSICAL REVIEW LETTERS 105 (26), (2010)

Marchand, DJ; De Filippis, G; Cataudella, V; Berciu, M; Nagaosa, N; Prokof’ev, NV; Mishchenko, AS; Stamp, PCE
Sharp Transition for Single Polarons in the One-Dimensional Su-Schrieffer-Heeger Model
PHYSICAL REVIEW LETTERS 105 (26), (2010)

Lucignano, P; Stornaiuolo, D; Tafuri, F; Altshuler, BL; Tagliacozzo, A
Evidence for a Minigap in YBCO Grain Boundary Josephson Junctions
PHYSICAL REVIEW LETTERS 105 (14), (2010)

Carillo, F; Papari, G; Stornaiuolo, D; Born, D; Montemurro, D; Pingue, P; Beltram, F; Tafuri, F
Little-Parks effect in single nanoscale YBa$_2$Cu$_3$O$_{6+x}$ rings
PHYSICAL REVIEW B 81 (5), (2010)

Yamauchi, K; Picozzi, S
Interplay between Charge Order, Ferroelectricity, and Ferroelasticity: Tungsten Bronze Structures as a Playground for Multiferroicity
PHYSICAL REVIEW LETTERS 105 (10), (2010)

Nagali, E; Giovannini, D; Marrucci, L; Slussarenko, S; Santamato, E; Sciarino, F
Experimental Optimal Cloning of Four-Dimensional Quantum States of Photons
PHYSICAL REVIEW LETTERS 105 (7), (2010)

Nicoletti, D; Limaj, O; Galvani, P; Rohringer, G; Toschi, A; Sangiovanni, G; Capone, M; Held, K; Ono, S; Ando, Y; Lupi, S
High-Temperature Optical Spectral Weight and Fermi-liquid Renormalization in Bi-Based Cuprate Superconductors
PHYSICAL REVIEW LETTERS 105 (7), (2010)

Ciamarra, MP; Lippiello, E; Godano, C; de Arcangelis, L
Unjamming Dynamics: The Micromechanics of a Seismic Fault Model
PHYSICAL REVIEW LETTERS 104 (23), (2010)

Adesso, G; Campbell, S; Illuminati, F; Paternostro, M
Controllable Gaussian-Qubit Interface for Extremal Quantum State Engineering
PHYSICAL REVIEW LETTERS 104 (24), (2010)

Giampaolo, SM; Adesso, G; Illuminati, F
Probing Quantum Frustrated Systems via Factorization of the Ground State
PHYSICAL REVIEW LETTERS 104 (20), (2010)

Cedergren, K; Kirtley, JR; Bauch, T; Rotoli, G; Troeman, A; Hilgenkamp, H; Tafuri,F; Lombardi,F
Interplay between Static and Dynamic Properties of Semifluxons in YBa$_2$Cu$_3$O$_7$-delta 0-pi Josephson Junctions
PHYSICAL REVIEW LETTERS 104 (17), (2010)

Tarantini, C; Mott, M; Gurevich, A; Shen, Y; Singh, RK; Rowell, JM; Newman, N; Larbalestier, DC; Cheng, P; Jia, Y; Wen, HH
Suppression of the Critical Temperature of Superconducting NdFeAs(OF) Single Crystals by Kondo-Like Defect Sites Induced by alpha-Particle Irradiation
PHYSICAL REVIEW LETTERS 104 (8), (2010)

Guarnaccia, G; Noce, C
Upper bounds for ground-state correlation functions in the Hubbard model
PHYSICS LETTERS A 374 (27), 2777-2780 (2010)

Sanna, S; Esposito, V; Tebano, A; Licoccia, S; Traversa, E; Balestrino, G
Enhancement of Ionic Conductivity in Sm-Doped Ceria/Yttria-Stabilized Zirconia Heteroepitaxial Structures
SMALL 6 (17), 1863-1867 (2010)

Ciamarra, MP; Nicodemi, M; Coniglio, A
Recent results on the jamming phase diagram
SOFT MATTER 6 (13), 2871-2874 (2010)
Publications

2010

Ghiringhelli, G; Sala, MM; Cezar, JC; Brookes, NB; De Luca, GM; Salluzzo, M
Orbital reconstruction at the LAO/STO interface investigated by x-ray spectroscopy
SPINTRONICS III 7760, (2010)

Gavrlikin, SY; Ivanenko, OM; Lykov, AN; Mitsen, KV; Tsvetkov, AY; Attanasio, C; Cirillo, C; Prischepa, SL
Asymmetry of the critical current and peak effect in superconducting multilayers
SUPERCONDUCTOR SCIENCE & TECHNOLOGY 23 (6), (2010)

Wagner, M; Stroppa, A; Mittendorfer, F; Ramsey, MG; Surnev, S; Netzer, FP
Electronic structure of bimetallic Ni-Rh nanowires
SURFACE SCIENCE 604 (17-18), 1406-1413 (2010)

Ambrosone, G; Basa, DK; Coscia, U; Rava, P
Correlation between structural and opto-electronic properties of a-Si1-xCx:H films deposited by plasma enhanced chemical vapour deposition
THIN SOLID FILMS 518 (20), 5871-5874 (2010)

Fornasini, ML; Manfrinetti, P; Mazzone, D
Crystal structure of ytterbium gold stannide, Yb2Au3Sn2
ZEITSCHRIFT FUR KRISTALLOGRAPHIE-NEW CRYSTAL STRUCTURES 225 (2), 221-222 (2010)

Nicoletti, D; Di Pietro, P; Limaj, O; Calvani, P; Ono, S; Ando, Y; Lupi, S
Infrared and THz study of the hole-doped Cu-O plane in its whole phase diagram
35TH INTERNATIONAL CONFERENCE ON INFRARED, MILLIMETER, AND TERAHERTZ WAVES (IRMMW-THZ 2010)

Paparo, D; Tielrooij, KJ; Piatkowski, L; Bakker, HJ; Bonn, M
Time Domain Terahertz Spectroscopy for investigating the dielectric relaxation dynamics of water in model membranes
35TH INTERNATIONAL CONFERENCE ON INFRARED, MILLIMETER, AND TERAHERTZ WAVES (IRMMW-THZ 2010)

Kaciulis S.; Mezzi A.; Ferdeghini C.; et al.
Chemical composition of superconducting SmFeAsO doped with fluorine
SURFACE AND INTERFACE ANALYSIS Volume: 42 Issue: 6-7 Special Issue: SI Pages: 692-695 JUN-JUL 2010

Tropeano M.; Pallecchi I.; Cimberle M. R.; et al.
Transport and superconducting properties of Fe-based superconductors: a comparison between SmFeAsO(1-x)F(x) and Fe(1+y)Te(1-x)Se(x)
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 23 Issue: 5 Article Number: 054001 MAY 2010

Putti M.; Pallecchi I.; Bellingeri E.; et al.
New Fe-based superconductors: properties relevant for applications
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 23 Issue: 3 Article Number: 034003 (2010)

Malagoli A.; Braccini V.; Bennini C.; et al.
Study of the MgB(2) grain size role in ex situ multifilamentary wires with thin filaments
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 23 Issue: 2 Article Number: 025032 FEB 2010

Matarazzo, V; De Nicola, S; Zito, G; Mormile, P; Rippa, M; Abbate, G; Zhou, J; Petti, L
Spectral characterization of two-dimensional Thue-Morse quasicrystals realized with high resolution lithography
JOURNAL OF OPTICS Volume: 13 Issue: 1 Published: JAN 2011

Stroppa, A; Jain, P; Barone, P; Marsman, M; Perez-Mato, JM; Cheetham, AK; Kroto, HW; Picozzi, S
Electric Control of Magnetization and Interplay between Orbital Ordering and Ferroelectricity in a Multiferroic Metal-Organic Framework
ANGEWANDE CHEMIE-INTERNATIONAL EDITION Volume: 50 Issue: 26 Pages: 5847-5850 (2011)

Tomaiuolo, G; Barra, M; Preziosi, V; Cassinese, A; Rotoli, B; Guido, S
Microfluidics analysis of red blood cell membrane viscoelasticity
LAB ON A CHIP Volume: 11 Issue: 3 Pages: 449-454 Published: 2011
Publications

2010

Di Castro, D; Kanigel, A; Maisuradze, A; Keren, A; Postorino, P; Rosenmann, D; Welp, U; Karapetrov, G; Claus, H; Hinks, DG; Amato, A; Campuzano, JC
Muon spin rotation study of the magnetic penetration depth in the intercalated graphite superconductor CaC6
PHYSICAL REVIEW B 82 (1), (2010)

Lehmann, AG; Congiu, F; Lampis, N; Granozio, FM; Perna, P; Radovic, M; di Uccio, US
Magnetic properties of pseudomorphic epitaxial films of Pr0.7Ca0.3MnO3 under different biaxial tensile stresses
PHYSICAL REVIEW B 82 (1), (2010)
2011

Slussarenko, S; Karimi, E; Piccirillo, B; Marrucci, L; Santamato, E
Efficient generation and control of different-order orbital angular momentum states for communication links

Braggio, A; Governale, M; Pala, MG; Konig, J
Superconducting proximity effect in interacting quantum dots revealed by shot noise
SOLID STATE COMMUNICATIONS Volume: 151 Issue: 2 Pages: 155-158 Published: JAN 2011

Ristic, Z; Di Capua, R; De Luca, GM; Chiarella, F; Ghiringhelli, G; Cezar, JC; Brookes, NB; Richter, C; Mannhart, J; Salluzzo, M
Nanoscale modulation of the density of states at the conducting interface between LaAlO(3) and SrTiO(3) band insulators
EPL Volume: 93 Issue: 1 Article Number: 17004 Published: JAN 2011

Carlini, R; Artini, C; Borzone, G; Masini, R; Zanichelli, G; Costa, GA
Synthesis and characterisation of the compound CoSbS
JOURNAL OF THERMAL ANALYSIS AND CALORIMETRY Volume: 103 Issue: 1 Pages: 23¬-27 Published: JAN 2011

Artini, C; Costa, GA; Masini, R
Study of the formation temperature of mixed LaREO(3) (RE Dy, Ho, Er, Tm, Yb, Lu) and NdGdO(3) oxides
JOURNAL OF THERMAL ANALYSIS AND CALORIMETRY Volume: 103 Issue: 1 Pages: 17¬ Published: JAN 2011

Shiroka, T; Lamura, G; De Renzi, R; Belli, M; Emery, N; Rida, H; Caven, S; Mareche, JF; Lagrange, P; Herold, C
mu SR investigation of the intercalated graphite superconductor CaC(6)
NEW JOURNAL OF PHYSICS Volume: 13 Article Number: 013038 Published: JAN 2011

Marini, C; Valentini, M; Perucchia, A; Dore, P; Sarma, DD; Lupi, S; Postorino, P
Metal-insulator transition in NiS2-xSex: chemical vs external pressure effects
HIGH PRESSURE RESEARCH Volume: 31 Issue: 1 Pages: 18-22 Article Number: Published: 2011

di Liberto, F; Pastore, R; Peruggi, F
Dissipated energy and entropy production for an unconventional heat engine: the stepwise 'circular cycle'
PHILOSOPHICAL MAGAZINE Volume: 91 Issue: 13-15 Special Issue: SI Pages: 1864-1876 Published: 2011

Pastore, R; Ciamarra, MP; Coniglio, A
Flow and jam' of frictional athermal systems under shear stress

Bellingeri, E; Pallecchi, I; Buzio, R; Gerbi, A; Marre, D; Cimberle, MR; Tropeano, M; Putti, M; Palenzona, A; Kaciulis, S; Fardoughini, C
Critical Temperature Enhancement by Biaxial Compressive Strain in FeSe(0.5)Te(0.5) Thin Films

Grimaldi, G; Leo, A; Cirillo, C; Casaburi, A; Cristiano, R; Attanasio, C; Nigro, A; Pace, S ; Huebener, RP
Non-linear Flux Flow Resistance of Type-II Superconducting Films
JOURNAL OF SUPERCONDUCTIVITY AND NOVEL MAGNETISM Volume: 24 Issue: 1-2 Pages: 81-87 Published: JAN 2011

Guarino, A; Cirillo, C; Leo, A; Santandrea, S; Grimaldi, G; Polcari, A; Fittipaldi, R; Attanasio, C; Romano, P; Romano, A; Vecchione, A; Nigro, A
Transport Properties of Over-doped Epitaxial NdCeCuO Films

Gentile, P; Annunziata, G ; Cuoco, M; Noce, C; Romano, A
Phase Diagram for Mixed-Parity Superconductors
JOURNAL OF SUPERCONDUCTIVITY AND NOVEL MAGNETISM Volume: 24 Issue: 1-2 Pages: 923-925 Published: JAN 2011

Daniel, C; Rufolo, C; Bobba, F; Scarfato, A; Cucolo, AM; Guerra, G
Ferroelectric co-crystalline polymers
JOURNAL OF MATERIALS CHEMISTRY Volume: 21 Issue: 47 Pages: 19074-19079 Published: 2011

Ciattoni, A; Rizza, C; Palange, E
Multistability at arbitrary low optical intensities in a metal-dielectric layered structure
OPTICS EXPRESS Volume: 19 Issue: 1 Pages: 283-288 Published: JAN 3 2011
2011

Casaburi, A; Ejrnaes, M; Zen, N; Ohkubo, M; Pagano, S; Cristiano, R  
Thicker, more efficient superconducting strip-line detectors for high throughput macromolecules analysis  
APPLIED PHYSICS LETTERS Volume: 98 Issue: 2 Article Number: 023702 Published: JAN 10 2011

Giovannetti, G; Kumar, S; Stroppa, A; van den Brink, J; Picozzi, S; Lorenzana, J  
High-Tc Ferroelectricity Emerging from Magnetic Degeneracy in Cupric Oxide  
PHYSICAL REVIEW LETTERS Volume: 106 Issue: 2 Article Number: 026401 Published: JAN 12 2011

Monras, A; Illuminati, F  
Measurement of damping and temperature: Precision bounds in Gaussian dissipative channels  
PHYSICAL REVIEW A Volume: 83 Issue: 1 Article Number: 012315 Published: JAN 24 2011 ISSN: 1050-2947

Citro, R; Andrei, N  
Quantum pumping of interacting bosons  
PHYSICAL REVIEW A Volume: 83 Issue: 1 Article Number: 015601 Published: JAN 26 2011

Levchenko, A; Norman, MR; Varlamov, AA  
Nernst effect from fluctuating pairs in the pseudogap phase of the cuprates  
PHYSICAL REVIEW B Volume: 83 Issue: 2 Article Number: 020506 Published: JAN 31 2011

Annunziata, G; Cuoco, M; Gentile, P; Romano, A; Noce, C  
Does a ferromagnet with spin-dependent masses produce a spin-filtering effect in a ferromagnetic/insulator/superconductor junction?  
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 2 Article Number: 024021 Published: FEB 2011

Cirillo, C; Ilyina, EA; Attanasio, C  
Static and dynamic properties of the vortex lattice in superconductor/weak ferromagnet bilayers  
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 2 Article Number: 024017 Published: FEB 2011

Gualdi, G; Giampaolo, SM; Illuminati, F  
Modular Entanglement  
PHYSICAL REVIEW LETTERS Volume: 106 Issue: 5 Article Number: 050501 Published: FEB 1 2011

Martinelli, A; Ferretti, M; Giamarchi, T; Ritter, C  
The crystal and magnetic structure of Ti-substituted LaCrO(3)  
MATERIALS RESEARCH BULLETIN Volume: 46 Issue: 2 Pages: 190-193 Published: MAR 2011

Nucara, A; Granazio, FM; Radovic, M; Vitucci, FM; Maselli, P; Fittipaldi, R; Vecchione, A; Calvani, P  
Optical investigation of LaMnO(3) thin films: a study of the 2-eV band  
EUROPEAN PHYSICAL JOURNAL B Volume: 79 Issue: 4 Pages: 435-441 Published: FEB 2011

Fierro, A; Liccardo, A  
A simple stochastic lattice gas model for H1N1 pandemic. Application to the Italian epidemiological data  
EUROPEAN PHYSICAL JOURNAL E Volume: 34 Issue: 2 Article Number: 11 Published: FEB 2011

Bouillot, P; Kollath, C; Lauchli, AM; Zvonarev, M; Thielenmann, B; Ruegg, C; Orignac, E; Citro, R; Klanjsek, M; Berthier, C; Horvatic, M; Giamarchi, T  
Statics and dynamics of weakly coupled antiferromagnetic spin-1/2 ladders in a magnetic field  
PHYSICAL REVIEW B Volume: 83 Issue: 5 Article Number: 054407 Published: FEB 9 2011

Stroppa, A; Kresse, G; Continenza, A  
Revisiting Mn-doped Ge using the Heyd-Scuseria-Ernzerhof hybrid functional  
PHYSICAL REVIEW B Volume: 83 Issue: 8 Article Number: 085201 Published: FEB 9 2011

Tinti, A; Righetti, F; Ligonzo, T; Valentini, A; Nappi, E; Ambrosio, A; Ambrosio, M; Aramo, C; Maddalena, P; Castrucci, P; Scarselli, M; De Crescenzi, M; Fiandrini, E; Grossi, V; Santucci, S; Passacantando, M  
Electrical analysis of carbon nanostructures/silicon heterojunctions designed for radiation detection  
NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATORS SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT Volume: 629 Issue: 1 Pages: 377-381 Published: FEB 11 2011

Annunziata, G; Cuoco, M; Noce, C; Sudbo, A; Linder, J  
Spin-sensitive long-range proximity effect in ferromagnet/spin-triplet-superconductor bilayers  
PHYSICAL REVIEW B Volume: 83 Issue: 6 Article Number: 060508 Published: FEB 23 2011
2011

Galdi, A; Aruta, C; Orgiani, P; Brookes, NB; Ghiringhelli, G; Moretti Sala, M; Mangalam, RVK; Prellier, W; Luders, U; Maritato, L
Magnetic properties and orbital anisotropy driven by Mn(2+) in nonstoichiometric La(x)MnO(3-delta) thin films
PHYSICAL REVIEW B Volume: 83 Issue: 6 Article Number: 064418 Published: FEB 23 2011

Iorio, A; Perroni, CA; Ramaglia, VM; Cataudella, V
Electron-lattice and strain effects in manganite heterostructures: The case of a single interface
PHYSICAL REVIEW B Volume: 83 Issue: 8 Article Number: 085107 Published: FEB 23 2011

Sereni, JG; Giovannini, M; Berisso, MG; Saccone, A
Electron concentration effects on the Shastry-Sutherland phase stability in Ce(2-x)Pd(2+y)In(1-z) solid solutions
PHYSICAL REVIEW B Volume: 83 Issue: 6 Article Number: 064419 Published: FEB 23 2011

Ambrosio, A; Maddalena, P
Effect of radial defect lines in the focalization of unitary polarization order light beams
APPLIED PHYSICS LETTERS Volume: 98 Issue: 9 Article Number: 091108 Published: FEB 28 2011

Slussarenko, S; Murasaki, A; Du, T; Chigrinov, V; Marrucci, L; Santamato, E
Tunable liquid crystal q-plates with arbitrary topological charge
OPTICS EXPRESS Volume: 19 Pages: 4085-4090 Published:FEB 28 2011

Braccini, V; Xu, A; Jaroszynski, J; Xin, Y; Larbalestier, DC; Chen, Y; Carota, G; Dackow, J; Kesgin, I; Yao.; Guevara, A; Shi, T; Selvamanickam, V
Properties of recent IBAD-MOCVD coated conductors relevant to their high field, low temperature magnet use
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 3 Article Number: 035001 - MAR 2011

Ejrnaes, M; Casaburi, A; Cristiano, R; Martucciello, N ; Mattioli, F; Gaggero, A; Leoni, R; Villegier, JC; Pagano, S
Characterization of superconducting pulse discriminators based on parallel NbN nanostripes
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 3 Article Number: 035018 - MAR 2011

Manfrinetti, P; Morozkin, AV; Isnard, O; Wrubl, F; Mozharivskyj, Y; Svitych, V
Magnetic ordering of novel La(3)NiGe(2)-type R(3)CoGe(2) compounds (R = Pr, Nd, Sm, Gd-Dy)
INTERMETALLICS Volume: 19 Issue: 3 Pages: 321-326 Published: MAR 2011

Sanz, M; Lopez-Arias, M; Marco, JF; de Nalda, R; Amoroso, S; Ausanio, G; Lettieri, S; Bruzzese, R; Wang, X; Castillejo, M
Ultrafast Laser Ablation and Deposition of Wide Band Gap Semiconductors
JOURNAL OF PHYSICAL CHEMISTRY C Volume: 115 Issue: 8 Pages: 3203-3211 Published: MAR 3 2011

Botti, A; de Lisio, C; Iuorio, M; Minutolo, P
Diffusivity in water and fluorescence properties of organic nanoparticles produced in flames
APPLIED PHYSICS B-LASERS AND OPTICS Volume: 102 Issue: 4 Pages: 711-715 Published: MAR 2011

Amoruso, S; Aruta, C; Bruzzese, R; Wang, X; di Uccio, US
Substrate heating influence on the deposition rate of oxides during pulsed laser deposition in ambient gas
APPLIED PHYSICS LETTERS Volume: 98 Issue: 10 Article Number: 101501 Published: MAR 7 2011

Nocera, A; Perroni, CA; Ramaglia, VM; Cataudella, V
Stochastic dynamics for a single vibrational mode in molecular junctions
PHYSICAL REVIEW B Volume: 83 Issue: 11 Article Number: 115420 Published: MAR 11 2011

De Marco, P; Fioriti, F; Bisti, F; Parisse, P; Santucci, S; Ottaviano, L
Bulk phase two dimensional chiral growth of 6,13 Pentacenequinone on SiO(2)
JOURNAL OF APPLIED PHYSICS Volume: 109 Issue: 6 Article Number: 063508 Published: MAR 15 2011
2011

Maroni, B; Di Castro, D; Hanfland, M; Boby, J; Vercesi, C; Mozzati, MC; Weyeneth, S; Keller, H; Khasanov, R; Drathen, C; Dore, P; Postorino, P; Malavasi, L
Pressure Effects in the Isoelectronic REF{0.85}Ir{0.15}AsO System
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY Volume: 133 Issue: 10 Pages: 3252–3255 Published: MAR 16 2011

Colonna, N; Profeta, G; Continenzen, A; Massidda, S
Structural and magnetic properties of CaFe(2)As(2) and BaFe(2)As(2) from first-principles density functional theory
PHYSICAL REVIEW B Volume: 83 Issue: 9 Article Number: 094529 Published: MAR 28 2011

Brand, S; Ball, RC; Nicodemi, M
Stochastic transitions and jamming in granular pipe flow
PHYSICAL REVIEW E Volume: 83 Issue: 3 Article Number: 031309 Part: Part 1 Published: MAR 30 2011

Stornaiuolo, D; Papari, G; Cennano, N; Carillo, F; Longobardi, L; Massarotti, D; Barone, A; Tafuri, F
High quality factor HTS Josephson junctions on low loss substrates
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 4 Article Number: 045008 - APR 2011

Vajpayee, A; Jha, R; Srivastava, AK; Kishan, H; Tropeano, M; Fedeghini, C; Awana, VPS
The effect of synthesis temperature on the superconducting properties of n-SiC added bulk MgB(2) superconductor
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 4 Article Number: 045013 - APR 2011

Pursiainen, S; Sorrentino, A; Campi, C; Piana, M
Forward simulation and inverse dipole localization with the lowest order Raviart-Thomas elements for electroencephalography
INVERSE PROBLEMS Volume: 27 Issue: 4 Article Number: 045003 Published: APR 2011

Man'ko, VI; Marmo, G; Porzio, A; Solimeno, S; Ventriglia, F
Homodyne estimation of quantum state purity by exploiting the covariant uncertainty relation
PHYSICA SCRIPTA Volume: 83 Issue: 4 Article Number: 045001 Published: APR 2011

Savoia, A; Siano, M; Paparo, D; Marrucci, L
Nonlocal optical second harmonic generation from centrosymmetric birefringent crystals: the case of muscovite mica

Polcari, A; Romano, P; Sabatino, L; del Vecchio, E; Consales, M; Cusano, A; Cutolo, A; Colantuoni, V
Electrical and optical characterization of DNA molecules as a function of concentration in aqueous solution
JOURNAL OF APPLIED PHYSICS Volume: 109 Issue: 7 Article Number: 074703 Published: APR 1 2011

Kushnir, VN; Prischepa, SL; Aarts, J; Bell, C; Cirillo, C; Attanasio, C
Effect of the variation of the exchange energy on the superconducting critical temperature of S/F/S trilayers
EUROPEAN PHYSICAL JOURNAL B Volume: 80 Issue: 4 Pages: 445-449 Published: APR 2011

Pal, A; Tropeano, M; Kaushik, SD; Hussain, M; Kishan, H; Awana, VPS
Intriguing complex magnetism of Co in RECoAsO (RE=La, Nd, and Sm)
JOURNAL OF APPLIED PHYSICS Volume: 109 Issue: 7 Article Number: 07E121 Published: APR 1 2011

Serbyn, MN; Skvortsov, MA; Varlamov, AA; Gaitinski, V
Comment on "Giant Nernst Effect due to Fluctuating Cooper Pairs in Superconductors" Reply
PHYSICAL REVIEW LETTERS Volume: 106 Issue: 13 Article Number: 139702 Published: APR 1 2011

De Nicola, S; Adamo, M; Sarnelli, E; Nappi, C
Closed form solutions for the self-resonances in a short Josephson junction
PHYSICS LETTERS A Volume: 375 Issue: 14 Pages: 1598-1601 Published: APR 4 2011

Rubano, A; Fiebig, M; Paparo, D; Marino, A; Maccariello, D; di Uccio, US; Granuzzo, FM; Marrucci, L; Richter, C; Paetel, S; Mannhart, J
Spectral and spatial distribution of polarization at the LaAlO(3)/SrTiO(3) interface
PHYSICAL REVIEW B Volume: 83 Issue: 15 Article Number: 155405 Published: APR 5 2011

Ciattoni, A; Rizza, C; Palange, E
All-optical active plasmonic devices with memory and power-switching functionalities based on epsilon-near-zero nonlinear metamaterials
PHYSICAL REVIEW A Volume: 83 Issue: 4 Article Number: 043813 Published: APR 12 2011
Publications

2011

Cataudella, V; De Filippis, G; Perroni, CA
Transport properties and optical conductivity of the adiabatic Su-Schrieffer-Heeger model: A showcase study for rubrene-based field effect transistors
PHYSICAL REVIEW B Volume: 83 Issue: 16 Article Number: 165203 Published: APR 14 2011

Santandrea, S; Giubileo, F; Grossi, V; Santucci, S; Passacantando, M; Schroeder, T; Lupina, G; Di Bartolomeo, A
Field emission from single and few-layer graphene flakes
APPLIED PHYSICS LETTERS Volume: 98 Issue: 16 Article Number: 163109 Published: APR 18 2011

Moretti Sala, M; Bisogni, V; Aruta, C; Balestrino, G; Berger, H; Brookes, NB; de Luca, GM; Di Castro, D; Grioni, M; Guarise, M; Medaglia, PG; Granazio, FM; Minola, M; Perna, P; Radovic, M; Salluzzo, M; Schmitt, T; Zhou, KJ; Braicovich, L; Ghiringhelli, G
Energy and symmetry of dd excitations in undoped layered cuprates measured by Cu L(3) resonant inelastic x-ray scattering
NEW JOURNAL OF PHYSICS Volume: 13 Article Number: 043026 Published: APR 19 2011

Malvestuto, M; Carleschi, E; Fittipaldi, R; Gorelov, E; Pavarini, E; Cuoco, M; Maeno, Y; Parmigiani, F; Vecchione, A
Electronic structure trends in the Sr(n+1)Ru(n)O(3n+1) family (n=1,2,3)
PHYSICAL REVIEW B Volume: 83 Issue: 16 Article Number: 165121 Published: APR 19 2011

Sassa, Y; Radovic, M; Mansson, M; Razzoli, E; Cui, XY; Pailhes, S; Guerrero, S; Shi, M; Willmott, PR; Granazio, FM; Mesot, J; Norman, MR; Patthey, L
Ortho-II band folding in YBa(2)Cu(3)O(7-delta) films revealed by angle-resolved photoemission
PHYSICAL REVIEW B Volume: 83 Issue: 14 Article Number: 140511 Published: APR 22 2011

Giovannini, D; Negali, E; Moretti, L; Sciarino, F
Resilience of orbital-angular-momentum photonic qubits and effects on hybrid entanglement
PHYSICAL REVIEW A Volume: 83 Issue: 4 Article Number: 042338 Published: APR 29 2011

Di Porto, P; Crosignani, B; Ciattoni, A; Liu, HC
Bertrand's paradox: a physical way out along the lines of Buffon's needle throwing experiment
EUROPEAN JOURNAL OF PHYSICS Volume: 32 Issue: 3 Pages: 819-825 Published: MAY 2011

Lavagnino, L; Moroni, R; Bisio, F; Terreni, S; Mattera, L; Canepa, M
A spin polarized He metastable beam investigation of the adsorption of L-cysteine on magnetic surfaces
NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION B-BEAM INTERACTIONS WITH MATERIALS AND ATOMS Volume: 269 Issue: 9 Pages: 932-935 Published: MAY 1 2011

Glatz, A; Varlamov, AA; Vinokur, VM
Quantum fluctuations and dynamic clustering of fluctuating Cooper pairs
EPL Volume: 94 Issue: 4 Article Number: 47005 Published: MAY 2011

Avella, A; Mancini, F; Mancini, FP; Plekhanov, E
Filling and temperature dependence of the spin susceptibility of the two-dimensional Hubbard model in the superconducting d-wave phase
JOURNAL OF PHYSICS AND CHEMISTRY OF SOLIDS Volume: 72 Issue: 5 Special Issue: SI Pages: 362-365 MAY 2011
Publications

2011

Avella, A; Mancini, F; Mancini, FP; Plekhanov, E
Single-particle dispersion of the 2D p-d model
JOURNAL OF PHYSICS AND CHEMISTRY OF SOLIDS Volume: 72 Issue: 5 Special Issue: SI Pages: 384-387 MAY 2011

Muramatsu, T; Kanemasa, T; Kagayama, T; Shimizu, K; Aoki, Y; Sato, H; Giovannini, M; Bonville, P; Zlatic, V; Aviani, I; Khasanov, R; Rusu, C; Amato, A; Mydeen, K; Nicklas, M; Michor, H; Bauer, E
Reentrant quantum criticality in Yb(2)Pd(2)Sn
PHYSICAL REVIEW B Volume: 83 Issue: 18 Article Number: 180404 Published: MAY 2 2011

Rizza, C; Ciuttoni, A; Palange, E
Two-peaked and flat-top perfect bright solitons in nonlinear metamaterials with epsilon near zero
PHYSICAL REVIEW A Volume: 83 Issue: 5 Article Number: 053805 Published: MAY 5 2011

Bisti, F; Stroppa, A; Picozzi, S; Ottaviano, L
Fingerprints of the hydrogen bond in the photoemission spectra of croconic acid condensed phase: An x-ray photoelectron spectroscopy and ab-initio study
JOURNAL OF CHEMICAL PHYSICS Volume: 134 Issue: 17 Article Number: 174505 Published: MAY 7 2011

Tosi, G; Sanvitto, D; Baudisch, M; Karimi, E; Piccirillo, B; Marrucci, L; Lemaître, A; Bloch, J; Viná, L
Vortex stability and permanent flow in nonequilibrium polaron condensates
JOURNAL OF APPLIED PHYSICS Volume: 109 Issue: 10 Article Number: 102406 Published: MAY 15 2011

Panaccione, G; Manju, U; Offi, F; Annese, E; Vobornik, I; Torelli, P; Zhu, ZH; Hossain, MA; Simoncelli, L; Fondacaro, A; Lacovig, P; Guarino, A; Yoshida, Y; Sawatzky, GA; Damascelli, A
Depth dependence of itinerant character in Mn-substituted Sr(3)Ru(2)O(7)
NEW JOURNAL OF PHYSICS Volume: 13 Article Number: 053059 Published: MAY 31 2011

Ciancio, R; Pettersson, H; Fittipaldi, R; Kalabukhov, A; Orgiani, P; Vecchione, A; Maeno, Y; Pace, S; Olsson, E
Electron backscattering diffraction and X-ray diffraction studies of interface relationships in Sr(3)Ru(2)O(7)/Sr(2)RuO(4) eutectic crystals
MICRON Volume: 42 Issue: 4 Special Issue: SI Pages: 324-329 Published: JUN 2011

Eisterer, M; Raunicher, R; Weber, HW; Bellingeri, E; Cimberle, MR; Pallecchi, I; Putti, M; Ferdeghini, C
Anisotropic critical currents in FeSe(0.5)Te(0.5) films and the influence of neutron irradiation
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 6 Article Number: 065016 Published: JUN 2011

Vignolo, M; Romano, G; Bellingeri, E; Martinelli, A; Nardelli, D; Bitchkov, A; Bernini, C; Malagoli, A; Braccini, V; Ferdeghini, C
In situ high-energy synchrotron x-ray diffraction investigation of phase formation and sintering in MgB(2) tapes
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 6 Article Number: 065014 Published: JUN 2011

Martinelli, A; Palenzona, A; Tropeano, M; Putti, M; Ferdeghini, C; Profeta, G; Emerich, E
Retention of the Tetragonal to Orthorhombic Structural Transition in F-Substituted SmFeAs: A New Phase Diagram for SmFeAsO(1-x)F(x)
PHYSICAL REVIEW LETTERS Volume: 106 Issue: 22 Article Number: 227001 Published: JUN 1 2011 ISSN: 0031-9007

Antoine, CZ; Berry, S; Aurino, M; Jacquot, JF; Villegier, JC; Lamura, G; Andreone, A
Characterization of Field Penetration in Superconducting Multilayers Samples
IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY Volume: 21 Issue: 3 Pages: 2601–2604 Part: Part 3 JUN 2011

Celentano, G; De Marzi, G; Gaudio, S; Augierri, A; Galluzzi, V; Mancini, A; Rufoloni, A; Vannozzi, A; della Corte, A; Gambardella, U; Saggese, A; Jiang, JJ; Weiss, J; Hellstrom, E
The Effect of Doping on the Magnetic Properties in Ba(Fe(1-x)Co(x))(2)As(2) Polycrystalline Samples
IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY Volume: 21 Issue: 3 Pages: 2874–2877 Part: Part 3 JUN 2011
Publications

2011

Wrubl, F; Shah, KV; Joshi, DA; Manfrinetti, P; Pani, M; Ritter, C; Dhar, SK
Superstructure and magnetic properties of R(15)X(9)C compounds (R = rare earth; X = Si and Ge)
JOURNAL OF ALLOYS AND COMPOUNDS Volume: 509 Issue: 23 Pages: Published: JUN 9 2011

Longobardi, L; Stornaiuolo, D; Papari, G; Tafuri, F
Feasibility of a High Temperature Superconductor rf-SQUID Based on Biepitaxial Josephson Junction Technology

Pagano, S; Martucciello, N; Cristiano, R; Ejrnæs, M; Casaburi, A; Leoni, R; Gaggero, A; Mattioli, F; Villegier, JC; Cavalier, P
Nano-Strip Three-Terminal Superconducting Device for Cryogenic Detector Readout

Fierro, A; Abete, T; Coniglio, A; de Candia, A
Clusters in Colloidal Systems
JOURNAL OF PHYSICAL CHEMISTRY B Volume: 115 Issue: 22 Pages: 7281-7287 Published: JUN 9 2011

Citro, R; Naddeo, A; Origiac, E
Quantum dynamics of a binary mixture of BECs in a double-well potential: a Holstein-Primakoff approach
JOURNAL OF PHYSICALS B-ATOMIC MOLECULAR AND OPTICAL PHYSICS Volume: 44 Issue: 11 Article Number: 115306 Published: JUN 14 2011

Iannotti, V; Amoruso, S; Ausanio, G; Wang, X; Lanotte, L; Barone, AC; Margaris, G; Trohidou, KN; Fiorani, D
Interplay between particle anisotropy and exchange interaction in Fe nanoparticle films
PHYSICAL REVIEW B Volume: 83 Issue: 21 Article Number: 214422 Published: JUN 16 2011

Piovano, G; Cavaliere, F; Paladino, E; Sassetti, M
Coherent properties of nanoelectromechanical systems
PHYSICAL REVIEW B Volume: 83 Issue: 24 Article Number: 245107 Published: JUN 17 2011

Pagano, S; Martucciello, N; Cristiano, R; Ejrnæs, M; Casaburi, A; Leoni, R; Gaggero, A; Mattioli, F; Villegier, JC; Cavalier, P
Nano-Strip Three-Terminal Superconducting Device for Cryogenic Detector Readout

Ricci, F; D’Orazio, F; Continenza, A; Lucari, F; Freeman, AJ
MOKE experiments and theory of uniform and nonuniform distribution of magnetic nanocrystals: Mn(5)Ge(3) in Ge
PHYSICAL REVIEW B Volume: 83 Issue: 22 Article Number: 224421 Published: JUN 27 2011

Barone, P; Picozzi, S; van den Brink, J
Buckling-induced Zener polaron instability in half-doped manganites
PHYSICAL REVIEW B Volume: 83 Issue: 23 Article Number: 233103 Published: JUN 27 2011

Forte, F; Cuoco, M; Noce, C; van den Brink, J
Doping dependence of magnetic excitations of one-dimensional cuprates as probed by resonant inelastic x-ray scattering
PHYSICAL REVIEW B Volume: 83 Issue: 22 Article Number: 224421 Published: JUN 27 2011

Luk‘yanchuk, IA; Varlamov, AA; Kavokin, AV
Giant Nernst-Enstgeshausen Oscillations in Semiclassically Strong Magnetic Fields
PHYSICAL REVIEW LETTERS Volume: 107 Issue: 1 Article Number: 016601 Published: JUN 29 2011

Colonna, N; Profeta, G; Continenza, A
Effects of nonhydrostatic pressure on the structural and magnetic properties of BaFe(2)As(2)
PHYSICAL REVIEW B Volume: 83 Issue: 22 Article Number: 224526 Published: JUN 30 2011

Malagoli, A; Kametani, F; Jiang, J; Trociwitz, UP; Hellstrom, EE; Larbalestier, DC
Evidence for long range movement of Bi-2212 within the filament bundle on melting and its significant effect on J(c)
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 7 Article Number: 075016 Published: JUL 2011

Bezotosny, PI; Gavrilkin, SY; Lykov, AN; Attanasio, C; Cirillo, C; Prischepa, SL
Asymmetry of the Pinning Force in Thin Nb Films in Parallel Magnetic Field
JOURNAL OF SUPERCONDUCTIVITY AND NOVEL MAGNETISM Volume: 24 Issue: 5 Pages: 1553-1557 JUL 2011

Pallecchi, I; Tropeano, M; Ferdeghini, C; Lamura, G; Martinelli, A; Palenzona, A; Putti, M
Pseudogap Analysis of Normal State Transport Behavior of 11 and 1111 Fe-Based Superconductors
JOURNAL OF SUPERCONDUCTIVITY AND NOVEL MAGNETISM Volume: 24 Issue: 5 Pages: 1751-1760 JUL 2011
Publications

2011

Scarpetta, S; Giacco, F; de Candia, A
Storage capacity of phase-coded patterns in sparse neural networks
EPL Volume: 95 Issue: 2 Article Number: 28006 DOI: 10.1209/0295-5075/95/28006 Published: JUL 2011

Chiarella, F; Barra, M; Cassinese, A; Di Girolamo, FV; Maddalena, P; Santamaria, L; Lettieri, S
Dicyanoperylene-diimide thin-film growth: a combined optical and morphological study

Amjad, JM; Khalesifard, HR; Slussarenko, S; Karimi, E; Marrucci, L; Santamato, E
Laser-induced radial birefringence and spin-to-orbital optical angular momentum conversion in silver-doped glasses
APPLIED PHYSICS LETTERS Volume: 99 Issue: 1 Article Number: 011113 Published: JUL 4 2011

Bisio, F; Prato, M; Barborini, E; Canepa, M
Interaction of Alkanethiols with Nanoporous Cluster-Assembled Au Films
LANGMUIR Volume: 27 Issue: 13 Pages: 8371-8376 Published: JUL 5

Iavarone, M; Scarfato, A; Bobba, F; Longobardi, M; Karapetrov, G; Novosad, V; Yefremenko, V; Giubileo, F; Cucolo, AM
Imaging the spontaneous formation of vortex-antivortex pairs in planar superconductor/ferromagnet hybrid structures
PHYSICAL REVIEW B Volume: 84 Issue: 2 Article Number: 024506 Published: JUL 7 2011

Di Bartolomeo, A; Giubileo, F; Santandrea, S; Romeo, F; Citro, R; Schroeder, T; Lupina, G
Charge transfer and partial pinning at the contacts as the origin of a double dip in the transfer characteristics of graphene-based field-effect transistors
NANOTECHNOLOGY Volume: 22 Issue: 27 Article Number: 275702 Published: JUL 8 2011

Tosi, G; Marchetti, FM; Sanvitto, D; Anton, C; Szymanska, MH; Berceau, A; Tejedor, C; Marrucci, L; Lemaitre, A; Bloch, J; Vina, L
Onset and Dynamics of Vortex-Antivortex Pairs in Polariton Optical Parametric Oscillator Superfluids
PHYSICAL REVIEW LETTERS Volume: 107 Issue: 3 Article Number: 036401 Published: JUL 12 2011

Stroppa, A; Di Sante, D; Horiuchi, S; Tokura, Y; Vanderbilt, D; Picozzi, S
Polar distortions in hydrogen-bonded organic ferroelectrics
PHYSICAL REVIEW B Volume: 84 Issue: 1 Article Number: 014101 Published: JUL 15 2011

Bloisi, F; Pezzella, A; Barra, M; Chiarella, F; Cassinese, A; Vicari, L
Matrix assisted pulsed laser deposition of melanin thin films
JOURNAL OF APPLIED PHYSICS Volume: 110 Issue: 2 Article Number: 026105 Published: JUL 15 2011

Ambrosio, A; Maddalena, P; Carella, A; Borbone, F; Roviello, A; Polo, M; Neves, AAR; Camposeo, A; Pisignano, D
Two-Photon Induced Self-Structuring of Polymeric Films Based on Y-Shape Azobenzene Chromophore
JOURNAL OF PHYSICAL CHEMISTRY C Volume: 115 Issue: 28 Pages: 13566-13570 Published: JUL 21 2011

Perroni, CA; Ramaglia, VM; Cataudella, V
Effects of electron coupling to intramolecular and intermolecular vibrational modes on the transport properties of single-crystal organic semiconductors
PHYSICAL REVIEW B Volume: 84 Issue: 1 Article Number: 014303 Published: JUL 21 2011

Radovic, M; Salluzzo, M; Ristic, Z; Di Capua, R; Lampis, N; Vaglio, R; Granazio, FM
In situ investigation of the early stage of TiO(2) epitaxy on (001) SrTiO(3)
JOURNAL OF CHEMICAL PHYSICS Volume: 135 Issue: 3 Article Number: 034705 Published: JUL 21 2011

Ritter, C; Wrubel, F; Hill, AH; Pani, M; Manfrinetti, P
Crystal and magnetic structure of the R(15)Si(9)C compounds (R = Ho, Er, Tb)
JOURNAL OF PHYSICS-CONDENSED MATTER Volume: 23 Issue: 29 Article Number: 296002 Published: JUL 27 2011

Anghinolfi, L; Moroni, R; Mattera, L; Canepa, M; Bisio, F
Flexible Tuning of Shape and Arrangement of Au Nanoparticles in 2-Dimensional Self-Organized Arrays: Morphology and Plasmonic Response
JOURNAL OF PHYSICAL CHEMISTRY C Volume: 115 Issue: 29 Pages: 14036-14043 Published: JUL 28 2011
2011

Ausanio, G; Iannotti, V; Hison, CL; Lanotte, L; Amoruso, S; Aruta, C; Wang, X; Tamisari, M
Effect of deposition temperature on morphology and magnetic properties of Co(50)Fe(50) thin films produced by femtosecond pulsed laser deposition
THIN SOLID FILMS Volume: 519 Issue: 19 Pages: 6420-6425 Published: JUL 29 2011

Leo, A; Grimaldi, G; Citro, R; Nigro, A; Pace, S; Huebner, RP
Quasiparticle scattering time in niobium superconducting films
PHYSICAL REVIEW B Volume: 84 Issue: 1 Article Number: 014536 Published: JUL 29 2011

Romeo, F; Citro, R
Scattering theory of magnetic/superconducting junctions with spin-active interfaces
PHYSICAL REVIEW B Volume: 84 Issue: 2 Article Number: 024531 Published: JUL 29 2011

Barone, C; Pagano, S; Guarino, A; Nigro, A; Vecchione, A
Electric noise properties of optimally doped Nd(1.85)Ce(0.15)CuO(4) superconducting thin films
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 8 Article Number: 085003 Published: AUG 2011

Fittipaldi, R; Granata, V; Vecchione, A
Floating zone growth of eutectic Sr(n+1)Ru(n)O(3n+1) crystals
CRYSTAL RESEARCH AND TECHNOLOGY Volume: 46 Issue: 8 Special Issue: SI Pages: 769-772 AUG 2011

Putti, M; Grasso, G
MgB(2), a two-gap superconductor for practical applications
MRS BULLETIN Volume: 36 Issue: 8 Pages: 608-613 Published: AUG 2011

Pastore, R; Ciamarra, MP; de Candia, A; Coniglio, A
Dynamical Correlation Length and Relaxation Processes in a Glass Former
PHYSICAL REVIEW LETTERS Volume: 107 Issue: 6 Article Number: 065703 Published: AUG 4 2011

Prando, G; Lascialfari, A; Rigamonti, A; Romano, L; Sanna, S; Putti, M; Tropeano, M
Superconducting phase fluctuations in SmFeAsO(0.8)F(0.2) from diamagnetism at a low magnetic field above
PHYSICAL REVIEW B Volume: 84 Issue: 6 Article Number: 064507 Published: AUG 18 2011

Cirillo, C; Pagliarulo, V; Myoren, H; Bonavolonta, C; Parlati, L; Pepe, GP; Attanasio, C
Quasiparticle energy relaxation times in NbN/CuNi nanostripes from critical velocity measurements
APPLIED PHYSICS LETTERS Volume: 99 Issue: 6 Article Number: 062510 Published: AUG 8 2011

Evidence of guided resonances in photonic quasicrystal slabs
PHYSICAL REVIEW B Volume: 84 Issue: 8 Article Number: 085135 Published: AUG 29 2011

Ciamarra, MP; Lippiello, E; de Arcangelis, L; Godana, C
Statistics of slipping event sizes in granular seismic fault models
EPL Volume: 95 Issue: 5 Article Number: 54002 Published: SEP 2011

Le Tacon, M; Ghiringhelli, G; Chaloupka, J; Sala, MM; Hinkov, V; Haervort, MW; Minola, M; Bakr, M; Zhou, KJ; Blanco-Canosa, S; Monney, C; Song, YT; Sun, GL; Lin, CT; De Luca, GM; Salluzzo, M; Khaliullin, G; Schmitt, T; Braicovich, L; Keimer, B
Intense paramagnon excitations in a large family of high-temperature superconductors
NATURE PHYSICS Volume: 7 Issue: 9 Pages: 725-730 Published: SEP 2011

Rose, TP; Di Gennaro, E; Abbate, G; Andreone, A
Isotropic properties of the photonic band gap in quasicrystals with low-index contrast
PHYSICAL REVIEW B Volume: 84 Issue: 12 Article Number: 125111 Published: SEP 9 2011
Publications

2011

Kontar, EP; Brown, JC; Emslie, AG; Hajdas, W; Holman, GD; Hurford, GJ; Kasparova, J; Mallik, PCV; Massone, AM; McConnell, ML; Piana, M Prato, M; Schmahl, EJ Suarez-Garcia, E
Deducing Electron Properties from Hard X-ray Observations
SPACE SCIENCE REVIEWS Volume: 159 Issue: 1-4 Pages: 303-355 Published: SEP 2011

Glatz, A; Varlamov, AA; Vinokur, VM
Fluctuation spectroscopy of disordered two-dimensional superconductors
PHYSICAL REVIEW B Volume: 84 Issue: 10 Article Number: 104510 Published: SEP 12 2011

Ausano, G; Hison, CL; Iannotti, V Lanotte, L; Lanotte, L
Magneto-piezoresistance in elastomagnetic composites
JOURNAL OF APPLIED PHYSICS Volume: 110 Issue: 6 Article Number: 063903 Published: SEP 15 2011

Casula, M; Calandra, M; Profeta, G; Mauri, F
Intercalant and Intermolecular Phonon Assisted Superconductivity in K-Doped Picene
PHYSICAL REVIEW LETTERS Volume: 107 Issue: 13 Article Number: 137006 Published: SEP 21 2011

Moccia, M; Pisco, M; Cutolo, A; Galdi, V; Bevilacqua, P; Cusano, A
Opto-acoustic behavior of coated fiber Bragg gratings
OPTICS EXPRESS Volume: 19 Issue: 20 Pages: 18842-18860 Published: SEP 26 2011

Carrega, M; Ferraro, D; Braggio, A; Magnoli, N; Sassetti, M
Anomalous Charge Tunneling in Fractional Quantum Hall Edge States at a Filling Factor nu=5/2
PHYSICAL REVIEW LETTERS Volume: 107 Issue: 14 Article Number: 146404 Published: SEP 30 2011

Vecchione, A; Fittipaldi, R; Cirillo, C; Hesselberth, M; Aarts, J; Prischepa, SL; Kushnir, VN; Kupriyanov, MY; Attanasio, C
X-ray scattering study of interfacial roughness in Nb/PdNi multilayers
SURFACE SCIENCE Volume: 605 Issue: 19-20 Pages: 1791-1796 Published: OCT 2011

Anderson, U J; Jacob, MV ; Barra, M; Di Girolamo, FV; Cassinese, A
Effect of a plasma polymerised linally acetate dielectric on the optical and morphological properties of an n-type organic semiconductor
APPLIED PHYSICS A-MATERIALS SCIENCE & PROCESSING Volume: 105 Issue: 1 Pages: 95-102 OCT 2011

Vitucci, FM; Nucara, A; Mirri, C; Nicolloti, D; Ortolani, M; Schade, U; Calvani, P
Infrared and transport properties of LuFe(2)O(4) under electric fields
PHYSICAL REVIEW B Volume: 84 Issue: 15 Article Number: 153105 Published: OCT 21 2011

Pallecchi I.; Bernardini F.; Tropeano M.; et al.
Magnetotransport in La(Fe,Ru)AsO as a probe of band structure and mobility
PHYSICAL REVIEW B Volume: 84 Issue: 13 Article Number: 134524 DOI: 10.1103 PhysRevB.84.134524 Published: OCT 18 2011

Romeo, F; Citro, R; Di Bartolomeo, A
Effect of impurities on Fabry-Perot physics of ballistic carbon nanotubes
PHYSICAL REVIEW B Volume: 84 Issue: 15 Article Number: 153408 Published: OCT 21 2011

Peddis, D; Yaacoub, N; Ferretti, M; Martinelli, A; Piccaluga, G; Musini, A; Cannas, C; Navarra, G; Greneche, JM; Fiorani, D
Cationic distribution and spin canting in CoFe(2)O(4) nanoparticles
JOURNAL OF PHYSICS-CONDENSED MATTER Volume: 23 Issue: 42 Article Number: 426004 Published: OCT 26 2011

Ciamarra, MP; Pastore, R; Nicodemi, M; Coniglio, A
Jamming phase diagram for frictional particles
PHYSICAL REVIEW E Volume: 84 Issue: 4 Article Number: 041308 Part: Part 1 Published: OCT 28 2011

Yamauchi, K; Barone, P; Picozzi, S
Theoretical investigation of magnetoelectric effects in Ba(2)CoGe(2)O(7)
PHYSICAL REVIEW B Volume: 84 Issue: 16 Article Number: 165137 Published: OCT 31 2011

Bonavolonta, C; Albonetti, C; Barra, M; Valentin, M
Electrical mobility in organic thin-film transistors determined by noise spectroscopy
JOURNAL OF APPLIED PHYSICS Volume: 110 Issue: 9 Article Number: 093716 Published: NOV 1 2011
Publications

2011

Casaburi, A; Ejrnaes, M; Mattioli, F; Gaggero, A; Leoni, R; Martucciello, N; Pagano, S; Ohkubo, M ; Cristiano, R
Superconducting nano- striplines as quantum detectors
JOURNAL OF NANOPARTICLE RESEARCH Volume: 13 Issue: 11 Special Issue: SI Pages: 6121-6131 - NOV 2011

de Candia, A; Fierro, A; Coniglio, A
Dynamical Heterogeneities in the Crossover Region from Gel-like to Glassy-like Behavior
JOURNAL OF STATISTICAL PHYSICS Volume: 145 Issue: 3 Special Issue: SI Pages: 652-660 - NOV 2011

Pisani, G; Boselli, A; Spinelli, N; Wang, X
Characterization of Saharan dust layers over Naples (Italy) during 2000-2003 EARLINET project
ATMOSPHERIC RESEARCH Volume: 102 Issue: 3 Pages: 286-299 Published: NOV 2011 ISSN: 0169-8095

Carapella, G; Sabatino, P; Costabile, G
A single Abrikosov vortex trapped in a mesoscopic superconducting cylindrical surface
JOURNAL OF PHYSICS-CONDENSED MATTER Volume: 23 Issue: 43 Article Number:435701 NOV 2 2011

Stroppa, A; Mittendorfer, F
Tuning the CO Dissociation Barriers by Low-Dimensional Surface Alloys
JOURNAL OF PHYSICAL CHEMISTRY C Volume: 115 Issue: 43 Pages: 21320-21323 Published: NOV 3 2011

Longobardi, I; Massarotti, D; Rotoli, G; Stornaiuolo, D; Papari, G; Kawakami, A; Pepe, GP; Barone, A; Tafuri, F
Thermal hopping and retrapping of a Brownian particle in the tilted periodic potential of a NbN/MgO/NbN Josephson junction
PHYSICAL REVIEW B Volume: 84 Issue: 18 Article Number: 184504 Published: NOV 4 2011

Tarantini, C; Gurevich, A; Jaroszynski, J; Balakirev, F; Bellingeri, E; Pellecchi, I; Ferdeghini, C; Shen, B; Wen, HH; Larbalestier, DC
Significant enhancement of upper critical fields by doping and strain in iron-based superconductors
PHYSICAL REVIEW B Volume: 84 Issue: 18 Article Number: 184522 Published: NOV 17 2011

Bisti, F; Stroppa, A; Donarelli, M; Picozzi, S Ottaviano, L
Electronic structure of tris(8-hydroxyquinolinato)aluminium(III) revisited using the Heyd-Scuseria-Ernzerhof hybrid functional: Theory and experiments
PHYSICAL REVIEW B Volume: 84 Issue: 19 Article Number: 195112 Published: NOV 9 2011

Sanna, S; Carretta, P; Bonfa, P; Prando, G; Allodi, G; De Renzi, R; Shir oka, T; Lamura, G; Martinelli, A; Putti, M
Correlated Trends of Coexisting Magnetism and Superconductivity in Optimally Electron-Doped Oxypnictides
PHYSICAL REVIEW LETTERS Volume: 107 Issue: 22 Article Number: 227003 Published: NOV 22 2011

Shiroka, T; Lamura, G; Sanna, S; Prando, G; De Renzi, R; Tropeano, M; Cimerle, MR; Martinelli, A; Bernini, C; Palenzona, A; Fittipaldi, R; Vecchione, A; Carretta, P; Sirti, AS; Ferdeghini, C; Putti, M
Long-to short-range magnetic order in fluorine-doped CeFeAsO
PHYSICAL REVIEW B Volume: 84 Issue: 19 Article Number: 195123 Published: NOV 23 2011

Giovannetti, G; Kumar, S; Stroppa, A; Balestieri, M; van den Brink, J; Picozzi, S; Lorenzana, J
Comment on “High-Tc Ferroelectricity Emerging from Magnetic Degeneracy in Cupric Oxide” Reply
PHYSICAL REVIEW LETTERS Volume: 107 Issue: 23 Article Number: 239702 Published: NOV 29 2011

Sabatino, P; Carapella, G; Costabile, G
Magneto-transport properties of curved mesoscopic superconducting strips
SUPERCONDUCTOR SCIENCE & TECHNOLOGY Volume: 24 Issue: 12 Article Number: 125007 - DEC 2011

Toccoafondi, C; Prato, M; Maidecchi, G; Penco, A; Bisio, F; Cavalleri, O; Canepa, M
Optical properties of Yeast Cytochrome c monolayer on gold: An in situ spectroscopic ellipsometry investigation

Cazalilla, MA; Citro, R; Giamarchi, T; Orignac, E; Rigol, M
One dimensional bosons: From condensed matter systems to ultracold gases
REVIEWS OF MODERN PHYSICS Volume: 83 Issue: 4 Pages: 1405-1466 Published: DEC 1 2011
Publications

2011

Barone, P; Yamauchi, K; Picozzi, S
**Ferroelectricity due to Orbital Ordering in E-Type Undoped Rare-Earth Manganites**
PHYSICAL REVIEW LETTERS Volume: 106 Issue: 7 Article Number: 077201 Published: FEB 14 2011

Parente, V; Lucignano, P; Vitale, P; Tagliacozzo, A; Guinea, F
**Spin connection and boundary states in a topological insulator**
PHYSICAL REVIEW B Volume: 83 Issue: 7 Article Number: 075424 Published: FEB 22 2011

Kushnir, VN; Prischepa, SL; Cirillo, C; Vecchione, A; Attanasio, C; Kupriyanov, MY; Aarts, J
**Multiple order parameter configurations in superconductor/ferromagnet multilayers**
PHYSICAL REVIEW B Volume: 84 Issue: 21 Article Number: 214512 Published: DEC 7 2011

Fierro, A; Abete, T; de Candia, A; Coniglio, A
**Relaxation Process and Dynamical Heterogeneities in Chemical Gels: Critical Behavior of Self-Overlap and Its Fluctuation**
JOURNAL OF PHYSICAL CHEMISTRY B Volume: 115 Issue: 48 Pages: 14274-14279 Published: DEC 8 2011

Schnyder, AP; Manske, D; Avella, A
**Resonant generation of coherent phonons in a superconductor by ultrafast optical pump pulses**
PHYSICAL REVIEW B Volume: 84 Issue: 21 Article Number: 214513 Published: DEC 9 2011

Bosi, F; Cella, G; Di Virgilio, A; Ortolan, A; Porzio, A; Solimeno, S; Cerdonio, M; Zendri, JP; Allegrini, M; Belfi, J; Beverini, N; Bouhadef, B; Carelli, G; Ferrante, I; Maccioni, E; Passaquieti, R; Stefani, F; Ruggiero, ML; Tartaglia, A; Schreiber, KU; Gebauer, A; Wells, JPR
**Measuring gravitomagnetic effects by a multi-ring-laser gyroscope**
PHYSICAL REVIEW D Volume: 84 Issue: 12 Article Number: 122002 Published: DEC 9 2011

Vincenti, MA; de Ceglia, D; Ciattioni, A; Scalora, M
**Singularity-driven second-and third-harmonic generation at epsilon-near-zero crossing points**
PHYSICAL REVIEW A Volume: 84 Issue: 6 Article Number: 063826 Published: DEC 12 2011
Events

✓ SPIN Kick-off meeting, Genova 10-11 June 2010
  http://www.spin.cnr.it/index.php/kickoff

✓ SM-2010: Superconductivity and Magnetism, Paestum 5-11 Sept. 2010
  http://sm2010.sa.infn.it/

✓ ESMF 2010: European School on Multiferroics, L'Aquila 26 Sept. - 1 Oct. 2010
  http://www.casti.aquila.infn.it/homepages/bismuth/ESMF2010/index.html

✓ AQUIFER: AQUila Initiative on FERroics, L’Aquila 19 Sept. - 23 Oct. 2010
  http://www.icmr.ucsb.edu/programs/aquifier.html

✓ Materiali innovativi e stati della materia: come e perché utilizzarli,
  Napoli 14 March 2011 and Salerno 23 March 2011
  http://mama.spin.cnr.it/index.php/eventsl/74-meeting-na
  http://mama.spin.cnr.it/index.php/eventsl/76-meeting-sa

✓ 1st Advisory Board Meeting, Genova 23-24 May 2011
  http://www.spin.cnr.it/index.php/1stadvisoryboard
In memory of Antonio Barone

Antonio Barone (AB) prematurely passed away on Dec 4th 2011 at the age of 72, after a one-year battle with cancer.

He left behind his wife Sveva and his two sons, Alberto and Livio. Antonio was currently Professor Emeritus at the University of Napoli Federico II, where he had been teaching for about 40 years. The initial research activity of AB was in the field of nuclear physics. In this context, almost 45 years ago, the Ge “Lithium drift” semiconductor detectors represented a novelty, due to the high energy resolution allowed by those devices.

Superconductors stimulated new approaches to radiation detection and this motivated Antonio’s interests toward the superconductivity.

In the 1967 the birth of the Laboratorio di Cibernetica of the CNR offered him the possibility to work in a joint project USA-Italy (University of Wisconsin, Madison - CNR Naples) in the field of superconductivity on the peculiar subject of the superconductive “Neuristors”. His research activity on Josephson junctions opened a wide variety of very stimulating subjects in which AB was deeply involved, ranging from the soliton propagation in “long” Josephson structures to fluctuations phenomena, from light-sensitive junctions and proximity effect to the development of innovative superconducting devices.

The strong interaction of AB with the Landau Institute for Theoretical Physics of the Academy of Sciences, in Moscow, characterizes a long period of his research activity with a precious merging of theoretical and experimental aspects. All this body of work converged into the famous monograph on the “Physics and Applications of the Josephson Effect”, written in collaboration with Gianfranco Paternò in 1982. This became rapidly the reference text for the Josephson effect, as documented by thousands of citations and the fact it was translated into Russian, Japanese and Chinese. In 1983, AB was awarded by the Academy of Sciences in Moscow the highest academic title of “Doctor of the Physical-Mathematical Sciences”, and later the coveted Kapitza Prize.
In memory of Antonio Barone

The discovery of high-Tc superconductors (HTS) opened new problems and perspectives. In this context, AB and his group, significantly contributed by reporting original results on the “archetype” high-Tc Josephson junctions. Of great impact were the studies on unconventional superconductivity, first developed for “p-wave” superconductors, but definitely very inspiring for the d-wave experiments on HTS compounds, and later on the physics of HTS Josephson junctions.

Macroscopic quantum phenomena and “particle detectors” are the keywords and the logical paths where to bring back several relevant contributions of Antonio scattered in more than 40 years of activity. Topics of his interest ranged from the fundamentals of macroscopic quantum tunnelling to barrier penetration in nonstationary fields, to finally a project into a wider vision of macroscopic quantum phenomena in unconventional systems.

Antonio is universally considered not only the founder of the Superconductivity School in the Napoli area, but also as the “grande maestro” and one of the most representative physicists in Italy. He has filled very relevant positions of scientific management in Italy and participated in many international committees. He has significantly contributed to the popularization of superconductivity as a divulgar, as a professor, as a researcher and as a manager.

An intense wave of sympathy and friendships has arrived from all over the world testifying how his gentleness, his sense of science and his smile were a solid bridge of friendship and respect with colleagues, students and people of everyday life. This premature departure cannot be dissociated from so many years spent working together. This moment cannot be dissociated from the awareness of having had the privilege to deal with a real gentleman of science and life, a man of vision and perspective.

Francesco Tafuri, Giampiero Pepe and Ruggero Vaglio