VI reunión
grupo especializado
de física de estado sólido
Real Sociedad Española de Física

Zaragoza
3-5, febrero 2010
Edificio Paraninfo
Universidad de Zaragoza

PROGRAMA DEFINITIVO Y LIBRO RESÚMENES

gefes 2010

Zaragoza

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MINISTERIO DE CIENCIA E INNOVACIÓN

CSIC

GOBIERNO DE ARAGON

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Programa Definitivo y Libro de Resúmenes

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CSIC

GOBIERNO DE ARAGON

Comité Organizador

- Fernando Bartolomé Usieto (CSIC)
- Luis Miguel García Vinuesa (Universidad de Zaragoza)
- Juan José Mazo (Universidad de Zaragoza)
- Luis Morellón (Universidad de Zaragoza)
- Belén Villacampa (Universidad de Zaragoza)

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Comité Científico

- Nicolás Agrait, Universidad Autónoma de Madrid
- María Asunción Fernández, ICMSE, Universidad de Sevilla - CSIC
- Jesús Mª González, ICMM, CSIC,
- Amílcar Labarta, Universidad de Barcelona
- María del Pilar López Sancho, ICMM, CSIC
- Narcis Mestres, ICMAB, CSIC
- Xavier Obradors, ICMAB, CSIC
- Juan José Palacios, Universidad de Alicante
- Francisco Javier Palomares, ICMM, CSIC
- Fran Rivadulla, Universidad de Santiago
- Jacobo Santamaría, Universidad Complutense de Madrid
- Ana Cros Stötter, Universidad de Valencia
- Luis Viña, Universidad Autónoma de Madrid

Las reuniones del Grupo Especializado de Física del Estado Sólido de la Real Sociedad Española de Física se celebran desde los años 80 del siglo pasado, y con periodicidad bienal ininterrumpida desde el año 2000, estando plenamente asentadas en la comunidad científica de nuestro país. La que se celebrará en febrero de 2010 en Zaragoza será ya la sexta edición de esta "nueva era" de las reuniones del GEFES, tras las de Madrid (2000), Calella (2002), San Sebastián (2004), Alicante (2006) y Santiago de Compostela (2008).

Esperamos que el programa muestre y permita discutir la situación actual de la Física del Estado Sólido al más alto nivel. Tanto las charlas plenarias e invitadas como las contribuciones de los socios en orales y carteles nos hace albergar esperanzas de que esta edición resultará tan interesante como lo fueron las pasadas, y si cabe aún más.

La sede de la reunión, el Edificio Paraninfo de la Universidad de Zaragoza, es la antigua Facultad de Medicina y Ciencias, un lugar histórico para nuestra comunidad y de gran valor artístico, que fue declarado Bien de Interés Cultural. Estamos convencidos de que, al igual que la Ciudad de Zaragoza, os resultará cómodo y acogedor.

Gracias a todos por contribuir a esta reunión GEFES 2010. Esperamos de corazón que la disfrutéis.

El comité local

Programa

GEFES Poster

GEFES otros

GEFES Oral

GEFES Plenary

GEFES ceremonia

miércoles 3 de febrero

09:00 a 10:00 | Entrega de Documentación e Inscripción; Colocación POSTERS (Sala Josefa Amar y Borbón)

10:00 a 10:15 | Presentación GEFES 2010 Aula Magna
***Sesión 1**. Moderadora: Pilar López Sancho, Instituto de Ciencia de Materiales de Madrid, CSIC*

10:15 a 11:15 | 4: Dr. Konstantin Novoselov, U. Manchester, U.K.; Graphene & Its Chemical Derivatives

11:15 a 11:50 | Pausa Café (instalación de posters en la misma sala)
***Sesión 2**. Moderador: Juan José Palacios, Departamento de Fisica Aplicada, Universidad de Alicante*

11:50 a 12:10 | 5: Dra. Elsa Prada, ICMM, CSIC; Quantum pumping in graphene

11:50 a 14:00 | Juan José Palacios, Departamento de Fisica Aplicada, Universidad de Alicante

12:10 a 12:30 | 108: Dr. Gonzalo Otero; ICMM, CSIC; Fullerenes from aromatic precursors

12:30 a 12:50 | 157: Dra. Julia Herrero Albillos, BESSY; Microscopic investigations of exchange bias in FeMn/Co bilayers on the nm length scale

12:50 a 13:45 | 150: Dr. José Luis Martínez, Director ILL, Institut Laue Langevin (ILL): En la vanguardia de las técnicas de neutrones

14:00 a 16:00 | Pausa comida: Restaurante Eliseos, Paseo Sagasta, 4
***Sesión 3**. Moderador: Luis M. García, Instituto de Ciencia de Materiales de Aragón, CSIC-Universidad de Zaragoza*

16:00 a 16:20 | 59: Dr. Xavier Trepat, U Barcelona; What can material science teach us about biology?

16:00 a 18:00 | Luis M. García, Instituto de Ciencia de Materiales de Aragón, CSIC-Universidad de Zaragoza

16:20 a 16:40 | 80: Dra. Noelia Marcano, ICMA, CSIC-U. Zaragoza; Quantum effects and surface states in the magnetotransport properties in two- and one-dimensional Bi-Nanostructures

16:40 a 17:00 | 23: Dr. Fernando Delgado, U Alicante; Spin-transfer torque on a single magnetic adatom

17:00 a 17:20 | 9: Dr Juan Ignacio Climente, U.J.I. Castellón; Holes in quantum dot molecules

17:20 a 17:40 | 113: Dr. Javier Sesé, INA, U. Zaragoza; Properties and applications of focused-ion-beam-induced-deposition material using W(CO)6 as precursor gas

17:40 a 18:00 | 2: Dr. Oliver Friedrichs, EMPA, ETH, Zurich; Diborane – The key to reversible hydrogen storage in borohydrides

18:00 a 19:30 | CAFÉ con POSTERS

jueves 4 de febrero

***Sesión 4**. Moderador: Benjamín Martínez, Instituto de Ciencia de Materiales de Barcelona, CSIC*

09:00 a 10:00 | 153: Dr. Hans Hilgenkamp, U. Twente, Países Bajos; Effects of interface conductance and magnetism between insulating, non-magnetic oxides

09:00 a 11:00 | Benjamín Martínez, Instituto de Ciencia de Materiales de Barcelona, CSIC

10:00 a 10:20 | 32: Dra. Maria Varela, Oak Ridge Nat. Lab. USA; Real space atomic resolution mapping of María Varela, Structure, electronic properties and spin in the aberration corrected scanning transmission electron microscope

10:20 a 10:40 | 28: Dr. Gervasi Herranz, ICMAB, CSIC; Transiciones metal-aislante vistas desde la espectroscopía magnetoóptica

10:40 a 11:00 | 38: Dr. Zouhair Sefrioui, U. Complutense Madrid, Spin filtering at interfaces of oxide magnetic tunnel junctions

11:00 a 11:30 | Pausa Café (sala posters)
***Sesión 5**. Moderadora: María Varela, Oak Ridge National Laboratory, US-DOE*

11:00 a 11:30 | 14: Dr. Gustau Catalán, CIN2, Barcelona, Nanodomains and their walls

11:30 a 14:00 | María Varela, Oak Ridge National Laboratory, US-DOE

11:50 a 12:10 | 42: Dr. Víctor Pardo, USC; Maximally anisotropic point Fermi surface system: VO2 films embedded in TiO2

12:10 a 12:30 | 49: Dra. Bianchi Méndez, U. Complutense Madrid; Nanohilos y nanocintas de óxido de galio: síntesis y propiedades ópticas

12:30 a 12:50 | 152: Dr. Daniel Torrent, U Pol. Valencia; Invisibilidad acústica en dos y tres dimensiones

12:50 a 13:45 | 156: Dr. Salvador Ferrer: ALBA Light source: Present status and perspectives

14:00 a 16:00 | Pausa comida: Restaurante Eliseos, Paseo Sagasta 4
***Sesión 6**. Moderadora: Lourdes Fábrega, Instituto de Ciencia de Materiales de Barcelona, CSIC*

16:00 a 16:20 | 19: Dra. Reyes Calvo, U Alicante; The Kondo effect in ferromagnetic atomic contacts

16:20 a 16:40 | 29: Dr. Marco Evangelisti, ICMA, CSIC-U. Zaragoza; Molecular coolers

16:40 a 17:00 | 145: Dr. J.J. Sáez Garitaonandía, EHU-U. País Vasco; ¿Qué hay detrás del oro magnético?

17:00 a 17:20 | 63: Dr. David Serrate, INA, U. Zaragoza; Interplay between spin-polarized and spin-orbit coupling STM contrast in noncollinear magnetic order

17:20 a 18:30 | CAFE con POSTERS
Sesión Vespertina "Magnetismo y Bajas Temperaturas"
Moderador: Juan Bartolomé, Instituto de Ciencia de Materiales de Aragón, CSIC-Universidad de Zaragoza

18:30 a 19:25 | 33: Pietro Gambardella, CIN2, Barcelona; Spin-orbit phenomena in metal-organic and metal-oxide layers

19:25 a 20:20 | 148: Wolfgang Wernsdorfer, CNRS-Grenoble; Molecular Spintronics using Molecular Nanomagnets

viernes 5 de febrero

***Sesión 8**. Moderador: Juan José Mazo, Instituto de Ciencia de Materiales de Aragón, CSIC-Universidad de Zaragoza*

09:00 a 10:00 | 1: Dr. Sergio O. Valenzuela, CIN2, Barcelona; Large amplitude driving of a superconducting artificial atom

10:00 a 10:20 | 3: Dra. Belén Valenzuela, ICMM, CSIC; Microscopic description of the new high temperature iron superconductors

10:20 a 10:40 | 155: Dra. Francesca M. Marchetti, U. Autónoma Madrid; Persistent currents and quantised vortices in a matter--light superfluid

10:40 a 11:00 | 71: Dr. Albert Romano, U Barcelona; Focused ion beam techniques and individual nanowires: from the contact strategy and characterization of the nanowires to the fabrication of functional

11:00 a 11:30 | Pausa Café

***Sesión 9**. Moderadora: Ana Cros, Instituto de Ciencia de Materiales, Universidad de Valencia*

11:30 a 11:50 | 20: Dr. Álvaro Blanco, ICMM, CSIC; Self-assembled disorder in photonic nanostructures

11:50 a 12:10 | 12: Dr. Fernando Lahoz Zamarro, U. La Laguna; Hybrid organicinorganic structures for optical amplification in waveguides

12:10 a 12:30 | 95: Dr. Jose I. Martín, U. Oviedo; Crossed ratchet effects on domain wall motion in nanostructured Co-Si amorphous films with 2D arrays of asymmetric holes

12:30 a 12:50 | 54: Dr. Antonio García Martín, IMM, CSIC; Magnetoplasmonics: an overview on the fundamentals and applications

12:50 a 13:10 | 122: Dr. Fernando de León-Pérez, ICMA, CSIC-U. Zaragoza; The role of surface plasmon polaritons in the optical interaction of a hole pair in a metal film

13:10 a 13:30 | 57: Dr. Ángel Barranco, ICMS, CSIC-U. Sevilla; Luminescent plasma nanocomposites for the fabrication of photonic sensing devices

13:30 a 13:50 | Clausura

14:00 a 16:00 | Cocktail de despedida, en Edificio Paraninfo (Sala Josefa Amar y Borbón)

Listado de Pósters

Propiedades magnéticas, superconductoras, mecánicas y eléctricas

- Formation of a One-Atom Contact on Pb: Adhesion and Energy Dissipation
- Tuning exchange bias in Ni/FeF2 heterostructures using antidot arrays
- Controlling exchange bias in Co–CoOx nanoparticles by oxygen content
- Electrochemical fabrication and characterization of metal nanocontacs
- Nuevas configuraciones magnéticas: parimagnetismo
- Epitaxial strain control of magnetoelectric coupling in multiferroic o-AMnO3 thin films
- Desorden magnético en películas Fe7Au93 y polvos Fe14Au86 nanoestructurados
- Nuevo criterio para determinar el orden de una transición de fase a partir de medidas puramente magnéticas
- Size-dependent spin structures of iron nanoparticles coupled to a ferromagnetic cobalt substrate
- Interplay between spin-orbit and curvature in curved graphene nanoribbons
- Mo-based proximity bilayers for cryogenic radiation detectors
- Magnetic properties of graphite irradiated with MeV ions
- Scanning probe based reversible recording of multilevel resistive switching in La0.7Sr0.3MnO3 thin films
- Magnetic interactions in oxo-carboxylate bridged gadolinium(III) complexes.
- Irreversibility in solid state first-order transitions studied with calorimetric techniques
- Papel de la aleatoriedad de las disoluciones sólidas en fenómenos de separación de fases.
- Size dependent dipolar order in molecular clusters of Mn6
- Atomic-resolution imaging of oxygen vacancy induced spin state superlattice in La0.5Sr0.5CoO3-∂
- Negative Magnetization in NdFexGa1-xO3: a phase-separation effect
- Proximity effects in hybrid superconductor/ferromagnetic (S/F) systems Nb/Co-Si thin films
- High magnetic anisotropy of Fe^+ ions in KTaO_3 and SrCl_2
- Transiciones estructurales magnéticas y eléctricas en las cobaltitas dobles YBaCo2O5.50 y Y(Ba,Ca,Sr)Co2O5.50.
- Magnetic anisotropy modulation of the inverse superconducting spin-switch in LCMO/YBCO/LCMO hybrids
- Bitter decoration technique applied to energetic analysis of pinning in YBCO due to different artificial defects
- Revisiting the metal to insulator transition in Pr0.50Ca0.50CoO3-d (d=0)
- Mono- and pentanuclear gadolinium single-molecule magnets
- Caracterización de la porosidad del bloque canario a partir de sus propiedades eléctricas
- Ferromagnetism in transparent MgO thin films
- Complex critical states in type-II superconductors
- Vortex dynamics in YBCO films with artificial nanostructures defined by high resolution lithography techniques
- Pinning effects generated by ferromagnetic and non ferromagnetic interfacial nanostructures in YBCO films grown by chemical deposition methods
- Electrical transport model of Intermediate Band in Ti implanted Si.
- Thermal switching in extremely underdamped Josephson Junctions
- Magnetic properties of single-crystalline TiO2/CrO2 CVD grown films
- Temperature dependence of the slow relaxation in La0.5Sr0.5MnO2.5 Brownmillerite

- Magnetic structure of the new quiral compound [Cr(CN)6][Mn{(R)-pnH}(DMF)] 2•H2O
- Magnetic Properties of Magnetic nanoholes…
- Anomalous thermal dependence of remanence…

Propiedades ópticas y cristales fotónicos

- Nonlinear optical properties optimization of a liquid crystal azopolymer with strong donor-pi-acceptor moieties
- Magnetic field induced modulation of surface plasmon polaritons in plasmonic microinterferometers
- Crecimiento y caracterización estructural y óptica de cristales de molibdato de lantano dopados con iones de tierras raras Er3+ y Nd3+
- In search of optimal performance for light-harvesting nanostructures

Semiconductores, sensores

- High-pressure electronic, vibrational and structural properties of SrWO4
- Observation of persistent vortices in a polariton superfluid
- Formation of highly ordered Cu-TCNQ thin films by Cu diffusion

Simulación de materiales

- Huge enhancement of differential magnetoresistance in nanoparticle arrays
- Transport through two-dimensional metallic nanoparticle arrays
- Lanthanide-based Single Molecule Magnets: Theoretical models and ab initio calculations.
- A first principles stydy of thiol-capped Au nanoparticles: structural and electronic properties as a funtion of thiol coverage
- Estudio del efecto de desorden y defectos de superficie sobre la fricción atómica
- Modelling of demagnetization processes on ultrashort timescales
- Magnetic domains and surface effects in hollow maghemite nanoparticles
- Microscopic origin of exchange bias in inverted core/shell magnetic nanoparticles

Microscopías de proximidad y microscopía electrónica

- Study of the domain structure and coercitive fields in cobalt nanostripes by VF-MFM
- Electronic inhomogeneities of epitaxial graphene on Ru(0001) probed by dynamic STM and STS measurements
- Thermometry with a nearly temperature independent sensitivity using a normal-superconducting tunnel diode biased close to the superconducting gap

Materiales y Energía

- The role of additives in nanocrystalline hydride materials for hydrogen storage: A microstructural and chemical characterization
- Termodinámica del proceso de hidrogenación de aleaciones pseudo-binarias Mg6PdxNi1-x
- MgH2-decomposition at room temperature investigated by transport measurements
- On the formation mechanism of Co-doped pyrite thin films
- Heat capacity and direct determination of the magnetocaloric effect in Mn1-xCoxAs (0 < x 0.02)
- Structural and optical study of Ga incorporation into the lattice of InxGa1-xN nanocolumns

Materiales y electrónica molecular

- Magnetoresistance in Hydrogenated Graphene Nanoribbons
- Magnetic Phthalocyanines on surfaces. Theoretical approach
- Pressure-induced phase transition in CuWO4: A study of the vibrational, electronic and structural properties

Materia blanda, polimeros y materiales mesoporosos

- Rotational reorganization of microscopic objects using chiral switch doped liquid crystals

Grandes instalaciones: sincrotrón, neutrones

- Diffusive behaviour of benzene molecules adsorbed on graphite basal plane
- XtremeD – un nuevo difractómetro de neutrones para altas presiones y campos magnéticos desarrollado por España
- Understanding Magnetic Interaction Mechanisms in Molecule Based Magnets: Spin Densities Studies
- Magnetic structure of the metal-organic complex [Co2(bta)]n
- Possible magnetic anisotropy and interplay of magnetic interactions in a trimer of Mn(II)
- Los CRG´s D1B y D15 en el ILL: aplicación de las técnicas neutrónicas para el estudio de la materia
- Termo-difracción de neutrones in situ en aleaciones binarias de Fe: transformaciones structurales y anomalías magneto-volúmicas

Física de superficies e interfases

- Structure and transport of LaFeO3 - Sm2CuO4 superlattices
- Organic-inorganic hybrid surfaces: a double bottom-up strategy to tune mechanical and electrostatic responses at the nanoscale
- Andreev Reflection in FEBID-Co - FIBID-W nanocontacts
- 'In situ' assessment of non-magnetic phase formation in (Fe/Si)n films by magnetic measurements

Física del sólido para la información cuántica

- Spin-lattice relaxation via quantum tunnelling in molecular nanomagnets
- Quantum switches in circuit QED

Materiales nanoestructurados y nanotecnologías

- Permanent magnetism in phosphine- and chlorine-capped gold clusters and nanoparticles
- Control del campo coercitivo de láminas delgadas de hierro mediante redes periódicas de agujeros
- Analysis of the Kondo Effect in Low Coordinated Ferromagnets
- Imaging of magnetic domain walls in cobalt nanowires grown by focused-electron-beam-induced deposition
- Origin of the enhanced magnetic moment in epitaxial Fe3O4 ultra thin films
- Synthesis and self-assembled of 1-D nanostructures based on La0.3Sr0.7MnO3 from template directed chemical solution deposition
- Magnetotransport properties of Fe-based nanowires grown by focused-electron-beam-induced-deposition
- Superconducting vortex dynamics in Nb thin films induced by the magnetic states of Ni nanoring arrays
- Formación de contactos atómicos de Au y Ag
- Electrical and optical study of Si-doped GaN nanowires

- Metal-Insulator transition in graphene
- Chemically Grown La0.7Sr0.3MnO3/Single Crystal Heteroepitaxies
- Ordered Arrays of Manganite Oxide Nanostructures from Electron Activated Water Developable Precursors
- Magnetic response of cobalt nanoparticles embedded in gold and vanadium-gold systems
- Control of magnetization in epitaxial Fe planar nanowires
- Controllable Manganite Nano-Islands Formation from Electron Beam Lithography on Single Crystals
- Tunning SPR in Au films by trermal treatments
- Control of the chirality and polarity of magnetic vortices in triangular nanodots
- Modelling and Elucidating Magnetic Properties of Colloidal Nanostructures based on Interparticle Interactions
- Nonlinear response of molecular nanomagnets: a journey across the quantum to classical border
- SQUID-microsusceptometry on nanoparticle layers fabricated by dip-pen nanolithography: a new combination towards the direct characterization of surface patterned nanoparticles
- Red de vórtices superconductores en películas superconductoras sobre nanoestructuras magnéticas: Experimentos y simulaciones.
- Growth of TFA-YBCO nanocomposite films with added preformed nanoparticles
- Biodistribution of magnetic nanoparticles by magnetization measurements
- Nanostructuration in complex oxide thin films
- Evolution of the dielectric, magnetic and optical properties of iron doped CaCu3Ti4O12 ceramics with the sintering time
- Transport properties of superconducting amorphous W-based nanowires fabricated by focused-ion-beam-induced-deposition
- Surface anisotropy, orbital moment and biomedical applications in magnetic nanoparticles
- Influence of the substrate and deposition temperature on the magnetotransport properties of Fe/MgO discontinuous multilayers
- Nonlocal proposals for the Exchange Energy Density Functional
- Self-consistent modelling of electron surface accumulation in InN nanocolumns
- Functional oxide epitaxial layers obtained by Ink jet printing
- Nano-cuerdas superficiales en películas delgadas de Co: origen de su anisotropía magnética
- Microstructure and magnetic properties of ultrathin Co/Ag multilayers grown by MBE on Si(111) and MgO(001)
- Magnetotransporte en el milikelvin sin helio líquido
- STM Study of Magnetic Polyoxometalates on HOPG Surfaces
- Interfacial effects in LSMO and LCMO manganite thin films
- Self-assembling of Magnetic Nanoparticles onto Technological Substrates
- Conductividad térmica de circona de zircona estabilizada con itria (10%-YSZ) nanocristalina obtenida por aleación mecánica
- Raman scattering on InAs single nanowires near the E1 transition
- Study of third Hund's rule compliance on W polarized moment in Co-W amorphous nanoparticles

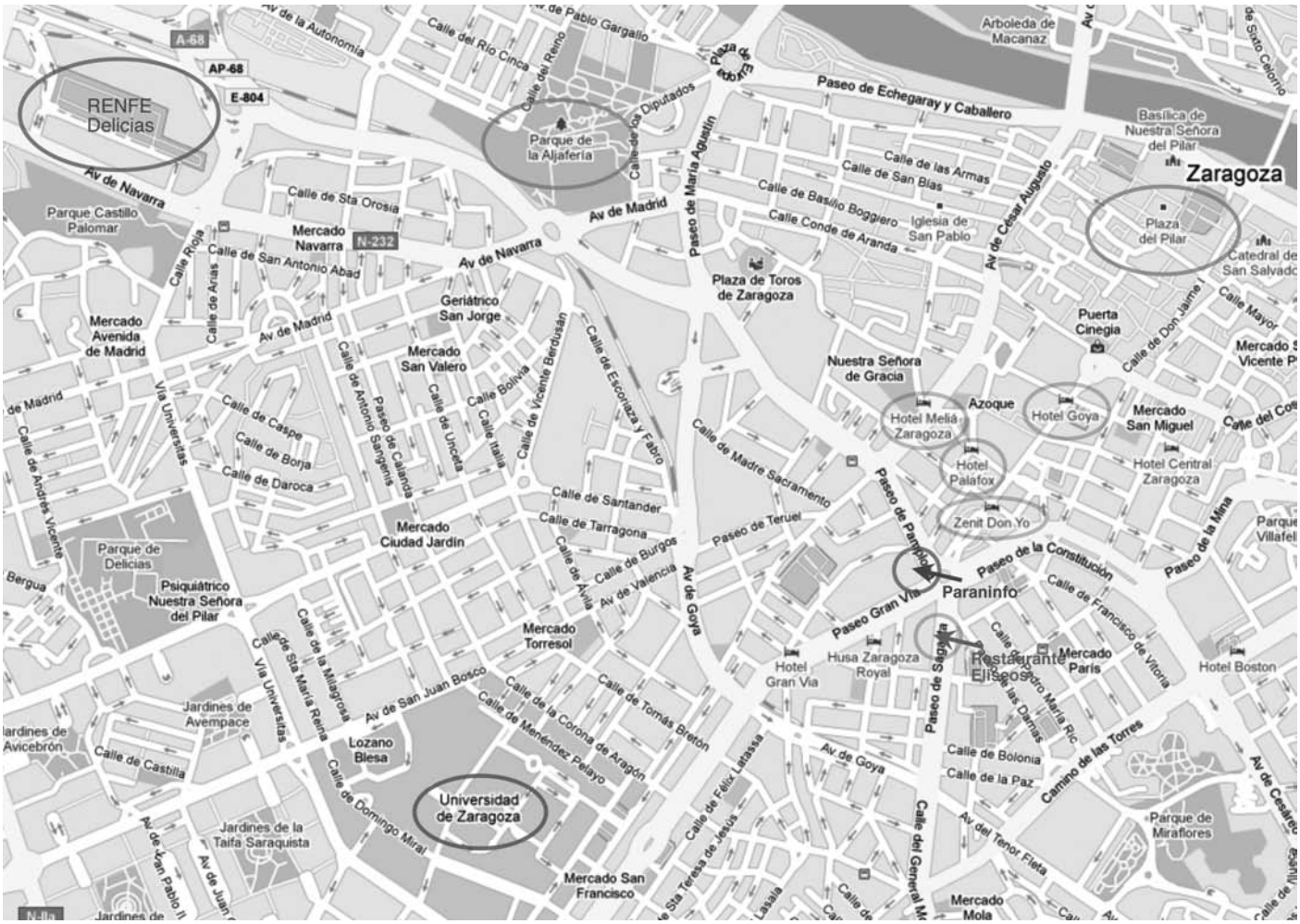
Cómo llegar y Sede

Sede

Paraninfo de la Universidad de Zaragoza
Plaza Basilio Paraíso, nº 4
50008 Zaragoza

Líneas de autobuses urbanos con parada en el Paraninfo

Por estar situado en el centro neurálgico de la ciudad de Zaragoza existen numerosas líneas de autobús urbano que conectan el edificio con todos los puntos de la ciudad.
Autobuses: 21, 30, 40, 45, ...
Transportes Urbanos de Zaragoza: www.tuzsa.es



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PLENARIAS

Miércoles 10:15 h

TÍTULO: **Graphene & Its Chemical Derivatives**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

E-MAIL: **kostya@manchester.ac.uk**

AUTORES:

Autor 1: ***Kostya Novoselov*** (University of Manchester) - Ponente

CONTENIDO:

When one writes by a pencil, thin flakes of graphite are left on a surface. Some of them are only one angstrom thick and can be viewed as individual atomic planes cleaved away from the bulk. This strictly two dimensional material called graphene was presumed not to exist in the free state and remained undiscovered until the last year. In fact, there exists a whole class of such two-dimensional crystals. The most amazing things about graphene probably is that its electrons move with little scattering over huge (submicron) distances as if they were completely insensitive to the environment only a couple of angstroms away. Moreover, whereas electronic properties of other materials are commonly described by quasiparticles that obey the Schrödinger equation, electron transport in graphene is different: It is governed by the Dirac equation so that charge carriers in graphene mimic relativistic particles with zero rest mass. The very unusual electronic properties of this material as well as the possibility for it's chemical modification make graphene a promising candidate for future electronic applications.

Miércoles 12:50 h

TÍTULO: **Institut Laue Langevin (ILL): En la vanguardia de las técnicas de neutrones**

ÁREA TEMÁTICA: **Grandes instalaciones: sincrotrón, neutrones**

E-MAIL: **martinez@ill.fr**

AUTORES:

Autor 1: ***José Luis Martínez*** (Institut Laue Langevin, BP 156. Grenoble Cedex 9. Francia) - Ponente

CONTENIDO:

Después de 44 años de funcionamiento, el ILL continúa siendo la referencia mundial para técnicas de neutrones. Para mantener la posición de vanguardia, el ILL está desarrollando un ambicioso programa de mejora de la instrumentación disponible, que implica la construcción de 4 nuevos instrumentos y la mejora de otros 5, así como la renovación de 600 metros de guías de neutrones y gran parte del equipamiento de entorno de la muestra (nuevas bobinas superconductoras y nuevas celdas para obtener alta presión hidrostática). Todo este proceso culminara en 2013, con la segunda fase del programa de modernización llamado Milenio. A día de hoy se ha conseguido mejorar la eficacia global en un factor 18, respecto a la eficacia de os instrumentos disponibles en el año 2000. Para poder mantener la posición de vanguardia hasta al menos el año 2030, en Septiembre de 2010 se va a comenzar la discusión sobre la tercera fase del programa Milenio para continuar las inversiones de mejora en el periodo

2013-2018. Durante 2010 y 2011 se van discutir los nuevos proyectos de instrumentación en colaboración con los usuarios y diferentes expertos, para seleccionar los instrumentos más innovadores para el futuro de las técnicas de neutrones.

La participación de España en el ILL es muy importante, siendo el cuarto país después de los tres países asociados (Alemania, Francia y Reino Unido), tanto a nivel de inversiones como de uso de las instalaciones por tiempo de haz, como de de visitantes y proyectos de tesis. Además grupos españoles están a cargo de la gestión de varios instrumentos tipo CRG, dedicados a la difracción de polvo y de monocristal. En 2008, el número total de usuarios de las instalaciones del ILL ha sido de 1247, que han realizado un total de 766 experimentos. El número total de publicaciones en ese mismo año es de más de 600, siendo la gran mayoría en el ámbito de la física y la química del estado sólido.

Jueves 9 h

TÍTULO: **Effects of interface conductance and magnetism between insulating, non-magnetic oxides.**

AUTORES:

Autor 1: ***Hans Hilgenkamp*** (Faculty of Science and Technology and MESA+ Institute for Nanotechnology. University of Twente, Enschede, The Netherlands and Leiden Institute of Physics, Leiden University, The Netherlands)

CONTENIDO:

Remarkable electronic and magnetic behavior results from electronic reconstruction at interfaces in complex oxides. In recent years this has been strikingly shown by various groups especially for interfaces to SrTiO3, for example with LaTiO3 and LaAlO3. Depending on the atomic arrangements of these interfaces and the conditions under which the films are deposited, they can become conducting, remain insulating, shown magnetic activity and even become superconducting. The analogy with 2-dimensional electron (hole) gasses as they occur in semiconductor heterostructures like AlGaAs-GaAs is exciting, even more when considering that transition metal oxides themselves already often display a large richness due to e.g., electron correlation effects.

The topic of interface conduction effects gets an even further dimension when considering the coupling between adjacent interfaces, separated just a few crystalline unit cells apart. We see indications for example of closely coupled electron and hole layers, which may provide a platform for new electronic phases such as dipolar electron-hole liquids.

In this talk I will discuss recent experimental and theoretical studies on such conducting hetero-interfaces between oxide insulators.

Jueves 12:50 h

TÍTULO: **ALBA Light source. Present status and perspectives.**

ÁREA TEMÁTICA: **Grandes instalaciones: sincrotrón, neutrones**

E-MAIL: **ferrer@cells.es**

AUTORES:

Autor 1: ***Salvador Ferrer*** (ALBA) - Ponente

CONTENIDO:

A brief overview of the status of the building and accelerator will be presented. The insertion devices already qualified and the present situation of the seven phase I beamlines will be described. Also, the progress of the optical metrology laboratory will be reported.

A general view of the future experimental facilities will be also exposed with the aim of already defining possible research projects.

Jueves 18:30 h

TÍTULO: **Spin-orbit phenomena in metal-organic and metal-oxide layers**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

E-MAIL: **pietro.gambardella.icn@uab.es**

AUTORES:

Autor 1: ***Pietro Gambardella***. (Centre d'Investigació en Nanociencia i Nanotecnologia (ICN-CSIC), UAB Campus, E-08193 Barcelona, Spain) - Ponente

CONTENIDO:

The spin-orbit interaction constitutes a weak but essential perturbation to the Hamiltonian of magnetic systems. Linking spins with atomic structure, spin-orbit coupling assumes a prominent role in structures of reduced dimensionality such as molecules and thin films, where it defines the orientation and magnitude of internal anisotropy fields. In this talk, we show two examples of how the interplay of structure and spin-orbit coupling can be used to control the magnetization of 1) metal-organic and 2) metal-oxide layers. In the first case, using a combination of scanning tunnelling microscopy, x-ray magnetic circular dichroism, and ligand field calculations we study the hybridization of molecular and metal states in supramolecular metal-organic networks adsorbed on metal surfaces, discussing under which conditions the magnetic anisotropy as well as the spin and orbital moments of the molecules can be modified via ligand or substrate interaction [1]. In the second case, we investigate novel spin-orbit torque mechanisms arising in Rashba-type, structurally asymmetric ferromagnetic metal layers traversed by an electric current [2]. The fundamental significance of these processes will be discussed together with perspectives for room temperature magnetoelectronic applications.

[1] P. Gambardella et al., Nature Mater. 8, 189 (2009).

[2] I. M. Miron et al., Nature Mater., in press (2010).

Jueves 19:25 h

TÍTULO: **Molecular Spintronics using Molecular Nanomagnets**

ÁREA TEMÁTICA: **Materiales y electrónica molecular**

E-MAIL: **wolfgang.wernsdorfer@grenoble.cnrs.fr**

AUTORES:

Autor 1: ***Wolfgang Wernsdorfer*** (Institut Néel, CNRS, Grenoble) - Ponente

CONTENIDO:

This presentation will address a new field called molecular spintronics, which combines the concepts of spintronics, molecular electronics and quantum computing [1]. Various research groups are currently developing low-temperature scanning tunnelling microscopes to manipulate spins in single molecules, while others are working on molecular devices (such as molecular spin-transistors, spin valves and filters, and carbon-nanotube-based devices [1]) to read and manipulate the spin state and perform basic quantum operations. The talk will discuss this - still largely unexplored - field and present our first results [2-4].

[1] L. Bogani & W. Wernsdorfer, Molecular spintronics using single-molecule magnets, Nature Mat. 7, 179 (2008).

[2] N. Roch, S. Florens, V. Bouchiat, W. Wernsdorfer & F. Balestro, Quantum phase transition in a single-molecule quantum dot, Nature 453, 633 (2008).

[3] Cleuziou, J.-P., Wernsdorfer, W., Bouchiat, V., Ondarçuhu, T. & Monthioux, M.: Carbon nanotube superconducting quantum interference device. Nature Nanotech. 1, 53 (2006).

[4] Cleuziou, J.-P., Wernsdorfer, W., Ondarçuhu, T. & Monthioux, M.: MagnetoCoulomb effect in cobalt filled carbon nanotubes, submitted.

Viernes 9 h

TÍTULO: **Large amplitude driving of a superconducting artificial atom**

ÁREA TEMÁTICA: **Física del sólido para la información cuántica**

E-MAIL: **Sergio.Valenzuela.icn@uab.es**

AUTORES:

Autor 1: ***Sergio Valenzuela*** (Centre d'Investigacions en Nanociencia i Nanotecnologia (CIN2-CSIC/ICN)) - Ponente

CONTENIDO:

Superconducting persistent-current qubits are quantum-coherent artificial atoms with multiple energy levels. In the presence of large-amplitude harmonic excitation, the qubit state can be driven through one or more of the energy-level avoided crossings. The resulting Landau-Zener transitions mediate a rich array of quantum-coherent phenomena as a function of the driving amplitude and frequency, as experimentally demonstrated using a niobium persistent-current qubit. In this talk, we will discuss the observation of Mach-Zehnder-type interferometry, for which quantum interference fringes for 1-50 photon transitions are identified, and microwave-induced cooling, for which effective qubit temperatures < 3 mK are achieved, a factor 10x-100x lower than the dilution refrigerator ambient temperature. We will also introduce a novel spectroscopy technique, where spectroscopic information is obtained from the dependence of the system response on the driving amplitude, rather than on the driving frequency. This approach surmounts many of the limitations of the conventional frequency-based approach, whose application is not universally straightforward and becomes challenging for frequencies in the range of tens and hundreds of gigahertz.

Work done in collaboration with: D.M. Berns, W.D. Oliver, M.S. Rudner, L.S. Levitov, T.P. Orlando, A.V. Shytov, and K.K. Berggren

VI reunión
grupo especializado
de física de estado sólido
Real Sociedad Española de Física

ORALES

Miércoles 11:50 h

TÍTULO: **Quantum pumping in graphene**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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Autor 2: ***Pablo San-Jose*** (Instituto de Estructura de la Materia-CSIC/Departamento de Física y Química Teóricas, Serrano 123, 28006 Madrid)

Autor 3: ***Henning Schomerus*** (Lancaster University/Department of Physics, UK- LA1 4YB, United Kingdom)

CONTENIDO:

We show that graphene-based quantum pumps can tap into evanescent modes, which penetrate deeply into the device as a consequence of Klein tunneling. The evanescent modes dominate pumping at the Dirac point, and give rise to a universal response under weak driving for short and wide pumps, in close analogy to their role for the minimal conductivity in ballistic transport. In contrast, evanescent modes contribute negligibly to normal pumps. Our findings add a new incentive for the exploration of graphene-based nanoelectronic devices.

Miércoles 12:10 h

TÍTULO: **Fullerenes from aromatic precursors**

ÁREA TEMÁTICA: **Física de Superficies e interfases**

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Autor 10: ***Jose Angel Martin Gago*** (Instituto de Ciencia de Materiales de Madrid (CSIC), Cantoblanco 28049, Madrid, Spain)

CONTENIDO:

Controlled synthesis of fullerenes and heterofullerenes on surfaces is a preceding step towards the development of a true fullerene-based molecular electronics. However, new methods are required for the rational, size-controlled synthesis of fullerenes, heterofullerenes, and endohedral fullerenes that can not be accessed by the current method of graphite vaporization.

Here we report a highly efficient dehydrogenation mechanism leading to the formation of fullerene C60 and for the first time triazafullerene C57N3 in a one-step from their corresponding planar polycyclic aromatic precursors by a surface catalysed process [1].

We have visualized the whole process by in-situ Scanning Tunneling Microscopy (STM) and X-Ray Photoemission Spectroscopy (XPS). The cyclodehydrogenation has been confirmed by the thermal desorption of HD and D2 from hexadeuterated 1-d6 precursors, and by the mass-spectrometric detection of C60 in the platinum-catalysed dehydrogenation. First principles DFT calculations have been used to follow the whole process.

The process is catalysed by reactive substrates, as Pt, which favours strong surface-molecule interactions. We have deeply studied by STM and DFT the interaction of the polycyclic planar precursors with different surfaces. Particularly we found that this system has the capability to induce a local separation of the chiral molecular species induced upon surface adsorption. The number of established bonds between the substrate and molecule seems to play a key-role in the properties of the system.

The mechanism we describe opens the door to size-controlled production of fullerenes and heterofullerenes, it could allow the encapsulation of different atomic and molecular species to form endohedral fullerenes and to the formation of different carbon-based nanostructures, such as graphene or doped graphene, which nowadays are not readily available on surfaces by other methods.

[1] Otero, G., Biddau, G., Sánchez-Sánchez, C., Caillard, R., López, M. F., Rogero, C., Palomares, F. J., Cabello, N., Basanta, M. A., Ortega, J., Méndez, J., Echavarren, A. M., Pérez, R., Gómez-Lor, B. and Martín-Gago, J. A., Nature 454, 865-869 (2008).

Miércoles 12:30 h

TÍTULO: **Microscopic investigations of exchange bias in FeMn/Co bilayers on the nm length scale**

ÁREA TEMÁTICA: **Física de Superficies e interfases**

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Autor 7: ***Mishra Shrawan*** (Helmholtz-Zentrum Berlin für Materialien und Energie GmbH. Germany)

Autor 8: ***Hermann A. Dürr*** (Helmholtz-Zentrum Berlin für Materialien und Energie GmbH. Germany)

CONTENIDO:

The direct exchange interaction at the interface between an antiferromagnet and a ferromagnet allows tailoring the magnetic properties of the materials like the coercitivity and the exchange bias. Both sputter deposited and in-situ grown Co/FeMn bi-layer films were studied exploiting the unique capabilities of element specific magnetic imaging by X-PEEM, which allows studying the magnetic interface coupling. We have investigated the domain structure in the ferromagnetic Co layer and the arrangement of magnetic moments at the interface of the FeMn antiferromagnet as a function of applied magnetic field at the S-PEEM end-station at BESSY. A special sample holder with integrated magnetization yoke was developed, allowing applying magnetic fields up to 25mT during imaging without significant reduction of the spatial resolution. Focussing on a particular area of the sample the evolution of magnetic domains in the ferromagnetic layer and at the interface as a function of the applied magnetic field has be monitored. A map of the local exchange bias (i.e. the shift of the hysteresis loop) is obtained from the analysis of the space-resolved hysteresis loop of a stack of images taken at different magnetic fields in the ferromagnetic Co layer. Our main objective is to correlate the observed variations in the local exchange bias with the magnetic arrangement of spins at the interface of the antiferromagnet. Results from the two different preparation methods will be presented, in order to show the correlation of the exchange bias with the interface quality, such as chemical intermixing or the presence of defects.

Miércoles 16:00 h

TítulO: **What can material science teach us about biology?**

ÁREA TEMÁTICA: **Materia blanda, polímeros y materiales mesoporosos**

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AUTORES:

Autor 1: ***Xavier Trepat*** (Universitat de Barcelona / Instituto de Bioingeniería de Catalunya) - Ponente

CONTENIDO:

To carry out its daily routine of crawling, dividing, stretching and contracting, the living cell needs an extraordinary capacity to regulate its shape and mechanics. This capacity stems from the unusual physical properties of a three-dimensional protein scaffold named the cytoskeleton. The cytoskeleton is arguably the most complex material that exists in nature. It is constituted by hundreds of different proteins that interact with each other in a highly specific manner and, as a requirement for life, exists out of thermodynamic equilibrium and in a constant state of remodeling. While such structural and dynamical complexity may have conferred the cell with diverse and unpredictable mechanical properties, recent evidence indicates that the behavior of the cytoskeleton conforms to a limited set of empirical laws that appear to be simple and universal. While mechanistic understanding of such laws is still lacking, their very existence suggests that rather than being addressed solely in terms of molecular details and specific interactions, cell mechanics needs to be addressed as well from a coarse-grained point of view. In this presentation I will discuss how a coarse-grained approach to material science has provided us with new insights into basic cellular functions.

Miércoles 16:20 h

TÍTULO: **Quantum effects and surface states in the magnetotransport properties in two- and one-dimensional Bi-Nanostructures**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Localization effects caused by quantum interference effects in disordered systems with reduced dimensionality have been studied over the past two decades [1]. In the case of Bi, the weak antilocalization (WAL) signal can be overshadow by the classical magnetoresistance (MR) since both contributions are positive in sign and decrease with temperature. The fabrication of Bi structures for the observation of WAL has been achieved introducing modifications to the crystallinity or the composition of the structure, which can alter the electrical transport properties of interest.

In the present work we investigate the relative intensity of the two effects when reducing the dimensionality of the system. We report the magnetotransport properties of Bi ultrathin films and Nanowires (NWs) over a wide range in temperature (2-300 K) for fields up to 90 kOe. The precise control of the thickness (t) of the films during the growth and the further optical lithography process have allowed the fabrication of continuous Bi micropatterned structures of lateral size of 4 μm and thickness in the range 10 nm < t < 100 nm. We observe a remarkable change in the temperature and field dependence of the Hall resistivity and the perpendicular MR as the film gets thinner. We discuss this behavior by considering the role of surface states, which become dominant below a critical film thickness tC.

We move a step forward to investigate quasi-one dimensional phenomena by focusing on Bi NWs. To date, there are few works reporting the electronic and magnetotransport properties of individual Bi NW because of the difficulties, on the one hand, in fabricating high quality crystalline Bi NWs and on the other hand, in making good electrical ohmic contacts to single NW due to a native Bi oxide coating on the NWs. We have succeeded in making ohmic contacts on individual Bi NWs with length 2 μm and 100 nm-width by means of focused ion beam techniques. Magnetotransport measurements show evidence for 1D-WAL at temperatures below 10 K.

[1] J. J. Lin and J. P. Bird, J. Phys.: Condens. Matter 14, R501 (2002).

Miércoles 16:40 h

TÍTULO: **Spin-transfer torque on a single magnetic adatom**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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Autor 3: ***Joaquín Fernández Rossier*** (Departamento de Física Aplicada, Universidad de Alicante, 03690 Alicante)

CONTENIDO:

We theoretically show how the spin orientation of a single magnetic adatom can be controlled by spin polarized electrons in a scanning tunnelling microscope configuration. The underlying physical mechanism is spin assisted inelastic tunnelling. Experiments with Mn adatoms deposited on a Cu2N surface have been reported for non-polarized currents [1,2]. We show that by changing the direction of the applied current, the orientation of the magnetic adatom can be completely reversed on a time scale that ranges from a few nanoseconds to microseconds, depending on bias and temperature. The changes in the adatom magnetization direction are, in turn, reflected in the tunnelling conductance. Therefore, this effect opens the possibility of writing/reading a single spin without the need of a local magnetic field.

[1] C.F. Hirjibehedin, C. P. Lutz, A. J. Heinrich, Science 312, 1021 (2006).

[2] C. Hirjibehedin et al., Science 317, 1199 (2007).

Miércoles 17:00 h

TÍTULO: **Holes in quantum dot molecules**

ÁREA TEMÁTICA: **Semiconductores, sensores**

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Autor 7: ***Allan S. Bracker*** (Naval Research Laboratory, Washington, USA)

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Autor 9: ***Daniel Gammon*** (Naval Research Laboratory, Washington, USA)

CONTENIDO:

Tunneling of carriers between vertically coupled quantum dots enables the formation of molecular-like orbitals which are important in many quantum dot-based devices, including those aiming at optically controlled quantum information storage [1,2].

While most early works dealing with coupled quantum dots focused on electron tunneling, we have recently started investigating hole tunneling instead. We have identified several instances where the behavior of holes is surprinsingly different from that of electrons. The differences arise from the proximity of heavy and light holes in the energy spectrum, which couple via spin-orbit interaction and give rise to novel physical phenomena. In this contribution we review some of these phenomena.

First we show that holes in vertically coupled quantum dots may form molecular ground states with antibonding character, a situation that never occurs in natural molecules [3]. This peculiar phenomenon is confirmed by magneto-photoluminescence experiments [4]. We next show that the tunnel-coupling strength can be controlled at will by modulating the spin-orbit interaction strength via longitudinal magnetic fields. This is a useful tool as it can be applied after growth, is fully reversible and –unlike transversal fields– does not mix states with orthogonal spin projections. Finally, we investigate the influence of structural deformations of the double quantum dot on the spin purity of holes. It is shown that vertical misalignment induces strong mixing between nearby hole states with opposite spin. Implications and opportunities for quantum information development following from this finding are discussed [6].

[1] M. Bayer et al., Science 291, 451 (2001).

[2] E.A. Stinaff et al., Science 311, 636 (2006).

[3] J.I. Climente et al., Phys. Rev. B 78, 115323 (2008).

[4] M.F. Doty et al., Phys. Rev. Lett. 102, 047401 (2009).

[5] J.I. Climente, Appl. Phys. Lett. 93, 223109 (2008).

[6] M.F. Doty et al., submitted.

Miércoles 17:20 h

TÍTULO: **Properties and applications of focused-ion-beam-induced-deposition material using W(CO)6 as precursor gas**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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Autor 1: ***Javier Sesé Monclús*** (Instituto de Nanociencia de Aragón) - Ponente

CONTENIDO:

The combination of focused-ion-beam technology with gas chemistry makes possible the deposition of materials with control at the nanoscale. The deposition occurs locally in the vicinity of the beam focus due to the breaking of precursor molecules produced by emitted secondary electrons. In particular, the precursor gas W(CO)6 produces a superconducting material with excellent properties for basic studies in Nanoscience, as well as being a very interesting technological material for superconducting electronics. The basics of the technique will be explained along with recent results obtained at the "Instituto de Nanociencia de Aragón, INA" and the "Instituto de Ciencia de Materiales de Aragón, ICMA" in collaboration with the "Universidad Autónoma de Madrid" and the Physicalisch-Technische Budestalt, PTB Berlin.

Complete list of authors / References:

M. J. Martínez-Pérez, J. Sesé, F. Luis, D. Drung and T. Schurig, "Circuit edit of superconducting microcircuits", Superconductor Science and Technology 22, 125020 (2009).

I. Guillamón, H. Suderow, S. Vieira, A. Fernández-Pacheco, J. Sesé, R. Córdoba, JM. De Teresa and MR. Ibarra "Nanoscale superconducting properties of amorphous W-based deposits grown with a focused-ion-beam", New Journal of Physics 10, 093005 (2008).

I. Guillamón, H. Suderow, A. Fernández-Pacheco, J. Sesé, R. Córdoba, JM. De Teresa, MR. Ibarra and , S. Vieira, "Direct observation of melting in a 2D superconducting vortex lattice", Nature Physics 5, 651 (2009).

J. M. De Teresa, A. Fernández-Pacheco, R. Córdoba R, J. Sesé, MR. Ibarra, I. Guillamón, H. Suderow and S. Vieira, "Transport properties of superconducting amorphous W-based nanowires fabricated by focused-ion-beam-induced- deposition for applications in nanotechnology", Mater. Res. Soc. Symp. Proc. 1180-CC04-09 (2009).

Miércoles 17:40 h

TÍTULO: **Diborane – The key to reversible hydrogen storage in borohydrides**

ÁREA TEMÁTICA: **Materiales y Energía**

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CONTENIDO:

Ever since Bogdanovic published his pioneering work on the reversible hydrogen storage in NaAlH4 [1], there was a dream of complex hydrides being the energy carrier of the future [2] replacing the depleting and CO2 emitting fossil fuels. This hope was even more fueled when in 2003 borohydrides were proposed as new hydrogen storage materials [3] with gravimetric hydrogen densities yet exceeding that of gasoline. However, so far no reversible and reliable system could be realized for technical applications. The reason might be that the role of diborane (B2H6) in the formation and decomposition was underestimated so far.

In the present work, we show that B2H6 plays a key role for reversible hydrogen storage in borohydrides [4,5]. We identified the crucial role of diborane in the formation and decomposition mechanism of borohydrides and present a model explaining the mass transport during these processes. Based on these insights, we developed a new method for the solvent-free synthesis of borohydrides at room temperature and demonstrated its feasibility with the synthesis of three of the most discussed borohydrides at present: LiBH4, Mg[BH4]2 and Ca[BH4]2 [6-8]. The method will open new ways for the preparation of a wide range of different borohydrides, or even mixed borohydride systems, with tuneable sorption properties [9].

[1] Bogdanovic, B., Schwickardi, M. J., Alloys Compd. 253, 1-9 (1997).

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[3] Züttel, A., Wenger, P., Rentsch, S., Sudan, P., Mauron, Ph., Emmenegger, Ch., J. Power Source 118, 1-7 (2003).

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[6] Ramzan, M., Ahuja, R., Vajo, J.J., Skeith, S.L., Mertens, F.J., J. Phys. Chem. B 109, 3719-3722 (2005).

[7] Ronnebro, E., Majzoub E.H., J. Phys. Chem. B 111, 12045-12047 (2007)

[8] Cern?, R., Filinchuk, Y., Hagemann, H., Yvon, K., Angew. Chem. Int. Edit. 46, 5765-5767 (2007).

[9] Nickels, E.A., Jones, M.O., David, W.I.F., Johnson, S.R., Lowton, R.L., Sommariva, M., Edwards, P.P., Angew. Chem. Int. Edit. 47, 2817-2819 (2008).

Jueves 10 h

TÍTULO: **Real space atomic resolution mapping of structure, electronic properties and spin in the aberration corrected scanning transmission electron microscope**

ÁREA TEMÁTICA: **Microscopías de proximidad y microscopía electrónica**

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CONTENIDO:

The properties of perovskite oxides are determined by the oxygen-metal bonds. The angles and lengths of these bonds determine fundamental properties such as bandgaps, bandwidths, spin states etc, and hence the system's macroscopic properties (e.g., ferroelectricity, magnetism). This is especially so in oxide interfaces, which may show unexpected behaviors due to factors such as low dimensionality, proximity, charge transfer or novel electronic phenomena. Understanding their properties, therefore, relies on a careful quantification of the atomic structure including the light O species, which is not always possible through standard (average) diffraction methods. Aberration corrected scanning transmission electron microscopy (STEM) and electron energy loss spectroscopy (EELS) have achieved the imaging of such light atoms in real space with atomic resolution. Here we will apply these techniques to the imaging of subtle O displacements across LaMnO3/SrTiO3 (LMO/STO) interfaces. The LMO/STO relative layer thicknesses alter the degree of epitaxial strain within the layers and affect the physical properties of the system, which can be tuned from insulating, mild ferromagnetic, to metallic ferromagnetic [1]. We will show how the octahedral distortions of relaxed LMO layers can be tuned through different degrees of epitaxial strain and affect the O sublattice of ultrathin STO layers. These results will be discussed and combined with density functional theory, in connection with the magnetotransport properties. Additionally, the EELS fine structure is sensitive to the spin state of certain transition metals [2]. Recent results regarding the spatial mapping of the spin state of Co in O deficient perovskites will also be discussed. Research sponsored by the Division of Materials Science and Engineering US Department of Energy.

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[1] J. Garcia-Barriocanal et al., Advanced Materials, in press (2009)

[2] R. Klie et al., Physical Review Letters 99, 047203 (2007).

Jueves 10:20 h

TÍTULO: **Transiciones metal-aislante vistas desde la espectroscopía magnetoóptica**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Las transiciones metal-aislante (TMI) en sistemas electrónicos fuertemente correlacionados son una de los fenómenos más fascinantes de la física de la material condensada. Un ejemplo paradigmático es el de algunos óxidos de metales de transición en los que los grados de libertad electrónicos, de red y de spin están íntimamente correlacionados y con escalas de energía en competición. De tal balance resultan diferentes estados correlacionados, como magnetismo, orden de carga, o formación de polarones, entre otros fenómenos. Estos estados pueden ser muy sensibles a estímulos externos tales como campos de tensión, magnéticos o eléctricos, y por lo tanto, las TMI pueden ser manipuladas externamente.

El método más común para explorar estas TMI es mediante medidas de transporte dc o de baja frecuencia. Sin embargo, se demuestra aquí que nuevas perspectivas y conocimiento se generan si se sondean estos sistemas con luz de energía comparable a la de las excitaciones electrónicas [1]. Habitualmente estas excitaciones ocurren a energías en la escala del eV e involucran, en consecuencia, fotones con frecuencias entre el infrarrojo cercano y el ultravioleta. Con tal propósito hemos medido la respuesta óptica alrededor de TMI de diferentes óxidos en el visible y ultravioleta en configuración transversal bajo campos magnéticos. En tales experimentos hemos medido simultáneamente las contribuciones magneto-ópticas y magneto-refractivas a la señal óptica. La señal magneto-óptica está relacionada con la componente no-diagonal del tensor dieléctrico, mientras que la contribución magneto-refractiva (variación del índice de refracción y de la conductividad óptica con el campo magnético), depende de los componentes diagonales. En consecuencia, tenemos acceso al magnetismo y al transporte óptico en un mismo experimento. Usando esta metodología, hemos analizado TMI en diferentes óxidos, entre los cuales manganitas de diferente composición y magnetita. Hemos estudiado en estos sistemas la magnetorresistencia colosal (manganitas) y la transición de Verwey (magnetita) desde la óptica de la espectroscopía magneto-óptica como herramienta original para profundizar la comprensión de la naturaleza de estas transiciones, cuya metodología es en general extrapolable a otros sistemas fuertemente correlacionados.

[1]. D. Hrabovsk? et al., Phys. Rev. B 79, 052401 (2009)

Jueves 10:40 h

Título: **Spin filtering at interfaces of oxide magnetic tunnel junctions**

ÁREA TEMÁTICA: **Física de Superficies e interfases**

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CONTENIDO:

The search for spin filter materials based on manganese perovskite oxides remains a major direction in the design of new spintronics devices. Spin filtering consists of modulating the tunneling current by the spin orientation dependence of the barrier height originating at the exchange splitting of a ferromagnetic insulating (FMI) barrier. The exponential dependence of the tunneling current on the barrier height may give rise to a very high spin-polarized current. However, the choice of native FMI spacers has remained very limited and their operation restricted to very low temperatures. The rich phase diagram of complex transition metal oxides offers a wider choice of novel candidate FMI barriers. However, despite the efforts towards using native FMI complex oxides, the very few examples investigated are restricted to low bias operation. A way to overcome these obstacles is integrating ultrathin antiferromagnetic layers as tunnel barriers in oxide magnetic tunnel junctions. In this

communication, we describe an alternative strategy to produce spin filtering by inducing a FMI state in an ultrathin antiferromagnetic layer in contact with a ferromagnetic layer. This artificially induced spin filtering persists up to relatively high temperatures and operates at high applied bias voltages, evidencing the potential of oxide interfaces for future spin-electronics devices.

This work was supported by the Spanish Ministry for Science and Education grants MAT 2005-06024-C02 01-02 and MAT 2008 06517.

Jueves 11:30 h

Título: **Nanodomains and their walls**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

When a ferroic (ferroelectric, ferroelastic, magnetic) or multiferroic material undergoes a phase transition, the low temperature phase often divides up into regions, called domains, with different orientations of the polar order parameter. The boundary between adjacent domains is known as the "domain wall". While in the past the domain walls were treated as functionally inert entities which just provided a physical border between domains, it is only recently that the walls are starting to be recognized as functional entities in their own right. This is due to the confluence of two factors. First, the size of domains decreases non-linearly with the thickness of thin films, so that very thin films have very small domains; the advent of thin film electronic devices thus demands a good understanding of the properties of domain walls, as these occupy a substantial volume fraction of the material. And, second, although domain walls are extremely thin (typically 1-10nm), we now have technology capable of addressing the individual properties of domain wals, and the initial findings are showing that their functional properties can indeed be dramatically different from those of the domains they separate.

In this talk I will give an overview of nanodomain and domain wall research, starting with a description of the size and morfology of ferroic domains in all kinds of situations (single crystals, epitaxial thin films, nanowires, nanodots), and finishing with some examples of domain wall functionality, such as large conductivity and possible ferromagnetism in the ferroelectric walls of BiFeO3 (an antiferromagnetic insulator), or the polarization in the walls of SrTiO3 (a non-polar ferroelastic material).

Jueves 11:50 h

TÍTULO: **Maximally anisotropic point Fermi surface system: VO2 films embedded in TiO2**

ÁREA TEMÁTICA: **Simulación de materiales**

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CONTENIDO:

Oxide heterostructures provide an unusually rich canvas for the design of unprecedented electronic states. Here we will discuss multilayer (TiO2)m/(VO2)n nanostructures, namely V4+:d1 – Ti4+:d0 interfaces, with no polar discontinuity, studied by density functional theory techniques [1]. This system shows a metal-insulator transition with respect to the VO2 layer thickness in our first principles calculations [2]. For n = 1 and 2 VO2 layers, the system is insulating. For 5 and more layers, it is ferromagnetic and half-metallic. For the quantum confined cases of n = 3 and 4 the system is neither insulating nor conducting, an unexpected state arises: the Fermi surface is point-like as in graphene, except that extreme anisotropy is present [3]. The electrons (or holes, depending on doping) behave as massless fermions along the zone diagonal in k-space, and as conventional (massive) fermions along the perpendicular direction. Certain characteristics identify this "semi-Dirac" phase as resulting from quantum confinement, rather than being an interface phenomenon. This point Fermi surface system differs from graphene not only in its extreme anisotropy, but that it arises in a half-metallic system, so spin degrees of freedom are removed. In this presentation an analysis of the evolution of the electronic structure through this unprecedented insulator-to-metal transition will be provided, the role of a non-intuitive orbital ordering of the V d1 ions will be discussed. Also the robustness of the semi-Dirac electronic structure to interfacial disorder and the introduction of spin-orbit coupling in the calculations will be analyzed.

[1] V. Pardo and W.E. Pickett, Phys. Rev. Lett. 102, 107003 (2009).

[2] V. Pardo and W.E. Pickett, arXiv:0910.4411 (2009).

[3] S. Banerjee, R.R.P. Singh, V. Pardo and W.E. Pickett, Phys. Rev. Lett. 103, 016402 (2009).

Jueves 12:10 h

TÍTULO: **Nanohilos y nanocintas de óxido de galio: síntesis y propiedades ópticas**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Entre los diversos tipos de nanomateriales, los nanohilos de óxidos semiconductores han suscitado un gran interés en la comunidad científica debido a su gran versatilidad. Algunas aplicaciones son su uso como sensores de gases, emisores de luz o detección de proteínas, entre otras. Por otra parte, los óxidos semiconductores transparentes (en inglés TCO), como el óxido de galio, constituyen una familia muy atractiva de materiales funcionales debido a que presentan una conductividad eléctrica aceptable junto con un valor alto del intervalo de energía prohibida. Las propiedades ópticas y electrónicas de los TCO se pueden ajustar mediante la incorporación controlada de impurezas o la variación de la concentración de vacantes de oxígeno, por lo que la caracterización de las nanoestructuras es fundamental para determinar sus propiedades. Las nanoestructuras de óxido de galio aún están poco estudiadas en comparación con otros óxidos, como el ZnO. Sin embargo, son muy prometedoras ya que el Ga2O3 presenta el mayor "gap" (4.9 eV) de la familia de TCO y además posee un alto índice de refracción (cercano a 2). En este trabajo, presentamos los estudios de propiedades ópticas llevados a cabo en nanohilos de óxido de galio crecidos sin catalizador externo. El método utilizado nos permite obtener nanohilos y nanocintas tanto sin dopar como dopados con impurezas ópticamente activas. Hemos estudiado las propiedades de luminiscencia y de guía de onda con la ayuda de un sistema de cátodoluminiscencia (CL) en el microscopio electrónico de barrido (SEM). Las impurezas utilizadas son Cr, Er y Eu, que permiten obtener emisión de luz bien definida en rojo, verde y azul a temperatura ambiente [1,2]. Por otra parte, hemos demostrado el comportamiento de guía de onda de los nanohilos, tanto para luz visible transmitida por los nanohilos como para la luz generada por el haz de electrones en el SEM.

[1] E. Nogales, J. A. García, B. Méndez and J. Piqueras, Appl. Phys. Lett. 91, 133108 (2007).

[2] E. Nogales, B. Méndez, J. Piqueras and J. A. García, Nanotechnology, 20, 115201 (2009).

Jueves 12:30 h

TÍTULO: I**nvisibilidad acústica en dos y tres dimensiones**

AUTORES:

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CONTENIDO:

Las ecuaciones básicas de la invisibilidad acústica son presentadas y explicadas. Se muestra que para hacer un cuerpo totalmente invisible a las ondas acústicas necesitamos rodearlo de un medio fluido con densidad de masa anisótropa. Además, dicha densidad de masa anisótropa tiene que ser divergente (cero o infinita) cerca de la superficie del objeto a ocultar. La anisotropía de masa se puede lograr mediante los llamados "metamateriales acústicos", y las divergencias de los parámetros acústicos se pueden evitar diseñando dispositivos de invisibilidad "imperfectos", que en lugar de hacer un objeto totalmente invisible reducen su tamaño aparente. Finalmente se explica la viabilidad de realizar físicamente los mencionados dispositivos de invisibilidad acústica y se presentan algunos experimentos que el GFO ha realizado para lograr materiales con anisotropía en la densidad masa.

Jueves 16 h

TÍTULO: **The Kondo effect in ferromagnetic atomic contacts**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Iron, cobalt and nickel are archetypal ferromagnetic metals. In bulk, electronic conduction in these materials takes place mainly through the s and p electrons, whereas the magnetic moments are mostly in the narrow d-electron bands, where they tend to align. This general picture may change at the nanoscale because electrons at the surfaces of materials experience interactions that differ from those in the bulk. Here we show direct evidence for such changes: electronic transport in atomic-scale contacts of pure ferromagnets (iron, cobalt and nickel), despite their strong bulk ferromagnetism, unexpectedly reveal Kondo physics, that is, the screening of local magnetic moments by the conduction electrons below a characteristic temperature. The Kondo effect creates a sharp resonance at the Fermi energy, affecting the electrical properties of the system; this appears as a Fano–Kondo resonance in the conductance characteristics as observed in other artificial nanostructures. The study of hundreds of contacts shows material-dependent log-normal distributions of the resonance width that arise naturally from Kondo theory These resonances broaden and disappear with increasing temperature, also as in standard Kondo systems. Our observations, supported by calculations, imply that coordination changes can significantly modify magnetism at the nanoscale. Therefore, in addition to standard micromagnetic physics, strong electronic correlations along with atomic-scale geometry need to be considered when investigating the magnetic properties of magnetic nanostructures.

Jueves 16:20 h

TÍTULO: **Molecular coolers**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Magnetic refrigeration is an energy-efficient and environmentally-friendly technology based on the Magneto-Caloric Effect (MCE). This describes the changes of magnetic entropy and (related) adiabatic temperature following a change in applied magnetic field. Although the MCE is intrinsic to any magnetic material, in only a few of these are the changes sufficiently large to make them suitable for applications. The key is to find the best performing refrigerant. Remarkably, the topic of magnetic refrigeration constitutes one of the most recently envisioned applications for molecular nanomagnets. A major boost is provided by our experimental discovery [1] that the MCE in these materials can be larger than in the best lanthanide alloys and magnetic nanoparticles conventionally studied and employed for low-temperature cooling applications. This undoubtedly represents an exciting prospect, maintaining molecule-based materials at the forefront of investigation in the context of nanoscience and nanotechnology.

Selected examples will be presented for demonstrating how the MCE can be enhanced by controlling and optimizing the molecular quantum properties, e.g. spin ground state, magnetic anisotropy, presence of low-lying excited spin states and intermolecular correlations. These results urgently demand immediate practical applications. Progresses towards the development of devices capable of exploiting the molecular functionalities will be discussed.

This work was done in close collaboration with E. K. Brechin (Edinburgh), M. Affronte (Modena) and E.J.L. McInnes (Manchester).

[1] M. Evangelisti et al., Appl. Phys. Lett. 87, 072504 (2005); E. Manuel et al., Phys. Rev. B 73, 172406 (2006); M. Manoli et al., Angew. Chem. Int.-Ed. 46, 4456 (2007); M. Manoli et al., J. Am. Chem. Soc. 130, 11129 (2008); M. Evangelisti et al., Phys. Rev. B 79, 104414 (2009); G. Karotsis et al., Angew. Chem. Int.-Ed., (2009, in press).

Jueves 16:40 h

TÍTULO: **¿Qué hay detrás del oro magnético?**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

El año 2004 se publicaron de forma simultánea dos trabajos en los que se revelaba de forma independiente el paso del Au del diamagnetismo al magnetismo [1,2]. En el primero se informaba sobre el comportamiento superparamagnético en todo el rango de temperaturas de unas nanopartículas (NP) de Au rodeadas de PAAHC. El segundo era aun más sorprendente pues anunciaba la aparición de magnetismo permanente prácticamente estable incluso hasta temperaturas por encima de ambiente en NP similares compuestas únicamente de alrededor 100 átomos de Au rodeadas de tiol. Hasta la publicación de dicho trabajo la mera mención de oro magnético hubiese sido tomada al menos como ridícula, más aun si se tiene en cuenta que en cualquier otro sistema a tales tamaños esas NPs hubiesen sido superparamagnéticas.

La explicación propuesta para este magnetismo se basa en los efectos tamaño y superficie. El reducido número de átomos de Au induce una reorganización electrónica que profundiza la hibridación de los electrones 6s con los 5d situando a estos últimos cerca del nivel de Fermi. La diferente afinidad entre los átomos metálicos y los átomos S de los grupos orgánicos rodeantes, induce diferentes transferencias de carga desde los átomos de Au de la superficie de la NP hacia los átomos S en donde los electrones 5d pueden estar implicados. Técnicas como dicroísmo circular magnético o Mössbauer en 197Au han confirmado la residencia del magnetismo en los átomos de Au [3].

Se ha logrado extender la técnica a otros metales nobles y compuestos de diferente naturaleza, "convirtiendo" en magnéticos a átomos de Ag, Cu y ZnO. Aunque esta anisotropía inducida por transferencia de carga, de origen poco claro, se asocia casi en exclusiva a NP sintetizadas por vía química, su efecto es mucho más amplio y podría ser la causante de la aparición de señal magnética de muchos de los denominados semiconductores magnéticos diluidos [4].

[1] Yamamoto Y., et al. Phys. Rev. Lett. 93, 116801 (2004).

[2] Crespo P., et al. Phys. Rev. Lett. 93, 087204 (2004).

[3] Garitaonandia J.S., Nano Lett. 8, 661 (2008).

[4] Chen S.J., et al. Appl. Phys. Lett. 95, 172507 (2009).

Jueves 17 h

TÍTULO: **Interplay between spin-polarized and spin-orbit coupling STM contrast in non-collinear magnetic order**

ÁREA TEMÁTICA: **Microscopías de proximidad y microscopía electrónica**

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CONTENIDO:

Apart from the relevance of the magnetocrystalline anisotropy, the spin-orbit coupling (SOC) has not been a key issue in surface science. In scanning tunnelling microscopy (STM), the local density of states portrays information about the magnetic structure as a consequence of spin-orbit coupling (SOC). Here we make use of spin-polarized STM with simultaneous SOC contrast to show that the ground state of the 2nd Mn layer on W(110) is a fast rotating ferromagnetic spin-spiral with wave vector along the [001] direction. It is noted that the propagation direction is perpendicular to that of the antiferromagnetic spin spiral on the 1st Mn layer [1], thereby providing a substrate with local magnetization density pointing in three orthogonal directions. In addition, SOC plays an important role in the stabilization of such complex magnetic ground state. The unique chirality observed in the rotational sense of several 2nd layer islands points out to a cycloidal spin spiral driven by the Dzyaloshinskii-Moriya interaction [2,3]. The link between the broken lattice symmetry and the magnetic free energy is of course the spin-orbit coupling. The SOC contrast is strongly dependent on the tip coating material and termination, so that it is possible to modulate the relative weight of SOC and spin-polarized contrast depending on the tip choice. The spin-orbit and magnetic contributions are additive. We propose that the SOC contrast is a useful tool supplementary to conventional spin-polarized STM which allows imaging of complex magnetic arrangements.

[1] M. Bode et al., Nature 447, 190 (2007).

[2] I. Dzyaloshinsky, J. Phys. Chem. Solids 4, 241 (158).

[3] T. Moriya, Phys. Rev. 120, 91 (1960).

Viernes 10 h

TÍTULO: **Microscopic description of the new high temperature iron superconductors**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Several families of high temperature superconductors based on iron have been discovered in the course of 2008. The maximum critical temperature reached is for the time being 56K. They are layered magnetic compounds that upon doping become superconductors. This situation reminds to the case of cuprates, the well-known high temperature superconductors. However, important differences have also been unveiled between copper and iron families. The undoped compound in cuprates is an antiferromagnetic Mott insulator with nearest neighbor antiferromagnetic ordering. On the contrary, iron superconductors parent compounds are semimetals and the magnetic moment, centered at Fe atoms, shows columnar ordering. An important point for understanding this difference is the layer structure of both superconductors. Coppers form a square lattice with oxygen located in the middle of the copper-copper bond while in iron superconductors the local Fe environment due to a Pnictogen/Chalcogenide atom is tetrahedral. This leads to the situation that in cuprates the physics at low energy can be described just with one orbital while it seems that all five iron orbitals are needed to model the new superconductors. Another important difference is that the new superconductors are very sensitive to the distortion of the tetrahedral environment of the iron. It has been reported in the literature that small changes in the tetrahedron give rise to different critical temperatures, superconducting order parameters and magnetic properties. The large number of orbitals complicates the analysis and introduces a very large number of fitting parameters. We have proposed a five bands tight binding model calculated with the Slater-Koster framework that with just few parameters reproduce quite well the bands and Fermi surface found with first principle calculations [1]. Compared to DFT tight-binding fits reported in the literature, this procedure greatly reduces the number of fitting parameters necessary to calculate the bands. Good agreement between our results and DFT predictions, which extends to the orbital weight of each band is found. We analyze the changes in the electronic structure and Fermi surface induced by a distortion of the tetrahedron and by the interactions.

[1] M.J. Calderón, B. Valenzuela and E. Bascones, Phys. Rev. B 80, 94531 (2009).

Viernes 10:20 h

TÍTULO: **Persistent currents and quantised vortices in a matter—light superfluid**

ÁREA TEMÁTICA: **Propiedades ópticas y cristales fotónicos**

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CONTENIDO:

Bose-Einstein condensation and superfluidity has been recently revealed in semiconductor microcavities, inaugurating a new era in the study of strongly coupled light-matter systems. The growing interest in this field is due to the unique properties of a condensate of exciton-polaritons, the composite particles resulting from strong light-matter interactions. In particular, polaritons have a short lifetime of the order of picoseconds, therefore needing continuous pumping to balance decay and reach a steady state regime. Rather than a drawback, the intrinsic non-equilibrium nature enriches the features of polariton condensation, but at the same time poses fundamental questions about the robustness of the coherence phenomena to dissipation and non-equilibrium. In this contribution, I will report the first observation of a metastable persistent superflow carrying quantum of angular momentum m in resonantly pumped exciton-polaritons. I will show that the non-equilibrium superfluid can hold a vortex state generated with an external laser. The polariton circulating superfluid persists in the absence of the driving rotating probe with no apparent dissipation. Moreover we observe a net transfer of the angular momentum m to the condensate steady state which maintains its rotation for as long as it can be tracked. In addition I will illustrate a second experiment aimed at investigating the stability of doubly charged vortices, m=2, in different regimes. The experimental results are compared with a theoretical analysis, obtained describing the triggered parametric scattering regime of polaritons via a two-component Gross-Pitaevskii equation, including pump and decay processes.

Viernes 10:40 h

TÍTULO: **Focused ion beam techniques and individual nanowires: from the contact strategy and characterization of the nanowires to the fabrication of functional**

ÁREA TEMÁTICA: **Semiconductores, sensores**

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CONTENIDO:

The characterisation of individual nanowires and the development of new nanodevices with enhanced performances based on them are limited by the difficulties in the formation of electrical nanocontacts to the nanowires. From the different nanofabrication techniques that have been proposed for this, we have devoted our efforts on Focused Ion Beam, which allows both ion milling and ion-assisted deposition, the latter when a gas precursor is introduced in the sample's chamber under well-determined conditions.

The methodology we have developed uses a dual beam Focused Ion Beam system that combines both an ion and an electron beam in the same machine and that adds to the previously indicated capabilities the electron-assisted deposition and the possibility to inspect the samples without introducing structural damage. The advantages of the methodology are that it is relatively rapid and can be used on-demand without the need of masks. Drawbacks are that the electrical characteristics of the deposited contacting material are worse than that of the bulk metal. However, for highly resistive nanomaterials, the properties are enough to perform electrical measurements without excessive problems.

The proposed nanofabrication procedure is designed to minimize the damage and modification of the sample caused during the process and has been successfully applied to materials with different electrical characteristics, ranging from semiconducting to metallic nanowires.

After a complete electrical characterisation of the properties of the deposited contacts, the extraction of key parameters of the contacted nanowires from different types of electrical measurements under different configurations has been achieved and will be discussed.

Besides the basic electrical characterisation, the behaviour of the contacted nanowires in the presence of different gas atmospheres allows the study of interaction mechanisms between these gases and the material, which is basic for the understanding of the use of such nanowires as gas sensors.

Finally, the characterisation of these nano-gas sensors based on individual nanowires will be presented. Different strategies to improve the throughput of fabrication of the nanosensors and to develop ultralow power consumption devices will be proposed, which paves the way to their commercialisation.

Viernes 11:30 h

TÍTULO: **Self-assembled disorder in photonic nanostructures**

ÁREA TEMÁTICA: **Propiedades ópticas y cristales fotónicos**

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CONTENIDO:

Self-assembled nanostructures usually develop ordered patterns in three dimensions. Artificial opals are one of such possible arrangements usually forming fcc structures with promising photonic properties. Often, and undesirably, unwanted defects are present spoiling the optical properties of such nanostructures: e.g. in thin self-assembled photonic crystals the staking from one up to four layers of dielectric spheres may arise according to three different arrangements: face-centered cubic, hexagonal close-packed or double hexagonal close-packed [1]. On the other hand, and contrary to intuition, the introduction of arbitrarily high amounts of disorder is, in some cases, an equally difficult task but the resulting material presents intriguing new optical properties. We have grown novel nanophotonic materials, photonic glasses, which are solid, disordered assembly of monodisperse dielectric spheres [2]. The novelty provided by these structures is the monodispersity of the spheres, which gives rise to a resonant behaviour of diffusion constant and transport mean free path. Diffusive modes at different frequencies, with different transport properties, appear in photonic glasses, as a result of the collective effect of the single-sphere Mie resonance [3]. This system has been recently used to produce Resonant Random Lasing, where lasing emission is controlled by Mie Resonances, able to tune wavelength emission [4].

[1] X. Checoury, S. Enoch, C. López, and A. Blanco, Appl. Phys. Lett. 90, 161131 (2007)

[2] P. David García, Riccardo Sapienza, Alvaro Blanco, and Cefe López, Adv. Mater. 19, 2597, (2007)

[3] R. Sapienza, P. D. García, J. Bertolotti, M. D. Martín, Á. Blanco, L. Viña, C. López, and D. S. Wiersma, Phys. Rev. Lett. 99, 233902 (2007)

[4] S. Gottardo, R. Sapienza, P. D. Garcia, A. Blanco, D. S. Wiersma, C. Lopez, Nature Photonics 2008, 2, 429.

Viernes 11:50 h

TÍTULO: **Hybrid organic-inorganic structures for optical amplification in waveguides**

ÁREA TEMÁTICA: **Materia blanda, polímeros y materiales mesoporosos**

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CONTENIDO:

In this paper we report on the fabrication and optical characterization of hybrid materials formed by a thin film of an organic semiconductor polymer on a porous silicon substrate. The polymer material poly(2-methoxy-5-(2´-ethyl-hexyloxy)-1,4-phenylene vinylene) (namely MEH-PPV) was deposited by spin-coating. The porous silicon (PS) substrate was obtained by electrochemical etching of p-type crystalline silicon. The refractive index of PS can be modulated from 1.16 to 1.46 through control of the electrochemical current. Therefore, waveguide structures have been obtained by the combination of these organic-inorganic materials.

The samples have been optically excited with a pulsed pump laser. A narrowing of the emission spectra and a superlinear increment of the emission intensity was observed when the pump power is increased above a certain threshold. These are experimental evidences of amplified spontaneous emission (ASE) that have been detected for the polymers. The confinement of the luminescence in the waveguide is essential in order to obtain ASE. Indeed, no ASE was observed in non-waveguide thin films. Estimation of the net gain coefficient and of the propagation loss of the waveguides has been performed. Values comparable to other PPV derivative waveguides have been obtained. Moreover, we report on the effect of the control of the refractive index of the PS substrate on the ASE threshold of the emissive polymer. By changing the porosity of the PS cladding the refractive index can be tuned at different values. A reduction of the ASE threshold is observed when the refractive index of the PS layer is decreased. A reasonable agreement between the experimental data and the theoretical predictions for a four-level waveguide amplifier model is found. These new hybrid materials are very attractive because they combine the excellent optical properties of conjugated polymers with the versatility of PS as a cladding layer, since its refractive index can be modulated as a function of the porosity of the layer, which makes the design of opto-electronic devices very flexible [1,2].

[1] F. Lahoz et al. Chem. Phys. Lett. 463, 387-390 (2008).

[2] F. Lahoz et al. Opt. Express 17, 16766-16775 (2009).

Viernes 12:10 h

TÍTULO: **Crossed ratchet effects on domain wall motion in nanostructured Co-Si amorphous films with 2D arrays of asymmetric holes.**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

The study of the domain wall motion in nanopatterned magnetic films with submicrometric array of asymmetric antidots has long attracted a great interest since it provides the basis for a wide number of magnetic devices [1,2]. When the pinning potential is asymmetric it can behave as a ratchet [3], so that DW propagation is favoured in one direction. The study of the driven motion of domain walls in these extended 2D magnetic films has been found to be subject to two different crossed ratchet effects [4,5] which results in an inversion of the sign of domain wall motion rectification. The novel ratchet behaviour appears as the pinned wall inside the array develops kinks. This provides an extra mechanism for DW motion only possible in a 2D geometry through upward/downward kink propagation. We have also recently observed that the movement of a kinked domain wall, what is pinned between two antidots, can be influenced by a perpendicular magnetic field.

Acknowledgments:

Work supported by Spanish MICINN (FIS2008-06249 and HP2008-0032), and FICYT (IB081-06 and BP06-109).

[1] A. Himeno et al., J. Appl. Phys. 97, 066101 (2005).

[2] M.Hayashi et al., Phys. Rev. Lett. 97, 207205, (2006).

[3] Linke, H. Agoust 2002 Applied Physics A: Materials Science and Processing 75(2), 167 (352) Special Number.

[4] Perez-Junquera, et al. Physical Review Letters 100(3), 037203 (2008).

[5] A. Alija, et al. Journal of Physics D - Applied Physics 42(4), 045001 (2009).

Viernes 12:30 h

TÍTULO: **Magnetoplasmonics: an overview on the fundamentals and applications**

ÁREA TEMÁTICA: **Propiedades ópticas y cristales fotónicos**

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CONTENIDO:

Subwavelength composite materials constitute an interesting path towards the development of materials with "on demand" optical properties. We will present our latest results on systems composed of both noble and ferromagnetic metals, which we denote as magnetoplasmonic systems. While noble metals have intense and narrow plasmon resonances they lack magneto-optical (MO) activity at reasonable magnetic field intensities. On the other hand, ferromagnetic metals are MO active but their plasmon resonances are weak and broad. By combining both kinds of materials we intend to obtain systems which simultaneously exhibit plasmon resonances and MO activity. We will show that thus it is possible both to enhance the magneto-optical activity of the system via surface plasmon excitation, and to modulate the plasmon properties via application of a magnetic field [1].

First we will analyze concentrate the MO response of Au/Co/Au nanodiscs [2], where we will show how the excitation of a localized surface plasmon (LSP) produces an enhancement of the electromagnetic field within the MO active layer, leading to an enhancement of the MO activity. The same influence of the LSP on the MO properties can be observed when the constituents responsible for plasmon excitation and MO activity are spatially separated (structures formed by Au nanodiscs and Au/Co/Au continuous trilayers separated by layers of SiO2 [3]).

The same system will allow the analysis of the effect of the MO activity on the plasmon properties. We will show that the wavevector of the surface plasmon polariton is the physical magnitude which is modified upon application of a magnetic field in the transverse configuration [4]. That modification can be used in a wide variety of scenarios. Here we will discuss its application in active microinterferometry [5].

[1] G. Armelles, et al., J. Opt. A: Pure Appl. Opt. 11, 114023 (2009).

[2] J. B. González-Díaz, et al., Small 4, 202 (2008).

[3] G.Armelles, et al., Opt. Express 16, 16104 (2008).

[4] J. B. González-Díaz, et al., Phys. Rev. B 76, 153402 (2007); E. Ferreiro-Vila, et al., Phys. Rev. B 80, 125132 (2009).

[5] V.V. Temnov, et al, to be published (2010).

Viernes 12:50 h

TÍTULO: **The role of surface plasmon polaritons in the optical interaction of a hole pair in a metal film**

ÁREA TEMÁTICA: **Propiedades ópticas y cristales fotónicos**

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CONTENIDO:

The phenomenon of extraordinary light transmission through nanohole arrays milled into metallic films at optical frequencies [1] has sparked a great deal of interest due to both its fundamental implications and its broad range of potential applications [2]. The transmission enhancement relies on the resonant excitation of surface plasmon polaritons (SPPs) by the incident light. We study an even more fundamental system than the metallic hole array, namely, a thin metal layer perforated by just two subwavelength holes. A hole pair is reminiscent of the Young's double-slit experiment, which lies at the heart of wave physics. The characteristic Young fringes of a slit doublet perforated in a opaque metallic screen has been already observed in the near field, and its interference pattern have been explained in terms of interacting SPP modes [3]. Similar experiments have been performed for hole dimers [4,5]; however, some contradictions and and not-well understood issues are found in the reported data. In order to shed light on this problem, we compute the optical response of a hole pair in a self-consistent way, with help of a recently developed modal expansion formalism [6]. The geometry of the problem (two identical circular holes at a given distance, perforated in a self-sustained metal film) allows us an analytical formulation of the relevant quantities, and the development of simple expressions for the resonance conditions. These quantities show that the SPP resonances manly determine the resonant pattern in real metals; although we also evaluate the evolution of the interaction mechanisms for decreasing values of the metal impedance, i.e. when the intensity of SPP modes becomes vanishing small. We are also able to differentiate between the hole-hole interaction and the contribution from the isolate holes.

[1] T.W. Ebbesen et al. Nature, 391, 667 (1998).

[2] C. Genet and T.W. Ebbesen, Nature 445,39 (2007).

[3] L. Aigouy et al., Phys. Rev. Lett. 98, 153902 (2007).

[4] Y. Alarverdyan et al., Nature Physics 3, 884 (2007).

[5] D. Pacifici et al., Opt. Express 16, 9222 (2008).

[6] F. de León-Pérez et al., New J. Phys. 10, 105017 (2008).

Viernes 13:10 h

TÍTULO: **Luminescent plasma nanocomposites for the fabrication of photonic sensing devices**

ÁREA TEMÁTICA: **Propiedades ópticas y cristales fotónicos**

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CONTENIDO:

Dye molecules embedded in different matrices in the form of thin films are the basis of specific materials used for laser cavities, optical filters, optical gas sensors, etc. Usually, the synthesis of this type of thin films is intended by sol/gel and similar wet methods and the films use to have a thickness of several microns. These procedures present some drawbacks as, for example, the need of different steps for drying, annealing, etc. Other limitations come from the microstructure of the films (e.g., surface roughness), that may impose some restrictions when these materials have to be integrated in optical and photonic devices. In the present communication we discuss a new methodology based on the remote microwave plasma assisted deposition of dye containing thin films that circumvent the above mentioned problems. It permits a tailored synthesis of optically active nanometric thin films containing dye molecules which are active as fluorescence emitters (i.e., colored and fluorescent films). The principle of this new procedure is the partial polymerization of dye molecules that are evaporated over a substrate while exposed to a remote microwave Ar plasma. As a result of this process a polymeric thin film is produced in one step where some dye molecules keep intact their optical activity. This methodology has been recently used for the deposition of novel plasma nanocomposites containing non-aggregated laser dyes to maximize the fluorescent emission of the materials and for the fabrication of optical NO2 sensing nanocomposites.

To illustrate the possibilities of the technique we present here results for different fluorescent dye molecules, as perylene dyes, and several xanthene and oxazine derivative cationic dyes which are typically used as gain media in tunable laser dyes. The luminescent, optical and sensing properties of these dye containing nanocomposites will be presented. These active optical layers are being developed for the fabrication of photonic sensor devices, optical filters and photonic chips (PHODYE EU Project). This is due to the full compatibility of the synthetic methodology with the present integrated microelectronic and optoelectronic technology. The possibilities for the fabrication of photonic devices integrating these active optical layers will be demonstrated.

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POSTERS

TÍTULO: **Formation of a One-Atom Contact on Pb: Adhesion and Energy Dissipation**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Quartz Tuning Fork (TF) has been recently successfully implemented in force detection schemes for scanning probe microscopy applications [1]. Here we report its use as a nanotribometer for studying energy dissipation and the forces in the formation of a single atom contact. The idea behind such a noncontact mono-atomic energy dissipation detector, is to take advantage of the mechanical resonance of a TF which has a large Q-factor which in our set-up is a function of the tip-sample dissipative forces. Finally, we report measurements of the shift in the resonance frequency and the Q-factor degradation of the oscillating TF, either as a function of the tip-sample voltage or distance. These experiments have been done on Pb close to the superconducting transition temperature in high vacuum.

[1] S. Morita, et. al. Noncontact Atomic Force Microscopy, Nanoscience and Technology (Springer-Verlag, Berlin 2002).

TÍTULO: **Tuning exchange bias in Ni/FeF2 heterostructures using antidot arrays**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The microscopic origin of exchange bias (EB) represents one of the challenges in solid state physics, despite the extensive experimental and theoretical investigations. We used focused ion beam lithography to fabricate a series of ordered arrays of Ni/FeF2 antidots to get a deeper insight of EB in nanostructures. Ni/FeF2 heterostructures were deposited by electron beam evaporation onto (110) MgF2 single-crystal substrates of 70 nm of antiferromagnetic (AF) FeF2, 50 nm of ferromagnetic (FM) Ni and 4 nm of Al. The antidots were fabricated in a square array, with antidot size of 200 nm and periodicity ranging from 100 to 900 nm (antidot density, AD, from 5% to 24 %). Magnetoresistance measurements were used to determine the EB field in the temperature range 4.2–300 K, in both the parallel and transversal configurations, after field cooling. For small/large cooling fields, the magnetoresistance curves display a shift towards negative/positive fields. At intermediate cooling fields (CF), two MR peaks are observed (one shifted to negative and the other to positive fields), whose relative height and area depend on CF. However, the absolute value of the EB field is almost independent of CF. This suggests that the AF domain size is comparable to or larger than the FM domain size, so each FM domain couples mostly to one AF domain with a particular direction of the EB. The transition from positive to negative EB can be systematically tuned with AD. The onset of positive EB appears at a CF one order of magnitude lower for AD=24 % than the unpatterned samples. These results are a consequence of the energy balance and suggest that the nanostructure plays a key role in the formation of pinned, uncompensated spin regions in the FeF2 layer. The non-interfacial magnetic moments created at the antidot faces favor the onset of positive EB at lower CF. The financial support of the Spanish MICINN (MAT2009-08667 and CSD2006-00012), Catalan DURSI (2009SGR856) and the U.S. Air Force are recognized.

M. Kovylina, M. Erekhinsky, R. Morales, J. Villegas, I.K. Schuller, A. Labarta and X. Batlle, Appl. Phys. Lett. 95, 152507 (2009).

TÍTULO: **Controlling exchange bias in Co–CoOx nanoparticles by oxygen content**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Starting from the first report of exchange bias (EB) in fine particles in the 1950s, a huge amount of EB systems have been investigated. However, despite the extensive experimental and theoretical investigations, the microscopic origin of EB still remains a challenge. We report on the occurrence of exchange bias on laser-ablated granular thin films composed of Co nanoparticles embedded in an amorphous zirconia matrix. The deposition method allows one to control the degree of oxidation of the Co particles by tuning the oxygen pressure at the vacuum chamber (from 2 10^-5 to 10^-1 mbar). The nature of the nanoparticles embedded in the nonmagnetic matrix is monitored from metallic, ferromagnetic (FM) Co to antiferromagnetic (AFM) CoOx, with a FM/AFM intermediate regime for which the percentage of the AFM phase can be increased at the expense of the FM phase, leading to the occurrence of exchange bias in particles of about 2 nm in size. For oxygen pressure of about 10^-3mbar the ratio between the FM and AFM phases is optimum with an exchange bias field of about 900 Oe at 1.8 K. The mutual exchange coupling between the AFM and FM is also at the origin of the induced exchange anisotropy on the FM leading to high irreversible hysteresis loops, and the blocking of the AFM clusters due to proximity to the FM phase. The financial support of the Spanish MICINN (MAT2009-08667, Consolider-Ingenio 2010 CSD2006-00012 and Ph.D. grant to MK) and Catalan DURSI (2009SGR856) are recognized.

M. Kovylina, M. García del Muro, Z. Konstantinović;, M. Varela, Ò. Iglesias, A. Labarta and X. Batlle, Nanotechnology 20, 175702 (2009)

TÍTULO: **Electrochemical fabrication and characterization of metal nanocontacs**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Electrochemistry can be used for the fabrication and characterization of different nanostructures such as nanocontacts or nanowires at room temperature. Simplicity and low cost are some of the advantages of this technique that allows the study of structures in the nanoscale without requiring sophisticated instrumentation.

In our experimental set-up, we measure the conductance across a noncontact fabricated either by dissolving a macroscopic metal wire or by depositing a selected metal in between two separated metallic electrodes. The conductance of the contact is related to its radius giving us the possibility to control the size of the nanocontact during its formation. In this way we can produce controlled-sized metal nanocontacts even down to the atomic scale [1].

[1] M.R. Calvo, A.I. Mares, V. Climent, J.M. Van Ruitenbeek and C. Untiedt Phys. Stat. Solid. (a) 204, 1677.(2007).

TÍTULO: **Nuevas configuraciones magnéticas: parimagnetismo**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Estudios recientes llevados a cabo sobre la fase de Laves ErCo2 han revelado la existencia de una nueva configuración magnética en la fase paramagnética [1] de este compuesto por encima de la temperatura de ordenamiento (Tc). En esta nueva fase (llamada fase parimagnética) los momentos de los átomos de cobalto forman agregados magnéticos nanométricos antiparalelos (en promedio) a los momentos del Er, que son los momentos dominantes. El tipo de comportamiento observado ha sido asociado [2] con las fases de Griffiths [3] y denota la existencia de una fase de corto alcance muy por encima de Tc, que pervive en una rango amplio de temperaturas y campos hasta que percola en Tc, dando lugar al orden de largo alcance.

En el presente trabajo nos preguntamos si la fase parimagnética existe en otros compuestos además del ErCo2. Para ello, hemos llevado a cabo un estudio magnético sistemático en la serie de compuestos RCo2, con R = Er, Ho, Dy, Tb, Gd. Las medidas de susceptibilidad magnética alterna nos muestran que el parimagnetismo aparece en todos los compuestos estudiados, que presenta en todos ellos un comportamiento tipo fase de Griffiths y se observa un relación sistemática entre la aparición del parimagnetismo y Tc del compuesto. Concluimos, que la aparición de esta nueva fase es general en la familia RCo2 y nos preguntamos si también aparecerá en compuestos ferrimagnéticos de otras familias.

[1] J. Herrero-Albillos, F. Bartolomé, L. M. García, A. T. Young, T. Funk, J. Campo and G. J. Cuello, Observation of a different magnetic disorder in ErCo2, Physical Review B 76, 2007.

[2] J. Herrero-Albillos, F. Bartolomé and L. M. García, Observation of a Griffiths-like phase in the paramagnetic regime of ErCo2, J. Phys. Condensed Matter 21, 2009.

[3] R. B. Griffiths, Nonalytic behavior above the critical point in a random Ising ferromagnet, Physical Review Letters 23, 1969.

TÍTULO: **Epitaxial strain control of magnetoelectric coupling in multiferroic o-AMnO3 thin films**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Multiferroic materials, combining two or more ferroic orders coupled, are the focus of much interest, since they could allow the development of a new generation of memories and microwave devices with improved performances. Very few materials are known to be multiferroic in single phase, because of the general incompatibility for the occurrence of either ferromagnetism and ferroelectricity. Nevertheless, some possible mechanisms which might lead to multiferroicity have been theoretically described. The experimental study of the few multiferroic compounds, such as orthorhombic manganites, becomes a test for these mechanisms and a help for the comprehension and optimization of these materials; and thin films offer a unique opportunity to explore new features, because of the microstructure control and possibilities that they allow.

Orthorhombic perovskites o-AMnO3, antiferromagnetic below TN~40 K, display at somehow lower temperatures (T~27K) an anomaly in the dielectric constant, which has been ascribed to the appearance of ferroelectricity. The dependence of this anomaly on the magnetic field, which results in a magnetocapacitance peak, points to a magnetoelectric coupling.

We report on a systematic and thorough study of how these features are modified by changing the strain in epitaxial YMnO3 thin films. Even more, we will show that the epitaxial strain induces a ferromagnetic ordering at lower temperatures, evidenced by the appearance of a remanent magnetization. The evolution with strain of this magnetization and of the electric polarization is used to characterize the magnetoelectric coupling and to analyse the possible origins of ferroelectricity in this system.

TÍTULO: **Desorden magnético en películas Fe7Au93 y polvos Fe14Au86 nanoestructurados**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

El estudio en detalle de nanopartículas magnéticas embebidas aleatoriamente en una matriz metálica es muy atractivo debido a su comportamiento magnético desordenado [1]. Recientemente se ha determinado por la técnica de "neutron spin echo" que el polvo nanoestructurado de Fe13Cu10Ag77 (4.6nm) exhibe un incremento de la anisotropía en la temperatura de bloqueo (alrededor de 150 K), debido a las interacciones dipolares [2]. Ahora estamos estudiando el efecto del cambio de la matriz cambiando Ag por Au (esto es, cambiando la interacción RKKY) y la estructura (polvo por película delgada). Películas de Fe7Au93 (200 nm de espesor) y polvos de Fe14Au86 (composición medida por EDX) se han preparado respectivamente por DC-magnetron sputtering y aleado mecánico. Las medidas de imanación en corriente continua (2-300 K, $H \leq 10$ KOe) muestran interacciones magnéticas para el caso de las películas delgadas, en contraste con el comportamiento de vidrio de espín reentrante que muestran las muestras en polvo.

[1] S. Bedanta et al, Phys, Rev. Lett, 98, 176601 (2007).

[2] L. Fernández Barquín et al, Phys. Rev. B. 76 172404 (2007).

TÍTULO: **Nuevo criterio para determinar el orden de una transición de fase a partir de medidas puramente magnéticas**

ÁREA TEMÁTICA: P**ropiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

El desarrollo de materiales magnetocalóricos que sirvan como refrigerantes a temperatura ambiente ha motivado la investigación de la dependencia del cambio de entropía magnética (DSM) con el campo aplicado. Recientemente se ha propuesto una curva universal para DSM, que puede obtenerse a partir de medidas puramente magnéticas en compuestos con transición de fase de segundo orden [1]. En nuestro trabajo hemos estudiado si este comportamiento universal se mantiene en compuestos con transición de fase de primer orden. Para cumplir este objetivo, hemos seleccionado dos grupos de materiales, las fases de Laves RCo2 y a la familia de manganitas La2/3(Ca,Sr)1/3MnO3, cuyas propiedades físicas han sido bien estudiadas. Hemos encontrado que el comportamiento universal de las curvas DSM escaladas se mantiene siempre para los materiales con transición de fase de segundo orden en contraste con los que presentan transición de fase de primer orden donde no se observa el colapso de los puntos en una curva universal. La clara diferencia entre el resultado para primer y segundo orden nos permite proponer este método como un nuevo criterio para determinar el orden de la transición de fase de un compuesto. El método se propone como una alternativa al criterio de Banerjee que introduce ambigüedades a la hora de determinar el orden de la transición en materiales que se encuentran muy cerca del punto crítico i.e. en los cuales el cambio en las propiedades físicas cerca de la temperatura de transición no es abrupto [2].

[1] V. Franco et al., Appl.Phys.Lett 89 (2006) 222512.

[2] M. Parra-Borderías et al., Journal of Alloys and Compounds 481 (2009), 48.

TÍTULO: **Size-dependent spin structures of iron nanoparticles coupled to a ferromagnetic cobalt substrate**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

By combining x-ray magnetic circular dichroism (XMCD) with photoemission electron microscopy (PEEM), we present direct observations of the magnetization orientation in *individual* iron particles with a size range from 5 to 25 nm and in contact with a ferromagnetic cobalt support. Our results reveal that the magnetization of the smaller particles (below 8 nm) is aligned parallel to that of the magnetic domains of the substrate, while a non-collinear alignment is observed for larger sizes. Numerical calculations reproduce the experimental trend and reveal a transition from an exchange- to an anisotropy-dominated regime: the smaller particles are in a single-domain state with magnetization collinearly aligned to that of the substrate while the larger particles exhibit a spin-spiral magnetic structure determined by the magnetic anisotropy energy. Our results demonstrate that the balance between the particle-substrate interaction and the individual properties of the particles can lead to unexpected spin arrangements at nanoscale interfaces.

TÍTULO: **Interplay between spin-orbit and curvature in curved graphene nanoribbons**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Geometrical deformations can induce changes on the physical properties of materials. With this aim we study the electronic structure of curved zigzag and armchair graphene nanoribbons. We use the tight-binding method in the Slater-Koster approximation considering all the valence orbitals of the atoms. Due to the curvature the one orbital model is incomplete, and it becomes necessary to include all the valence orbitals. We also study the effect of the spin-orbit interaction in these systems and the stability under the curvature of the quantum spin hall phase predicted by Kane and Mele in the zigzag nanoribons.

TÍTULO: **Mo-based proximity bilayers for cryogenic radiation detectors**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The so-called transition-edge sensors (TES) are superconducting sensors among the most promising components for extremely sensitive radiation detectors, from IR to x-rays. They are to be used in a new generation of astronomic instrumentation, such as the future space telescopes IXO and SAFARI-SPICA.

We report on the fabrication and characterization of Mo/Au bilayers for TES with operation temperatures down to 100mK. The proximity effect between the superconductor and the normal metal allows for a fine tuning of the operation temperature (the critical temperature, Tc), while the stability between Mo and Au allows a sharp interface and therefore sharp superconducting transitions, as required for high spectral resolution.

The Mo layers were deposited on silicon nitride membranes and layers by room temperature sputtering in a UHV chamber (base pressure 10-9 mb). Firstly, a thorough analysis of the electric and superconducting properties of the Mo films has allowed to optimize the film properties and to observe a dependence of Tc on residual resistivity anomalous among classical superconductors.

Secondly, Au layers were deposited either in-situ by DC sputtering and ex-situ by e-beam. We have designed a novel approach for the Mo/Au bilayers, depositing two Au layers: first an in-situ thin layer Au1 by sputtering to protect the Mo layer, and afterwards a second layer Au2 by e-beam. Critical temperatures Tc between 900mK and 100mK have been measured for these Mo/Au1/Au2 heterostructures. The proximity effect is analyzed in terms of the evolution of Tc with the Mo and Au thicknesses, and of the microstructure of the layers and the interface.

TÍTULO: **Magnetic properties of graphite irradiated with MeV ions**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

We have studied the change in the magnetic properties produced on highly oriented pyrolytic graphite (HOPG) samples after irradiation of H-, C- and N- ions in the MeV energy range, empoying the 5 MV ion-beam accelerator at Universidad Autónoma de Madrid. The use of specially made sample holders for the magnetic measurements through a SQUID magnetometer provided high reproducibility, allowing us to obtain directly the irradiation effects without any corrections or subtractions. Our results show that three main magnetic phenomena are triggered by the defects produced by the irradiation, namely Curie-like paramagnetism, ferromagnetism and an anomalous paramagnetic state that appears as precursor of the magnetic ordered state. Using SRIM simulations to estimate the amount of defects produced by the irradiation, the Curie-like paramagnetic response indicate an effective Bohr magneton number per produced defect of around 0.27. Direct measurements of the surface sample temperature during irradiation and the decrease in the paramagnetic as well as ferromagnetic contributions after irradiation indicate that self-heating effects are one of the causes for the small yield of ferromagnetism. Taking into account the role of hydrogen, the results suggest that the induced ferromagnetism appears when the average vacancy distance is around 2nm in the near surface region.

TÍTULO: **Scanning probe based reversible recording of multilevel resistive switching in La0.7Sr0.3MnO3 thin films**

ÁREA TEMÁTICA: P**ropiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Switching from different resistive states has been observed in several complex oxides with potential for large-capacity non-volatile memories. Most microscopic mechanisms proposed so far involve particular interfacial properties and imply high energy consumption for operation onset. Instead of the widely investigated high to low resistance transitions, we report on the nanoscale reversible transition from low resistive to tunable high resistive states. The conducting tip of a scanning force microscope has been used to reversibly write non-conducting states through the whole thickness of well characterized thin films of the robust metallic ferromagnet La0.7Sr0.3MnO3 obtained by chemical solution deposition. The Kelvin probe microscopy is proposed as a non-invasive reading tool for quantitative multilevel detection and Soft X-ray photoelectron emission microscopy highlights the importance of cationic and anionic diffusion in the process. This nanoscale investigation of the local resistivity switching in the absence of junction interfaces, points to inherent thin film properties as responsible for the observed phenomenon.

TÍTULO: **Magnetic interactions in oxo-carboxylate bridged gadolinium(iii) complexes**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Magneto-structural studies on polynuclear complexes, aimed at understanding the structural and chemical factors that govern the exchange coupling between paramagnetic centers are of continuing interest. The large number of magneto-structural studies on polynuclear complexes with first-row transition metal ions has provided a relatively good comprehension of the magnetic coupling in this family; however, the situation with the lanthanide-containing metal complexes is much less advanced. Having these in mind, magnetic studies with gadolinium(III) ion is a convenient choice because it has a 8S7/2 ground state and the next excited state is well separated in energy (ca. 10^4 cm^-1), so that its meff can be approximated with the spin-only formalism. Magnetic studies concerning dinuclear gadolinium(III) complexes having the di-m-oxo(carboxylate) bridging skeleton showed the occurrence of intramolecular antiferromagnetic interactions [1]. However several reports have also revealed the presence of ferromagnetic interactions in this type of complexes [2]. The interpretation of these results has allowed to establish a relationship between the nature of the magnetic coupling and the type of bridge involved [3]. But magneto-structural data for polynuclear gadolinium(III) compounds are still scarce and consequently, more examples are needed to have a solid basis to analyze all the factors involved [4]. In this work we will show our results within the systematic study of complex formation between gadolinium(III) and polycarboxylate-containing ligands aiming at investigating the factors that govern the magnetic coupling.

[1] See for example: (a) A. Panagiotopoulos, T. F. Zafiropoulos, S. P. Perlepes, E. Bakalbassis, I. Masson-Ramade, O. Kahn, A. Terzis and C. P. Raptopoulou, Inorg. Chem. 1995, 34, 4918-4920; (b) W. Plass and G. Fries, Z. Anorg. Allg. Chem. 1997, 623, 1205-1207

[2] See for example: (a) M. Hernández-Molina, C. Ruiz-Pérez, T. López, F. Lloret and M. Julve, Inorg. Chem. 2003, 42, 5456-5458; (b) J. P. Costes, J. M. Clemente-Juan, F. Dahan and F. Nicodéme, Dalton Trans. 2003, 1272-1275.

[3] R. Baggio, R. Calvo, M. T. Garland, O. Peña, M. Perec and A. Rizzi, Inorg. Chem 2005, 44, 8979-8987.

[4] L. E. Roy and T. Hughbanks, J. Am. Chem. Soc., 2006, 128(2), 568-575.

TÍTULO: **Irreversibility in solid state first-order transitions studied with calorimetric techniques**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

In solid state the first-order transitions rarely occur at the phase equilibrium point, that is a temperature T0 in which the free energy G of two phases is equal. Most often the transition on heating occurs at some temperature T2>T0 when the low temperature phase becomes unstable and on cooling at T1<T0, when the higher temperature phase does. Between T1 and T2 any phase or a mixture of both in metastable equilibrium is possible, depending on the path followed to the actual state. In all cases G decreases at the transition and the process is internally irreversible. Therefore the Clausius inequality states DH < T DS (DH, enthalpy increment, DS, entropy increment), but very often the symbol = is taken. Also the classical Clausius-Clapeyron equation must be modified. In this work we develop a method to estimate the actual DS from calorimetric measurements. Using a mean field approximation an upper bound is given by the expression DH/T< DS < 2*DH/(T1+T2). Some transitions on giant magnetocaloric compounds, shape memory alloys, and spin transition compounds are presented. Results of the experimental method and the mean field prediction are compared.

TÍTULO: **Papel de la aleatoriedad de las disoluciones sólidas en fenómenos de separación de fases**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Las manganitas substituidas (p.e. Pr0.50Ca0.50Mn1-xMxO3 donde M=Ti, Cr, Fe, Co, Ni, ...) presentan segregación de fases por debajo de la temperatura de orden de carga del compuesto puro (x=0, TCO~250K). En muchos casos, una de las fases que aparece es ferromagnética y metálica para niveles de substitución muy bajos (x~0.03) mientras que el compuesto puro es antiferromagnético y aislante). ¿Puede deberse esta separación de fases de largo alcance a fenómenos de muy corto alcance?

Esta pregunta nos llevó a realizar una serie de sencillas simulaciones por ordenador [EPL, 84 (2008) 67011] en las que la única hipótesis de partida es la aparición de una pequeña región alrededor de cada catión substituyente (RoI, 'region of influence'). El programa de simulación lo único que hace es, una vez colocados aleatoriamente en la red todos los cationes substituyentes, examinar como se distribuyen las pequeñas RoI en el sistema. Debido a esta aleatoriedad muchas de las RoI se solapan formando 'clusters' mayores. El examen de la distribución de tamaños de estos clusters y la cantidad de fase que aparece en función de x y del tamaño de la RoI (que tomamos entre una y dos celdas unidad), arroja resultados que a priori parecerían sorprendentes. Como muestra mencionaremos que con x=0.03 y un radio de la RoI de menos de dos celdas unidad se obtiene la aparición de un cluster percolante que ocupa más de la mitad del sistema.

La conclusión es que la aparición de metalicidad y ferromagnetismo en manganitas substituidas del tipo Pr0.50Ca0.50Mn1-xMxO3 podría deberse únicamente a la aparición de pequeñas zonas ferromagnéticas y metálicas alrededor de los cationes substituyentes (p.e. Fe, Co, Ni, ...), sin necesidad de recurrir a ningún fenómeno de largo alcance. Por otra parte, la simplicidad de las simulaciones, hace muy general los resultados obtenidos. De hecho, pueden aplicarse a cualquier perovskita en la que se substituya el catión de la posición B o también el de la posición A. Como ejemplos de perovskitas con separación de fases y que cumplen estas condiciones encontramos entre otros: La1-xCaxMnO3, Ca1-xLnxMnO3, Pr0.5Ca0.5-xBaxMnO3; EuBaCo2-xMxO5.50, YBa1-xCaxCo2O5.50.

TÍTULO: **Size dependent dipolar order in molecular clusters of Mn6**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

According to the original theory of Luttinger and Tisza [1], dipolar ferromagnetism would only be stable for samples cut in the shape of long needles. This was addressed by Griffiths [2] who demonstrated that the ground state of an array of dipolar coupled spins is independent of shape in the thermodynamic limit. So it would be interesting to study what happens with the ordered phase when the size of the sample is decreased. As a model material, we have chosen Mn6 that orders ferromagnetically at T = 0.17 K in bulk [3]. Micro and nanoparticles of this compound have been synthesized by using a compressed fluids technique [4]. We have concluded that fundamental properties of the molecular cores remain the same. Ac susceptibility experiments have been carried out between 15 mK and 10 K with the combination of a conventional inductive susceptometer and a recently developed SQUID microsusceptometer. Our results show that long-range magnetic order is suppressed for particle sizes smaller than 7 μm.

[1] J. Luttinger and L. Tisza, Phys. Rev. 70, 954 (1946).

[2] R.B. Griffiths, Phys. Rev. 176, 655 (1968).

[3] A. Morello et al., Phys. Rev. Lett. 90, 17206 (2003).

[4] M. Muntó et al., J. Mater. Chem. 16, 2612 (2006).

TÍTULO: **Atomic-resolution imaging of oxygen vacancy induced spin state superlattice in La0.5Sr0.5CoO3-∂**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The mixed valences of transition and rare-earth metals can stabilize a variety of compounds with O deficiency. At the same time, these oxygen vacancies play a key role in determining the functionality of many oxide materials. Here we examine the possibility of stabilizing unexpected magnetic states, not present in the bulk, by introducing high densities of ordered O vacancies in perovskite La0.5Sr0.5CoO3-d thin films. By means of aberration corrected electron microscopy and spectroscopy we will map an oxygen vacancy induced superstructure in the spin state of Co atoms, with atomic resolution, for the first time. First principles calculations show how in some cases ordered arrays of O vacancies in this system can stabilize a superstructure in the spin state of Co. The spin state ordering consists of high spin Co atoms in planes where the O vacancies are present alternating with intermediate spin Co atoms in planes with full oxygen stoichiometry.

TÍTULO: **Negative Magnetization in NdFexGa1-xO3: a phase-separation effect**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Negative magnetization has been recently observed in different systems, like oxides [1] or molecular magnets [2]. We have studied the evolution of the magnetic ordering of Fe and Nd with Ga content in NdFexGa(1-x)O3 by measuring FC-ZFC magnetization and ac magnetic susceptibility for $x \leq 0.4$.

FC magnetization curves for NdFexGa1-xO3 and $0.90 \geq x \geq 0.5$ under HFC < 3kOe shows negative magnetization below T = 20K. This negative contribution to the magnetization decreases as x increases, being negligible for ≥ 0.95. Xac measurements evidence the presence of irreversibility at T ≤125K, well below TC. The dependence of ac magnetic susceptibility with applied field and excitation frequency suggest the onset of a cluster-like separated phase within the majority canted antiferromagnetic phase. XMCD results on x=0.8 compound show that negative magnetization is caused by Fe atoms aligned antiparallel to the applied magnetic field. We present a comparison with previous results on other rare-earth orthoperovskites showing that the mechanism leading to negative magnetization in oxides is a Griffiths-like phase-separation which becomes frozen at low-temperature: spin rotation is prevented and a metastable state with M < 0 sets-in. We will show that a simple model based on a simple two-sublattices frozen Nd-Fe compensation is not compatible with experiments.

[1] F. Bartolomé et al., Physica B 312-313, 769 (2002)

[2] O. Kahn Nature 399 (1999) 21

TÍTULO: **Proximity effects in hybrid superconductor/ferromagnetic (S/F) systems Nb/Co-Si thin films**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The interplay between a superconductor system (S) and a ferromagnet (F) via proximity effects in artificial S/F hybrid systems has created a great interest in last years. In these systems two competing orders and characteristic lengths can be easily explored, revealing a very rich variety of phenomena from both fundamental and applied view [1]. In this work, proximity phenomena in hybrid Nb/Co-Si has been studied in a compositional range of Co-Si alloy from 56% of Co to 78 % of Co, that is, varying the strength of the ferromagnetic layer while the thicknesses in both superconductor and magnetic layers are kept a constant. We study the superconducting critical temperature Tc and critical magnetic field Hc2 for a Nb/Co-Si series of samples in a 4K liquid helium cryostat. Transport and magnetic properties of each single Co-Si thin films have been studied separately through resistivity and SQUID measurements. We found that the behaviour of the critical temperature Tc and the critical magnetic field present a non-monotonous dependence as a function of the Co percent, i.e., of the magnetic moment of the magnetic layer.

Acknowledgments:

Work supported by Spanish MICINN (FIS2008-06249 and HP2008-0032), and FICYT (IB081-06 and BP06-109).

[1] M. Vélez et al, Phys. Rev. B 59 (1999) 14659

TÍTULO: **High magnetic anisotropy of Fe^+ ions in KTaO_3 and SrCl_2**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The zero-field splitting constant, D, and the gyromagnetic tensor of the off-center systems KTaO_3:Fe^+ and SrCl_2:Fe^+ have been explored by means of high-level ab initio calculations at the C4v local equilibrium geometry. The calculated D values for KTaO_3:Fe^+ (9 cm^{-1}) and SrCl_2:Fe^+ (53 cm^{-1}) are found to be much higher than typical figures measured for insulating compounds containing common 3d Kramers ions with a spin S > 1/2 in the ground state (~0.01-1cm^{-1}). This result together with the calculated g_{\perp} and g_{\parallel} values are in agreement with available experimental information. The high magnetic anisotropy derived for Fe+ in KTaO_3 and SrCl_2 is shown to be strongly related to the existence of a 4E excited state lying only at about 3000 cm^{-1} and 600 cm^{-1}, respectively, above the ground state. Implications of present findings in the search of new molecular magnets with high values of the magnetic anisotropy are discussed in some detail.

TÍTULO: **Transiciones estructurales magnéticas y eléctricas en las cobaltitas dobles YBaCo2O5.50 y Y(Ba,Ca,Sr)Co2O5.50**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Una de las particularidades más destacables de los cationes de cobalto en estructuras perovskita es su capacidad para presentar diferentes estados de espín. La competición entre el acoplamiento interno de Hund y el desdoblamiento de los niveles d debido al campo cristalino hace que, por ejemplo, el Co3+ pueda presentar tres estados de espín (EE) diferentes: espín bajo (S=0), intermedio (S=1) y alto (S=2). La aparición, a diferentes temperaturas, de estos tres EE ha sido objeto de numerosos estudios por ejemplo en LaCoO3.

Otra familia de cobaltitas en las que el Co3+ ha mostrado transiciones de EE (en este caso abruptas) es RBaCo2O5.50 (R=tierra-rara/Y). En esta familia de dobles perovskitas los iones Ba2+, R3+, y O2- se ordenan de manera que el Co ocupa entornos octaédricos y piramidales alternando a lo largo del eje b. Estos óxidos presentan una transición metal-aislante a temperaturas cercanas a la ambiente (entre TMI=290K (Y) y 360K (Pr)). Estudios estructurales detallados [Frontera et al. PRB 65, 180405R (2002)] mostraron, para R=Gd, que esta transición tiene lugar debido a una transición de estado de espín en los iones Co3+ en entorno octaédrico. Cambios estructurales muy similares se han encontrado para R=Pr, Nd, Tb.

Esta interpretación no ha estado exenta de polémica, originada por una posible dependencia de la transición y EE con el tamaño de la tierra rara. Por ejemplo, en el caso R=Y hemos encontrado que la evolución del volumen de la celda a través de la transición metal aislante es opuesta a la de los casos antes mencionados (lo mismo ocurre para R=Ho). Además, hemos encontrado y estudiado en este compuesto una serie de transiciones estructurales y ordenes magnéticos sucesivos no reportadas en otros compuestos. Para reducir todavía más el tamaño de los cationes de tierra rara hemos substituido parcialmente el Ba por Sr y por Ca con resultados muy diferentes. En estos dos casos aparecen comportamientos estructurales, eléctricos y magnéticos distintos entre sí que también difieren de las diferentes transiciones observadas en YBaCo2O5.50.

TÍTULO: **Magnetic anisotropy modulation of the inverse superconducting spin-switch in LCMO/YBCO/LCMO hybrids**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The interplay between half metallic ferromagnetism and non conventional superconductivity has recently raised a great deal of attention thanks to the realization of high quality interfaces in superlattices combining manganites and high TC superconductors. The giant magnetoresistance found in these samples along the superconducting transition may be of interest in the search for new concepts of spintronic devices. Here we will describe new magnetic and transport properties of La0.7Ca0.3MnO3/YBa2Cu3O7 /La0.7Ca0.3MnO3 heterostructures. Combined ferromagnetic resonance, SQUID magnetometry, polarized neutron reflectivity, and magnetic circular dichroism have been used to characterize the magnetic structure. We will show that in F/S/F hybrids the resistance switching between high and low resistance states can be controlled by the biaxial anisotropy of the LCMO electrodes. The high-resistance state appearing when the magnetic layers are antiparallel aligned can be stabilized in a wide field range by applying magnetic field along the [110] easy axes direction. The modulation of the magnetoresistance with the magnetic anisotropy of the LCMO not only reveals important aspects on the origin of the inverse superconducting spin switch but also displays memory effects which can be used to design a superconducting memory concept. Both the writing and the reading operation can be achieved with a high degree of reliability combining the sensitivity of this heterostructure to the direction of application of the field and the strong magnetoresistive response. This result may be useful for complex oxide-based magnetic memory elements.

Work supported by CICYT MAT 2008 06517.

TÍTULO: **Bitter decoration technique applied to energetic analysis of pinning in YBCO due to different artificial defects**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

YBCO is a superconductor with a broad field of applications especially since the appearance of second generation coated conductors enabling superconducting power devices. Consequently, there have been a lot of efforts to control vortex pinning and vortex dynamics in this type of material. Natural defects like twin boundaries, stacking faults, dislocations, nanometric secondary phases,... may act as vortex pinning centers, however one would desire to introduce artificial defects in a controlled manner to tune and manipulate the superconducting properties. In this work we study vortex-defect interaction using the Bitter decoration technique for real visualization of the flux line lattice (FLL). Results on YBCO single crystals and films (samples with different intrinsic pinning) have been obtained. We have generated artificial nano-defects using indentations at nano-scale and irradiation with focus ion beam in the same samples. Bitter decoration results demonstrate that when the artificial defects are generated in single crystals (ordered systems), the FLL symmetry is lost and an increase of vortex density occurs at the nano-defects. Instead, for the case of thin films (disordered systems), an increase in FLL ordering and symmetry is obtained. Finally, we have derived an energetic model based on London theory as an approximation of the Ginzburg-Landau solution, with a general analytic expression for the energy of arbitrary arrangements of vortex position [1]. This model allows us to estimate values for the pinning energy of the FLL directly from decorated images. We observe that estimated values for the pinning energy increase in agreement with the increase of system disorder and also of the total energy of the FLL. With this model we are able to estimate the pinning energy associated to the different defects introduced and compare them to the pre-existing ones.

[1] E.H. Brandt, Supercond. Sci. Technol. 22, 034019 (2009).

TÍTULO: **Revisiting the metal to insulator transition in Pr0.50Ca0.50CoO3-d (d=0)**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

A sudden spin state transition has been claimed to take place in Pr0.50Ca0.50CoO3. This compound presents on cooling a sudden increase of the resistivity, usually described as a metal to insulator transition (MIT) at TMI ≈ 80 K. It is accompanied by an anisotropic cell anomaly and a sudden large cell volume contraction. This MIT has been interpreted as the sudden formation of mixed localized Co3+ (S=0, t2g6) and Co4+ (S=?, t2g5) low spin (LS) states; whereas above TMI a delocalized homogeneous t2g5(s*)0.5 state would be responsible for carrier conduction (as reported earlier for Pr0.50Sr0.50CoO3). In addition, three competing states are found in the phase diagram of Pr1-xCaxCoO3 in the range of Ca doping 0.3 ‹ x ‹ 0.6: PM/Metal (IS/LS), FM/Metal (IS/LS) and PM/Insulator (LS/LS) (depending on T and x), where spin states refer to the proposed states of Co3+ and Co4+ ions, respectively.

In this communication we present the results of a detailed investigation on the electronic, magnetic and structural properties of Pr1-xCaxCoO3 cobaltites, with emphasis on the appealing behavior around the composition Pr0.50Ca0.50CoO3. Fully oxygenated samples in the range 0.25 ‹ x ‹ 0.60 have been investigated (obtained by using high oxygen pressure during the preparation process). The origin and electronic changes at the MIT have been revisited by combining resistivity, magnetotransport and magnetic studies in our laboratory with structural and magnetic neutron (ILL) and synchrotron (ESRF) diffraction studies, and XAS measurements (BESSY) at different absorption edges.

A consistent physical picture have emerged that shed new light on the metal to insulator transition and the phase diagram of these strongly correlated materials. The scenario observed is not compatible with the previous simple picture of a spin state transition as responsible for electron localization, which also fails to give account of an unexpected strong asymmetry with doping (x),very near, at both sides of the composition x=0.50.

Financial support from MICINN (Spanish government) under projects MAT2006-11080-C02-02, MAT2009-09308, NANOSELECT CSD2007-00041, and Generalitat de Catalunya (2005-GRQ-00509, 2009SGR-126). We thank ESRF, BESSY and ILL for the provision of beamtime.

TÍTULO: **Mono- and pentanuclear gadolinium single-molecule magnets**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

We report an ultra-low-temperature study of lanthanide molecular materials with formula LnxWy, where Ln3+ is a lanthanide magnetic ion. We specifically focus on Ln = Gd and (x,y) is either (1,10), (1,30) or (5,30).We also consider the magnetically diluted system Gd0.3Y0.7W10. This new class of molecular materials can be seen as an ordered array of isolated mono- or pentanuclear Gd cores [1,2]. Our results confirm the ground state spin S = 7/2 with g = 2. More importantly, we find that all complexes behave as superparamagnets, with a dynamical blocking of the ac susceptibility below 1 K. Fitting the specific heat data measured on a single crystal of GdW10 enables us to determine the second-order anisotropy constant D = 0.18kB. Often, the small anisotropy of Gd compounds is ascribed to Gd-Gd dipolar interactions. Single-ion crystal-field effects are widely neglected for gadolinium, because of the zero angular momentum. In contrast with these views, we determine small yet detectable

single-ion anisotropies, which are responsible for the superparamagnetic freezing. In doing so, we also demonstrate that the strength and the sign of the magnetic anisotropy can be modified by changing the molecular symmetry. The change in the magnetic entropy between 0 and 7 T attains a maximum of 1.14 10^-2 Jkg^-1K^-1 at 1.92 K, which is one fifth of the record, making these materials very suitable for low-temperature magnetic refrigeration.

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TÍTULO: **Caracterización de la porosidad del bloque canario a partir de sus propiedades eléctricas**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

La afinidad que tiene el picón (denominación local para el lapilli) por el agua es el motivo de una de las principales patologías de la construcción (presencia de humedades indeseables en viviendas) que padece la Comunidad Canaria. Esta patología está directamente relacionada con la porosidad que presentan los prefabricados de hormigón con picón, siendo pues necesaria realizar una caracterización del mismo.

En este trabajo, se utiliza la Espectroscopía de Impedancias (EI) [1], como una técnica de medida indirecta para la caracterización de la red porosa de estos materiales. Dicha caracterización se realiza en el rango de frecuencias comprendido entre 5 Hz y 13 MHz y bajo dos diferentes voltajes (0.5 y 1V).

La técnica de ensayo consiste en analizar muestras cilíndricas de material, sumergidas en una solución salina de agua bidestilada con tres concentraciones diferentes de NaCl (1%, 3% y 10%).

Las curvas de conductividad eléctrica obtenidas han sido analizadas, ajustándolas a un modelo físico que predice la porosidad de hormigones de alto contenido en huecos propuesto por Neithalath [2].

Para comprobar la fiabilidad de estos resultados, se ha obtenido la porosidad de las muestras de cada bloque mediante método volumétrico empleando un picnómetro de helio [3], y mediante porosimetría por intrusión de mercurio [4].

Comparando estas técnicas con los resultados obtenidos en la EI, se comprueba que los valores de la porosidad accesible de cada muestra inferidos por el ajuste al modelo de Neithalath de la conductividad eléctrica son muy fiables, lo que demuestra que la EI es una técnica aplicable para la caracterización de la porosidad de los hormigones, siendo además rápida, sencilla y no destructiva.

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TÍTULO: **Ferromagnetism in transparent MgO thin films**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Magnesium oxide and its derivates, although extensively studied for decades, are still the focus of recent research efforts. These compounds represent technically relevant materials widely used as oxide ceramics for high-temperature applications, oxygen sensors, or in catalysis. In addition, the structurally simple MgO (NaCl-type) is often used as model substance to describe the chemical and physical properties of oxide compounds caused by crystal defects.

Here we present a recent topic of high impact, as to say the unexpected finding that p-bands can spontaneously polarize, giving rise to a ferromagnetic state in materials as diverse as ZnO or graphite. We report conclusive evidence for intrinsic ferromagnetism in MgO thin films intended for spin-photonics. The creation of cation vacancies is established as an efficient new method to induce ferromagnetism in MgO thin films, by hole-filling acceptor levels near the O 2p-dominated valence band. By means of both theoretical calculations and magnetic and microstructural characterization, we show that non-doped MgO has intrinsic spontaneous magnetization when cation vacancies are introduced into the crystalline matrix.

We have observed magnetic dichroism at the O K edges, which supports the intrinsic nature of the observed ferromagnetism in MgO films. This signal is attributed to the spin polarization of the 2p orbitals of oxygen atoms close to Mg vacancies. High resolution transmission electron microscopy demonstrates the existence of Mg cation vacancies in our samples. Furthermore, we have found that the magnetic moment per cubic centimeter is very close to the theoretical expected value. Besides, photoluminescence studies of MgO thin films at room temperature support our assignments of polarization to O2- low coordinated sites close to a Mg vacancy, according to literature data.

TÍTULO: **Complex critical states in type-II superconductors**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The magnetic flux dynamics of type-II superconductors within the critical state regime is posed in a generalized framework, by using a variational theory supported by well established physical principles.

This includes the incorporation of finite size effects, and an arbitrary external excitation as rotating, crossed or even inhomogeneous magnetic fields [1]. Physically meaningful material laws will be discussed [2]. In particular, we introduce the smooth version of Clem's and Perez-Gonzalez's Double Critical State Model (DCSM) [3] that incorporates the flux depinning and cutting processes. The advantages of the variational approach will be pointed out, focusing on the numerical performance and allocation within the finite element methods for 2D and 3D problems. Examples will be given. The theory will be validated by comparison to recent experiments, and to other calculations available in the literature [4,5].

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TÍTULO: **Vortex dynamics in YBCO films with artificial nanostructures defined by high resolution lithography techniques**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Understanding vortex pinning mechanisms and correspondingly the interaction between vortices and defects is still one of the major goals to enhance properties of superconducting materials. Therefore, the capability to artificially nanostructure superconducting materials using model systems to enhance vortex pinning is one of the major topics nowadays.

We have used high resolution nanolithography techniques (Focused Ion Beam, Electron Beam Lithography and nanoindentation) in order to create artificial pining sites in YBCO films grown by chemical methods. Model systems with different geometry, distribution and density of nano-defects have been studied.

The artificial pinning structures have been designed to compete with natural defects (dislocations, low angle grain boundaries, twin boundaries, stacking faults, random defects) which intrinsically produce strong pinning in YBCO films.

Angular critical current measurements have been performed in a wide temperature and magnetic field range in order to study the different vortex pinning contributions in different nanostructured YBCO films, demonstrating that critical currents can increase depending on the nanostructured model systems analysed. Moreover, the interaction vortex-defect at low magnetic fields has been explored by means of magnetic decoration. The elastic energy of the vortex lattice has been calculated on the decorated images and the pinning contribution from the artificial defects determined.

TÍTULO: **Pinning effects generated by ferromagnetic and non ferromagnetic interfacial nanostructures in YBCO films grown by chemical deposition methods**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Upon improving chemical solution deposition (CSD) techniques for more than 10 years we have developed experience in generating YBa2Cu3O7 (YBCO) films and coated conductors capable to carry currents densities in the range of 3 to 4 MA/cm2 (at 77K and H=0). To enhance these performances even more it is necessary to control vortex pinning mechanisms. Some theoretical works suggest that by pinning the vortex magnetic flux (magnetic pinning) instead of vortex core (core pinning), pinning force can be increased about 2 orders of magnitude. The proposed candidates systems to achieve these results are hybrid devices that combine superconductors (SC) and ferromagnetic (FM) materials. In this work we compare the pinning effect that FM and non FM interfacial nanostructures induce in the YBCO film grown by CSD on top of them. The FM nanostructures consist of La0.7Sr0.3MnO3 random distributed square shape nanoislands (200nm side and 15nm high) and the non FM structures are strain induced self-assembled Ce0.9Gd0.1O2-y nanowalls. Both kinds of nanostructures are grown by CSD. In order to understand the origin of the observed effects we have performed a complete analysis of local properties of these nanostructures (AFM, TEM, HRTEM). We deduce the pinning properties by means of angle dependent transport methodologies on patterned samples. Finally by milling down the YBCO thickness by Focused Ion Beam we explore the thickness dependence of the pinning properties.

TÍTULO: **Electrical transport model of Intermediate Band in Ti implanted Si.**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The Intermediate Band Solar Cell has been proposed as a candidate for the third generation of solar cells. The formation of an intermediate band (IB) inside the bandgap of the semiconductor permits to absorb photons with energy lower than bandgap. The absorbed photons can promote electrons from the valence band to conduction band directly or by means of two steps using the IB as intermediary. Obviously, this fact has strong consequences in the transport properties of the IBS. The analysis of transport properties of this IBS seems to be a difficult task, because the IBS is obtained in a two-layer, heterogeneous system.

In a recent paper we have shown that Ti-implanted Silicon above Mott limit forms an IBS. This has been proved by measuring both sheet resistance and Hall effect of the samples and comparing those experimental results with ATLAS simulation. The semiconductor gap used for IB layer in ATLAS is just the deep of the IB. This simulation works fine calculating the sheet resistance but fails treating to explain the Hall mobility results.

In the present work, we have elaborated an analytical model of the (IB) electrical properties of Ti implanted Si. We have analyzed silicon layers with Ti concentrations above the Mott limit implanted with 10E15, 5x10E15and 10E16 cm-2 and subsequent Pulsed Laser Melted (PLM) at 0.8 J/cm2. Hall effect measurements has been carried out in the van der Pauw configuration at variable temperatures of 7-400 K to determine the sheet resistance and mobility after non equilibrium thermal process. We have compared these experimental results with an analytical two layers model, and with ATLAS simulation.

In this study, we explain successfully all the Hal effect results by means of a two layer model. We show that the analytical model is in agreement with ATLAS numerical model of sheet resistivity. We find from the model that energetic position of IB is EC-EIB=0.36-0.38 eV and a majority hole conduction of the IB with a mobility about 0.5 cm2/V.s

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TÍTULO: **Thermal switching in extremely underdamped Josephson Junctions**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The escape of a particle in a metastable potential began with Kramers in the forties. Since then, a lot of works have been developed trying to understand this escape in the different range of parameters, both theoretically and experimentally. Experimentally the thermal activation can be tested in superconducting Josephson Junctions. In order to fit the possible experimental data we should know the range of validity for the different theories.

In this poster we present numerical results for the thermal switching in very underdamped Josephson Junctions. We compare our numeric with analytical results providing an unified picture in this limit.

We find that the usual high barrier approximation can yield non accurate results. Finally we apply our theory to the fluxon dynamics in arrays of Josephson Junctions.

TÍTULO: **Magnetic properties of single-crystalline TiO2/CrO2 CVD grown films**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The semimetallic character of the ferromagnetic CrO2 has stimulated its growth in thin film form since that property could be used to implement fully polarized spin currents in spintronic devices. In addition to this, the interfacial coupling between ferro- and antiferromagnetic phases (and all the associated exchange bias phenomenology) brings about the possibility of getting large coercivity increases which are also of potential use in the above mentioned devices.

Epitaxial thin films of CrO2 have been grown onto rutile TiO2 (100) and (110) single crystals, by thermal decomposition of gaseous CrO3 under low oxygen partial pressure (Low Pressure CVD). The optimum substrate temperature for CrO2 deposition was found to be 358ºC. The composition and microstructure of the films have been determined by X-ray diffraction (q-2q scans, w-scans and polar plots), Raman spectroscopy and XPS and UPS photoemission spectroscopies.

As for the magnetic characterization, we have obtained by means of a Vibrating Sample Magnetometer (VSM), i) the temperature dependence of the low applied field magnetization, measured after zero field cooling and field cooling the samples from 340 K down to 5 K and ii) the temperature dependencies of the coercivity and that of the exchange bias field. Also, and using a differential Magneto-optic Kerr Effect (MOKE) set-up working at room temperature, we have obtained the in-plane angular dependencies of the coercivity and the remanence.

From these techniques we conclude that: i) the sample grown onto the TiO2 (100) substrate initiated its growth through the formation of a Cr2O3 layer on top of which the CrO2 was formed, ii) in the case of the sample grown onto the TiO2 (110) substrate the presence of Cr2O3 was not observed, iii) the Cr2O3/CrO2 coupling resulted on a room temperature hysteresis loop showing distinguishable contributions of two phases (a single phase loop was obtained in the single phase sample), iv) the coercivity of the harder phase present in the Cr2O3/CrO2 sample was significantly enhanced with respect to that measured in the pure CrO2 one, v) the angular dependence of the in-plane remanence evidenced the occurrence in the samples of a well defined in-plane uniaxial anisotropy.

TÍTULO: **Temperature dependence of the slow relaxation in La0.5Sr0.5MnO2.5 Brownmillerite**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

The measurement, under constant magnetic field, of the time dependence of the magnetization can be used to get an estimate of the size of the ferromagnetic entities present in oxides exhibiting antiferromagnetic-ferromagnetic phase distributions [1].

The topotactic reduction of La0.5Sr0.5MnO3 leads to ordering of the anionic vacancies in the La0.5Sr0.5MnO2.5 composition. The so-obtained material, crystallizes in the brownmillerite structural type with unit cell parameters a = 0.54117(3), b = 1.67608(12), c = 0.54004(3) nm and space group Ibm2. Its characterization by means of electron diffraction and high-resolution electron microscopy suggests a complex microstructure arising from the coherent intergrowth of different brownmillerite-type domains that show short-range ordering at the A sub-lattice. The layer structure of La0.5Sr0.5MnO2.5 leads to a double magnetic behavior where a ferromagnetic two-dimensional component is present [2]. The measurement of the temperature dependence of the hysteretic and relaxational properties of a La0.5Sr0.5MnO2.5 sample was carried out by means of a VSM in the temperature range from 5 up to 300 K and under applied fields of up to 7 T. The results of those measurements allowed to conclude that i)

the sample exhibited hysteresis in all the considered temperature range, ii) the temperature variation of its coercive force corresponded to a monotonic increase with the decrease of the temperature, iii) the temperature variation of the activation volume, evaluated from constant applied demagnetizing field relaxation runs, diverged at ca. 300 K and showed sensibly constant low temperature values, and iv) the transverse dimension associated to the low temperature activation volume values was, approximately 10 nm. These results are discussed in terms of the size of the local environments associated to the presence of Mn+4 and therefore to the occurrence of ferromagnetic order.

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TÍTULO: **Magnetic structure of the new quiral compound [cr(cn)6][mn{(r)-pnh}(dmf)] 2•h2o**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Research on magnetic molecular materials has received strong attention in the last years for many reasons, among them, the possibility of these materials to exhibit more than one functional property at the same time, to be multifunctional. A very exciting possibility that is waiting to be discovered in a molecular material is magneto-chirality. Despite this interest, very few molecular candidates with likely possibilities have been synthesized, because chirality must be controlled not only in the molecular structure, the crystal must exhibit nuclear chirality. Prof. K. Inoue has developed successful strategies to produce good candidates to chiral magnets.

Our research group has studied with neutron scattering techniques the nuclear and magnetic structures of 2-d and 3-d ferrimagnets with magnetic ordering temperatures of 38 and 53K. These compounds, [Cr(CN)6][Mn{(S)-pnH}(H20)]•H2O (gn), [Cr(CN)6][Mn{(S)NH2-ala)}]3(2H2O) (syn), and K0.4[Cr(CN)6][Mn(S)-pn](S)-pn(2H2O) (yn), have been demonstrated to present coexistence of nuclear and magnetic chirality.

Nowadays, others cyano-bridged bimetallic complexes have been synthesised by Inoue, a 2D chiral ferrimagnet [Cr(CN)6][Mn(R)-pnH(DMF)]•(2H2O) (1) and a racemic one [Cr(CN)6][Mn(rac)-pnH(DMF)]•(2H2O) (2), where DFM is N,N-dimethylformamide. Compound 1 consists of two-dimensional bimetallic sheets, a situation similar to gn, also with the same spatial group P212121. 1. Magnetic measurements reveal an antiferromagnetic interaction between nearest neighbor Cr3+ and Mn2+ ions through cyanide bridges and a magnetic phase transition at TN=28.5K can be observed.

The nuclear and magnetic structures of this compound have been studied by neutron diffraction. The nuclear structure has been refined in paramagnetic phase and the magnetic structure at zero magnetic field has been determined. Following the evolution with temperature of several magnetic lines, information of critical exponents at the phase boundary with H=0 has been found.

TÍTULO: **Magnetic Properties of Magnetic Nanohole Arrays**

ÁREA TEMÁTICA: **Propiedades magnéticas, superconductoras, mecánicas y eléctricas**

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CONTENIDO:

Highly ordered arrays of magnetic nanoholes show a great potential for application on technologies, and particularly as high-density magnetic storage media. In our case, we have prepared magnetic nanohole arrays resorting to self-assembled nanoporous alumina membranes [1]. First, hexagonally ordered porous alumina membranes are prepared by a controlled double-step anodization. These are later used as substrate for sputter deposition of the magnetic nanohole array [3]. The geometrical properties of the template are affected by the type and the concentration of the electrolyte in the anodization process [2]. As an example, we show the results for hexagonal arrays of nanoholes with different diameters (from 32 to 48 nm) and 110 nm interpore distance. A family of Py nanohole arrays, with different thicknesses and substrate hole diameter, have been prepared. The deposited Py film keeps the ordering of the precursor porous alumina, thus giving rise to an ordered magnetic nanohole array.

Their geometrical characteristics, such as the hole density and their periodic distribution, will influence the local shape anisotropies [1], and consequently their magnetic properties. Samples morphology was characterized by SEM, and their magnetic properties were measured with a vibrating sample magnetometer (VSM). Also, room temperature transport properties and magneto-optical Kerr effect (MOKE) measurements were performed.

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[3] Pirota, K. R.; et al. JMMM, 320 (2008) 235-238.

TÍTULO: **Anomalous thermal dependence of remanence in FeCuZr ball milled alloys: an exafs study**

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CONTENIDO:

In this work we study the magnetic properties of amorphous FeCuZr alloys with nominal composition $(Fe_{50}Cu_{50})_{100-x}Zr_x$ (x = 13, 40 at. %) obtained by high energy ball-milling. Mössbauer spectroscopy confirms the alloy formation. As an example, the spectrum measured at 300K corresponding to sample with x=40 is shown in figure 1. The spectrum is characterized by a single line centered around zero velocity. Notice that no hyperfine splitting corresponding to ferromagnetic Fe is resolved. Moreover, previous magnetic characterization indicates that the alloys are ferromagnetic with a Curie temperature (Tc) of 255K and 45 K, for x=13 and x=40 respectively.

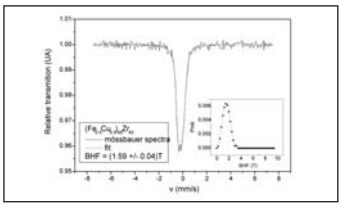

Fig. 1. Mössbauer spectra for $(Fe_{0.5}Cu_{0.5})_{60}Zr_{40}$

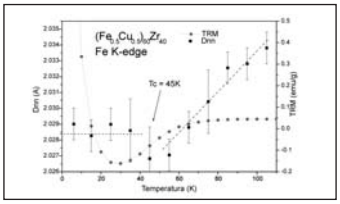

Fig. 2. Dnn and Thermoremanence for x=40at%

However, the thermoremanence exhibits an anomalous behavior as the temperature approaches Tc, see figure 1 for sample with x=40. An increase of the spontaneous magnetization at temperatures above Tc, is evidenced by thermoremanence measurements, see Figure 2 (solid red points). Such measurement is obtained by cooling the sample down to 5k under an applied field of 1T, then the field is removed and the remanence is measured upon increasing the temperature. The spontaneous increase of the magnetization above Tc could be related with changes in the interatomic distances with temperature, as occurs in invar alloys. Interatomic distances remain almost invariant with temperature for T<Tc, while over Tc the normal thermal expansion takes place [2,3]. In order to explain the thermorremanence measurements, EXAFS studies have been carried out at the BM29 ESRF in Grenoble. Figure 2 shows the dependence of the Fe-Fe nearest-neighbour (D_{nn}) distances with temperatures for sample x=40. It should be remarked that the D_{nn} distances are nearly temperature invariant for temperatures below Tc, as corresponding to the proposed invar effect. On the other hand, at temperatures over Tc the normal thermal expansion takes place. This thermal expansion is accompanied by an increase of the magnetization values. It is proposed that the increase of first near-neighbour´s distances with temperature produced by thermal expansion, can yield to and enhancement of the density of the states at Fermi level that could promote the appearance of a new magnetic order above Tc [2].

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TÍTULO: **Nonlinear optical properties optimization of a liquid crystal azopolymer with strong donor-pi-acceptor moieties**

ÁREA TEMÁTICA: **Propiedades ópticas y cristales fotónicos**

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CONTENIDO:

Liquid crystal polymers (LCP) bearing push-pull azo-chromophores as a side chain are a subject of a great interest due to its second order optical properties1, suitable for electrooptic and photorefractive applications. The incorporation of strong donor-pi-acceptor molecules to these systems gives rise to nonlinear optical (NLO) response, provided that a noncentrosymmetric order is achieved. On the other hand, it is well known that the light induced trans-cis-trans isomerization of azo group enhances chromophore mobility, which can assist electric field to obtain polar orientation in order to break centrosymmetry and thus, achieve a high NLO response. It has been also reported that the axial arrangement, inherent to Smectic A phases, can be used to increase the final polar order2.

Linear and NLO properties of thin films (100 nm-1000nm) of side chain azo-LCP with piperazine and cyano as donor and acceptor groups respectively have been measured. Absorption and refractive indices measurements showed out-of-plane arrangement, largely increased by heating upon the mesophase. A stable polar order can be achieved by using corona poling technique, and the second order susceptibility tensor chi(2) can be characterized by Maker Fringes measurements. However, the values found for d33 and d31 (dij=chiij/2) were below the expected ones for this system.

In this communication, we study different methods to improve the potentially higher nonlinear response of this polymer, which include the dilution of the chromophore, and the use of light or/and high temperature. Moreover, it is also described the effect of linearly polarized irradiation at 440 nm in chromophore arrangement, as well as in second order nonlinear properties. Therefore, we present a way of changing the original symmetry of the poled film from the usual C∞v, to C2v, and we determine the three independent nonlinear optical coefficients, d33, d31 y d24.

This work has been financially supported by MICINN-FEDER (MAT2008-06522-C02-01 and -02), Gobierno de Aragón-Fondo Social Europeo (E39) and Spanish Government (FPI program, Nº BES2006-12104).

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TÍTULO: **Magnetic field induced modulation of surface plasmon polaritons in plasmonic microinterferometers**

ÁREA TEMÁTICA: **Propiedades ópticas y cristales fotónicos**

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CONTENIDO:

Surface plasmons polaritons (SPP) are evanescent waves that propagate along a dielectric-metal interface. They can be confined below the diffraction limit using subwavelength metal structures, which leads to many possible applications, including miniaturized optical devices. Within that context, the development of active plasmonic configurations is important to achieve nanophotonic devices with advanced functionalities. This requires a system where the plasmon properties can be manipulated with an external agent and/or vice versa. Among the different control agents considered so far, the magnetic field seems a promising candidate, since it is able to modify the dispersion relation of SPP [1]. This modulation comes from the non-diagonal elements of the dielectric tensor, εij. For noble metals, the ones typically used in plasmonics, these elements are proportional to the applied magnetic field but unfortunately very small at field values reasonable for developing applications. On the other hand, ferromagnetic metals have sizeable εij values at small magnetic fields (proportional to their magnetization), but are optically too absorbent. A smart system to develop magnetic field sensitive plasmonic devices is the use of multilayers of noble and ferromagnetic metals [2,3].

In this work, we analyze the magnetic field induced SPP wavevector modulation (Δk) in Au/Co/Au films by means of surface plasmon interferometry via with tilted slit-groove microinterferometers [4]. We study the dependence of this modulation with the position of the Co layer inside the trilayer and with the wavelength. We will show that we can obtain modulation values of the order 1x10-3, reasonable although slightly low for developing active devices. To improve this modulation, the geometrical parameters of the structures should be optimized. One way of increasing Δk is by covering the Au/Co/Au trilayer with a dielectric medium with high εd. We have then analyzed our samples coated with a thin layer of PMMA, and we have measured a fourfold increase of the SPP wavevector modulation.

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TÍTULO: **Crecimiento y caracterización estructural y óptica de cristales de molibdato de lantano dopados con iones de tierras raras Er3+ Y Nd3+**

ÁREA TEMÁTICA: **Propiedades ópticas y cristales fotónicos**

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CONTENIDO:

La fuerte anisotropía, la alta susceptibilidad de tercer orden y la facilidad de incorporar iones lantánidos ópticamente activos hacen que los molibdatos con estructura de tipo scheelita se utilicen en aplicaciones fotónicas como matrices láser [1] y para conseguir Raman estimulado [2]. En particular, el molibdato de lantano posee una super-estructura scheelite con red √10as x cs x 3as que permite tres sitios distintos para el ion La3+ [3]. El efecto del ordenamiento de los diferentes dopantes, permitiendo estructuras más o menos ordenadas, y la modificación de sus propiedades ópticas motivan este estudio.

Se han sintetizado molibdatos de lantano puro La2(MoO4)3 y dopados con iones Er3+ y Nd3+ [Er0,1La1,9(MoO4)3 y Nd0,2La1,8(MoO4)3] mediante el método cerámico, obteniéndose durante el proceso pequeños cristales por nucleación espontánea. Dichos compuestos han sido caracterizados mediante difracción de rayos X en policristal para obtener información del grado de pureza de los cristales y los parámetros de celda y en monocristal para determinar los sitios en los que se alojan ambos dopantes.

La absorción óptica y las emisiones radiativas de los iones Er3+ y Nd3+ en esta matriz indican que los iones dopantes ocupan diferentes sitios dentro de la estructura cristalina con diferentes interacciones de tipo campo cristalino con los ligandos. Finalmente, se abordan los procesos de conversión de energía infrarroja en visible excitando ambos dopantes con láseres continuos en el infrarrojo cercano.

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TÍTULO: **In search of optimal performance for light-harvesting nanostructures**

ÁREA TEMÁTICA: **Propiedades ópticas y cristales fotónicos**

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CONTENIDO:

The increasing demands made on image processing at visible and near-infrared wavelengths require more electronics at the pixel level. Additional electronics reduces the available photosensitive area thus decreasing signal and image quality. One of the possible ways to overcome this limitation is to collect light from the total pixel area and guide it to the photosensitive area, i.e. to harvest the light.

In a recent work [1], it was demonstrated that a single slit of sub-wavelength width surrounded by grooves in a gold layer can be used to enhance the performance of a standard CMOS-fabricated photodetector. Such an enhancement results from constructive interference of surface waves which are generated by the incident light.

For the same type of system, we have now performed extensive numerical simulations in order to determine the set of geometrical parameters (depth, width and position of the grooves, slit-to groove distance, slit width and layer thickness) that provide optimal light-harvesting performance under given fabrication and operation conditions. In addition to global figures of merit, we have also studied the relative influence of different parameters, which can be understood in terms of groove cavity/slit waveguide mode excitation and in-phase groove reemission [2].

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TÍTULO: **High-pressure electronic, vibrational and structural properties of SrWO4**

ÁREA TEMÁTICA: **Semiconductores, sensores**

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CONTENIDO:

Strontium tungsten (SrWO4) is a wide band gap semiconductor (Eg = 5 eV) with several technological applications due to their excellent scintillating properties. At ambient conditions it crystallizes in the tetragonal scheelite structure (S.G. I41/a). In this structure the W6+ cations are surrounded by four O2- anions in a tetrahedrical configuration, whereas the Sr2+ cations are enclosed by eight oxygen ions in a pseudo-cubic configuration. In this work we present a high-pressure (HP) room-temperature study on the electronic, vibrational and structural properties of this compound. Particularly UV-VIS-NIR absorption measurements were carried out up to 15.5 GPa. Our experiments show a flat evolution with pressure of a direct band-gap up to 10 GPa. Dramatic changes in the optical absorption edge take place above that pressure, in agreement with the reported phase transition from the scheelite to the monoclinic fergusonite structure (S.G. I2/a) around 10 GPa. On the other hand we

performed HP Raman experiments. In this case we reached 45 GPa and we observed several induced phase transitions at 12.5, 21.0 and 40.7 GPa. Finally elastic x-ray diffraction measurements up to 28.5 GPa were carried out at the 16-IDB beam-line of the APS synchrotron (USA). In agreement with the Raman experiments we observed two phase transitions. The first one corresponds with the known scheelite to fergusonite transition, while beyond 21 GPa we found a more dense monoclinic structure. Along the communication we will explain the experimental techniques used in order to reach the HP conditions in each case, and we will also compare our experimental results with the literature and theoretical ab initio calculations.

TÍTULO: **Observation of persistent vortices in a polariton superfluid**

ÁREA TEMÁTICA: **Semiconductores, sensores**

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CONTENIDO:

Observation of quantized vortices, suggesting parallelisms between non-equilibrium polariton condensates and conventional superfluids, have been reported either by spontaneous formation and pinning in the presence of disorder [1,2] or by imprinting it onto the signal or idler of an optical parametric oscillator (OPO) [2]. Here we report the first observation of a polariton condensate receiving a quantized angular momentum by means of a short optical pulse and maintaining its rotation for a time much longer than both the pulse duration and the polariton lifetime. This observation shows a peculiar character of polariton condensates which strengthen its analogy with supercurrents in superconductors or persistent flow in condensates [3].

We use a $\lambda/2$ AlAs microcavity with a 20 nm GaAs QW at its centre. At 10 K, the heavy-hole excitons of the QW are strongly coupled with the cavity mode (Rabi splitting λ4.4 meV). The wedge-shaped cavity allows for tuning of the resonance between the QW exciton and the cavity mode by changing the position of the excitation spot on the sample. We exploit an OPO configuration to create a polariton condensate at k=0, and at a slightly negative detuning, in a relatively large area (Ø ~ 50 μm). We perturb the OPO´s signal state with a, smaller in size, pulsed (2 ps long) probe carrying an orbital angular momentum l=1.

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[2] D.N. Krizhanovskii, private communication.

[3] A. Amo, et al., Nature 459, 291 (2009).

TÍTULO: **Formation of highly ordered Cu-TCNQ thin films by Cu diffusion**

ÁREA TEMÁTICA: **Semiconductores, sensores**

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CONTENIDO:

Recently the possibility of using organic dielectrics has been explored, with the final goal of producing "all-organic" transistors [1,2], but the low dielectric constant of the gate materials and the low charge mobility of the organic semiconductors result in very slow devices that need relatively high voltages to work. Furthermore, the use of biological material as dielectric opens the possibility of building bioFETs with an enormous potential as sensors and diagnose devices that in the future may substitute today´s microarrays. The charge transfer complex (CT) can be proposed as active layers for organic semiconductor devices. CuTCNQ is an organic semiconductor charge transfer material that allows the realization of non-volatile cross-bar memory arrays with conductivity switching. The electronic transport properties of the grown film depend on the quality and orientation of the organic molecules crystallites.

In this work, we present a simple preparation method of this organic memory material, compatible with industrial processing and downsizing of the memory cells. The growth of TCNQ on Cu(100) is mainly governed by the high interaction of the TCNQ molecules with the substrate. The submonolayer growth stage has been followed with scanning tunneling microscopy (STM). We have used surface sensitive x-ray diffraction and x-ray photoelectron spectroscopy (XPS) for the complete characterization of the atomic and electronic structure respectively. The results indicate that the strong molecule-substrate interaction leads to the formation of a highly oriented growth of a TCNQ film on Cu of thinckness up to several microns. This strong interaction also leads by mild annealing of the layer to the formation of a highly oriented CuTCNQ layer by Cu diffusion from the substrate.

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TÍTULO: **Huge enhancement of differential magnetoresistance in nanoparticle arrays**

ÁREA TEMÁTICA: **Simulación de materiales**

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CONTENIDO:

Current through a metallic nanoparticle is a strongly non-linear function of voltage due to discrete charging (Coulomb blockade physics). When the nanoparticle is placed between two ferromagnetic electrodes the interplay between ferromagnetism and discrete charging controls the electronic transport through the nanoparticle. If the spin relaxation time in the nanoparticle is long, spin accumulation in the nanoparticle appears when the magnetic moment in the electrodes have anti-parallel orientation, but not for parallel orientation. Charging effects are strongly enhanced in nanoparticle arrays. Here we show that spin accumulation has a very strong effect in the transport properties of metallic nanoparticle arrays placed in between ferromagnetic electrodes. The observed behavior is qualitatively different to the case of a single island. Spin accumulation appears not only for antiparallel but also for parallel orientation of the electrodes's magnetic moments. In the last case, the threshold voltage which allows the flow of current is modified. Within the array the sign of the spin accumulation reverses leading to oscillations in the current, negative differential resistance and a huge enhancement of the differential magnetoresistance for a given range of voltages.

TÍTULO: **Transport through two-dimensional metallic nanoparticle arrays**

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CONTENIDO:

The electronic transport through a metallic nanoparticle array is blocked up to a finite threshold voltage which depends on disorder and size of the array. Here we analyze the tranport properties of two- dimensional metallic nanoparticle arrays for different lattice geometries and type of disorder (charge and resistance disorder or vacancies). We show that, contrary to general believe, the current depends linearly on voltage close to threshold. At higher voltages a range of superlinear behavior is found. In general, this superlinear behavior cannot be described in terms of a power-law.

TÍTULO: **Lanthanide-based Single Molecule Magnets: Theoretical models and ab initio calculations**

ÁREA TEMÁTICA: **Simulación de materiales**

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CONTENIDO:

The two main factors for observing a slow magnetic relaxation at a molecular level are a high spin value and a large magnetic anisotropy. Because of that, in the last years there has been a growing interest in the use of lanthanide ions in the synthesis of Single Molecule Magnets [1] and Single Chain Magnets [2] since their usual high magnetic moments and large magnetic anisotropies. However, the treatment of the magnetism in this kind of compounds is not so straightforward than in transition-metal clusters because of the strong spin-orbit coupling, which produces a complex energy level structure, and deeper theoretical studies are required.

In this contribution I will show several examples of molecular compounds containing lanthanide ions and showing slow magnetic relaxation in which the combination of ab initio calculations and Hamiltonian models has allowed to understand their experimental magnetic behaviour.

In the employed ab initio method, CASSCF/RASSI-SO [3], spin-free wavefunctions and energies are determined through the use of the Complete Active Space Self Consistent Field(CASSCF) method, in which the Spin-Orbit coupling is not considered. Then, Spin–Orbit coupling is included by a Restricted Active Space State Interaction computation(RASSI-SO). In the presented work, this quantum chemistry method has proved to be of great help in the theoretical study of lanthanide-based materials and, in particular, for predicting the direction of the easy single-ion anisotropy axes of the lanthanides ions and the nature of their ground and the low energy excited states. The results of the presented studies are very promising for the use of the CASSCF/RASSI-SO quantum chemistry method in order to shed light on the complex magnetic behaviour of the lanthanide-based magnetic molecular materials.

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TÍTULO: **A first principles stydy of thiol-capped Au nanoparticles: structural and electronic properties as a funtion of thiol coverage**

ÁREA TEMÁTICA: **Simulación de materiales**

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CONTENIDO:

The adsorption geometry of thiols in gold NPs has been the subject of intense debate [1,2,3]. In this work we study an ampler set of phases at each thiolate coverage. We performed a DFT-based molecular dynamics(MD) calculations for Au38(MT)x NPs, varing x from 1 to 30 methylthiolate with ab initio DFT SIESTA code [4]. We employed the Local Density Approximations(LDA) for the exchange and correlation energy based on Ceperly and Adler`s parametrization [5]. The interaction of the core electrons with the valence electrons is replaced by non-local and norm-conserving pseudopotentials based on the Troullier-Martins scheme [6]. We have considered three different core models for the cluster and for each case the thiols were initially placed in different arrangements-bridge adsorption or in the form of staples. We investigated the energetics, geometry and electronic structure of the relaxed NPs. The results confirm the relevance of the core reconstruction: i) when the number of thiols is small the usual fcc spherical core covered by a mixture of staples and bridge adsorbed thiols give the most stable structures; ii) at intermediate coverages the most stable NPs correspond to a new tubular core geometry protected mainly by staples; iii) arround 24 thiols coverage we retrieved the bi-icosahedral model of Pei et al [7]; iv) at larger coverages only the fcc spherical core was considered finding a substantial decrease in the stability of the NP.On the other hand, the charge transfer analysis indicated that thiols always accept some fraction of charge (~0.2e) from the surface gold atoms. The density of states projected(PDOS) on the atoms and/or atomic orbitals(AOs) gave no evidence for the formation of closed shell electronic structures.

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TÍTULO: **Estudio del efecto de desorden y defectos de superficie sobre la fricción atómica**

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CONTENIDO:

La nanotribología es la ciencia que estudia fenómenos de adhesión, fricción y wear. Entender la fricción a escala at atómica es un problema actual y muy importante tanto fundamental como tecnológicamente. Con el desarrollo de nuevas técnicas experimentales tales como el microscopio de fuerza de fricción y el aparato de fuerza superficial, investigaciones teóricas y experimentales de la fricción en la escala atómica han recibido una importante atención.

Analizamos el efecto de desorden y defectos superficial sobre procesos de fricción atómica y su comportamiento a diferentes temperaturas. Nuestro modelo de partida es el ampliamente conocido modelo unidimensional de Tomlinson. Este sistema ha sido recientemente empleado para estudiar la interacción punta-superficie en un microscopio de fuerza de fricción [1-3].

En este marco de trabajo, la punta se comporta como una partícula masiva atada a un soporte móvil a través de un resorte tipo armónico que se mueve sobre un potencial de sustrato unidimensional V(x). El potencial efectivo del sistema incluye los efectos de acoplamiento elástico de la punta con el soporte el cual se mueve a velocidad constante vs y la interacción punta-superficie V(x). M y x son la masa efectiva y la posición lateral de la punta, k es la constante de resorte. Los efectos térmicos se introducen a través de un término de ruido aleatorio que satisface la relación de fluctuación- disipación. Consideramos el efecto de introducir desorden en la superficie incluyendo un término armónico en el potencial punta-superficie. Adicionalmente se analiza el caso de un potencial de sustrato con una densidad de defectos dada. Los defectos se introducen a través de términos gausianos y localizados en posiciones, xj, seleccionadas en los máximos del potencial libre de defectos (xj=(2n+1)a/2). De esta manera buscamos introducir el efecto de vacancias de átomos en la superficie.

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TÍTULO: **Modelling of demagnetization processes on ultrashort timescales**

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CONTENIDO:

The implementation of novel magnetic recording and spintronic devices requires well-funded knowledge of the limits of spin manipulation. Recent pump-probe experiments with powerful femtosecond lasers have pushed these limits down to femtosecond timescale. These experiments have attracted many researchers with the aim to understand both fundamental mechanisms of the magnetization dynamics in a strongly out-of-equilibrium regime and to control the magnetic properties of materials on femtosecond timescale. The microscopic processes responsible for the ultrafast changes in the macroscopic magnetization of the ferromagnetic materials, such as Ni, have not been unambiguously identified yet. The scattering events lead to the energy flow between different subsystems: phonons, electrons and spins. This finally manifests itself as spin system excitation involving THz spin waves, its relaxation and fluctuations. A two-temperature model, which involves the electron heating after excitation and equilibration with the phonon system, describes the ultrafast dynamics by separating the system into two baths with different heat capacities. The microscopic damping mechanisms are included in the coupling to the bath (intrinsic damping) parameter proportional to the spin-flip rate. We discuss two possible candidates for microscopic processes: the Elliott-Yafet (mediated by phonons) and inelastic exchange scattering.

The connection between the electron temperatures and the magnetic system is established by a Langevin field term in the macroscopic Landau – Lifshitz – Bloch equation constituing a novel micromagnetic formalism. We show our capability to model the ultrafast demagnetisation processes at all three timescales: femtosecond demagnetisation, picosecond recovery and nanosecond optically-indiced precession.

We demonstrate that both spin (femtosecond demagnetization) and electron-phonon (magnetization recovery) rates in Ni increase as a function of the laser pump fluence. The slowing down for high fluences arises from the increased longitudinal relaxation time. We show an excellent quantitative agreement between femtosecond optical pump-probe experiment and our modelling in Ni, which reveals a predominant thermal demagnetization mechanism at femtosecond timescale.

Ref:

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U.Atxitia et al Appl. Phys.Lett. 91 (2007) 232507.

TÍTULO: **Magnetic domains and surface effects in hollow maghemite nanoparticles**

ÁREA TEMÁTICA: **Simulación de materiales**

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CONTENIDO:

We investigate the magnetic properties of ferrimagnetic and non-interacting maghemite hollow nanoparticles obtained by the Kirkendall effect. From the experimental characterization of their magnetic behavior, we find that polycrystalline hollow maghemite nanoparticles exhibit low blocked-to-superparamagnetic transition temperatures, small magnetic moments, significant coercivities and irreversibility fields, and no magnetic saturation on magnetic fields up to 5 T. Results are interpreted in terms of the microstructural parameters characterizing the maghemite shells by means of atomistic Monte Carlo simulations of an individual spherical shell. The model comprises strongly interacting crystallographic domains arranged in a spherical shell with random orientations and anisotropy axis. The simulation allows discernment between the influence of the polycrystalline structure and its hollow geometry, while revealing the magnetic domain arrangement in the different temperature regimes.

The financial support of the Spanish MICINN (MAT2009-08667, Consolider-Ingenio 2010 CSD2006-00012) and Catalan DURSI (2009SGR856) are recognized.

TÍTULO: **Microscopic origin of exchange bias in inverted core/shell magnetic nanoparticles**

ÁREA TEMÁTICA: **Simulación de materiales**

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CONTENIDO:

We present the results of a Monte Carlo (MC) simulation study [1] of the magnetic properties of an individual nanoparticle (NP) with inverted (AF/FM) core/shell structure for which unusual exchange biased hysteresis loops have been reported in recent experiments [2]. In order to clarify the microscopic origin of this phenomenology, we have run MC simulations based on a classical Heisenberg model of lattice spins for AF/FM spherical NPs of different sizes. In the model, the values of the anisotropy and exchange constants can be tuned in the core, shell and at the interfacial regions. Detailed analysis of magnetic order at the interface reveal that uncompensated spins of the AFM core are responsible for the EB phenomena in these kind of NPs and have allowed us to quantify the magnitude of the loop shifts with striking agreement with the macroscopic values. The simulated loops display shifts along the field axis with a non-monotonous dependence on the core diameter in agreement with the experiments. MICINN (MAT2009-08667, Consolider-Ingenio 2010 CSD2006-00012) and Catalan DURSI (2009SGR856) are recognized.

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TÍTULO: **Study of the domain structure and coercitive fields in cobalt nanostripes by VF-MFM**

ÁREA TEMÁTICA: **Microscopías de proximidad y microscopía electrónica**

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CONTENIDO:

Nanomagnetism is a research area of increasing interest focused on phenomena related to the low dimensionality of magnetic elements.Besides the interest of the magnetic nanostructures from a fundamental point of view, nanomagnets are of great technological importance in a variety of applications such as magnetic recording, sensors, biomagnetism, etc. In the last years, new ideas based on the domain wall control in magnetic nanostripes, as racetrack memories [1] and domain wall logic [2], have emerged. For the progress of such fields it becomes necessary not only the use of complex fabrication techniques and methods which allow us to obtain nanostructured materials but also the development of new techniques with suitable resolution and sensitivity to characterize nano-objets.Particularly interesting and hard to achieve is a direct study of their magnetization reversal process. In this respect, Magnetic Force Microscopy (MFM) is an advanced technique for domain observation, which can become a powerful "local" technique to study the switching process at the nanometer scale when in situ magnetic field is applied [3] i.e. by using the so-called Variable Field Magnetic Force Microscopy (VF-MFM). Moreover, since Atomic Force Microscopy (AFM)-based techniques enable the simultaneous observation of magnetic domains and surface topography of the same area, the interplay between both structural and magnetic properties can be analysed.

In this work we have studied the domain structure and magnetization reversal of cobalt nanostripes with different aspect ratio fabricated by the Focused Electron Beam Induced Deposition (FEBID) technique [4]. The nanostructures have been characterized by AFM/VF-MFM techniques.VF-MFM allows stable imaging of magnetic nanostructures with high mechanical stability under a variable in-plane and out-of-plane external magnetic field. Images of the same area at different magnetic fields can be obtained to study the evolution of the magnetization of individual nanostripes. As a novelty, special modes (the so-called 3D modes) have been used to evaluate the reversal magnetization process along the stripe.The coercitive fields and the hysteresis loops of the different nanostructures have been obtained with this new method.

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TÍTULO: **Electronic inhomogeneities of epitaxial graphene on Ru(0001) probed by dynamic STM and STS measurements**

ÁREA TEMÁTICA: **Microscopías de proximidad y microscopía electrónica**

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CONTENIDO:

Epitaxial growth of graphene on Ru(0001) surfaces is a powerful route to obtain wafer-scale graphene layers. Nevertheless the graphene-Ru(0001) interaction is expected to play an important role in electronic and chemical properties of the grown graphene layer. We have performed dynamic scanning tunneling microscopy (dyn-STM) and scanning tunneling spectroscopy (STS) at temperatures down to 300 mK on graphene epitaxialy grown on Ru(0001). We have found that both the local tunneling barrier height (LBH) obtained from the dyn-STM measurements and the local density of electronic states (LDOS) deduced from the STS measurements show a Moiré-like distribution. This inhomogeneity on the electronic properties of graphene on Ru(0001) is induced by local variations of the carbon – ruthenium interaction due to the lattice mismatch between the graphene and the Ru(0001) lattices.

TÍTULO: **Thermometry with a nearly temperature independent sensitivity using a normal-superconducting tunnel diode biased close to the superconducting gap**

ÁREA TEMÁTICA: **Microscopías de proximidad y microscopía electrónica**

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CONTENIDO:

We analyze the temperature dependence of the tunneling current in a normal-insulator-superconductor (NIS) tunnel junction and find that such a junction can serve as a primary thermometer below the superconducting critical temperature Tc with a nearly temperature independent sensitivity, provided the junction is suitably biased close to the superconducting gap. Deviations from expected behavior when the superconducting electrode does not follow most simple s-wave BCS density of satates, and possible applications are briefly discussed.

TÍTULO: **The role of additives in nanocrystalline hydride materials for hydrogen storage: A microstructural and chemical characterization**

ÁREA TEMÁTICA: **Materiales y Energía**

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CONTENIDO:

Single hydride (MgH2) as well as reactive complex hydrides (RHC) (MgH2+2LiBH4) are promising nanomaterials for hydrogen storage applications due to their high storage capacities up to 18.5 wt.%. Valuable improvements in their kinetics have been obtained by using additives such as Nb2O5 [1] and Ti-isopropoxide [2] for the single hydrides and reactive hydride composites, respectively. The objective of the present work is the comparative study of the behaviour of the Nb-based additive in the MgH2 single hydride and the Ti-based additive in the MgH2+2LiBH4 reactive hydride composite. Several characterization techniques have been used in this investigation. In particular, X-Ray Diffraction (XRD), X-Ray Absorption Spectroscopy (XAS), X-Ray Photoelectron Spectroscopy (XPS) and Electron Microscopy (TEM/EELS) experiments were carried out for the milled and cycled samples in absence and also in presence of the corresponding additives. It has been shown that although the evolution of the oxidation state for both Nb- and Ti-species are similar in both systems, the photoemission data show a direct evidence of the additive migration and while the Nb additive is performing its activity at the surface, the Ti active species migrate to the bulk improving the absorption/desorption kinetics. On the basis of the obtained information concerning the local structure and the oxidation state of the additives, the factors that drive the sorption mechanism will be discussed here.

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TÍTULO: **Termodinámica del proceso de hidrogenación de aleaciones pseudo-binarias Mg6PdxNi1-x**

ÁREA TEMÁTICA: **Materiales y Energía**

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CONTENIDO:

Recientemente hemos encontrado una nueva aleación pseudo-binaria de Mg6PdxNi1-x [1-2]. Esta aleación tiene interés en el problema de la acumulación de hidrogeno [3] dado que su alto contenido en magnesio junto a la presencia de los metales Ni y Pd, anticipan tanto una buena capacidad gravimétrica como buenas propiedades catalíticas para la disociación de la molécula de hidrógeno. Durante la hidrogenación, la aleación se despropociona en compuestos más estables como son MgH2, Mg2NiH4 y Mg5Pd2. La menor entalpía de la reacción, -63(3) kJ/molH2, comparada con la del MgH2 apunta hacia una menor temperatura de trabajo para este compuesto. Sin embargo, el cambio de entropía de la reacción, -114(4) J/KmolH2, empaña parcialmente este buen resultado haciendo que la temperatura a la que se alcanza una presión de equilibrio de hidrógeno de una atmósfera, 280 ºC, sea similar a la del MgH2, 282 ºC.

En esta comunicación presentaremos detalles de la termodinámica del proceso de desproporción de este material y discutiremos posibles caminos para mejorar sus propiedades de hidrogenación.

Agradecimientos

Los autores agradecen la ayuda económica del Ministerio de Educación y Ciencia (MEC) a través del Proyecto MAT2008-06547-C02-01. Agradecemos el apoyo técnico prestado por F. Moreno.

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TÍTULO: **MgH2-decomposition at room temperature investigated by transport measurements**

ÁREA TEMÁTICA: **Materiales y Energía**

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CONTENIDO:

Magnesium hydride (MgH2) is considered a promising material to be used to store hydrogen (it exhibits a high gravimetric capacity and it is cheap) but its high stability and slow H-kinetics prevent its utilization in mobile applications [1]. In this context, Mg-films seem to offer a better option than Mg-bulk to investigate the influence of different physical parameters (crystallite size, surface state…..etc) on the kinetics and thermodynamic properties as well as the possibility to grow new samples with novel structutures and compositions in a fast way. Moreover, Mg-films (and their related alloys) are also investigated to be used as a swichable mirror [2].

In this work, the transition between hydride state and metallic state of magnesium is investigated by transport properties [3]. To this aim, capped Pd-magnesium films of thicknesses 100 and 300 nm were prepared by e-beam evaporation and, subsequently hydrogenated at 100 ºC and P = 10 b. Thermoelectric and resisitivity measurements during desorpcion process of magnesium hydride thin films were carried out. Transport measurements were completed by structural (XRD), compositional (SEM-EDX) and optical measurements. Measurements reveal a variation of Seebeck coefficient and resistivity during desorption due to the MgH2 to Mg conversion. The obtained results are discussed under different models showing novel approachs to understand the desorption mechanism of the metal-hydrides.

Acknowledgments:

Author thanks to F. Moreno for technical support and MEC-MAT 2008-06547-C02-01 and RYC-2005-001054 for support.

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TÍTULO: **On the formation mechanism of Co-doped pyrite thin films**

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CONTENIDO:

For a long time, FeS2 has been considered a good photovoltaic material due to their adequate energy gap and high quantum efficiency. Moreover, the abundance of its components, as well as the high absorption coefficient, allows it to be used as thin films, what would contribute to the reduction of production costs. However, the use of FeS2 films present two main drawbacks: firstly, FeS2 films always exhibit p-type conduction independently of the preparation technique. Secondly, they usually have a high density of defects (mainly cation vacancies), what results in a decrease of the efficiency of the photovoltaic devices [1]. Nevertheless, it is well known that n-type pyrite films can be achieved by doping with transition metals such as Ti, Al or Co [2]. Besides, with the ultimate objective of reducing the number of defects in the films, investigations on the formation mechanism of the pyrite films by sulphuration of iron layer have been made which showed the existence of several diffusion mechanisms responsible for the creation of such defects.

In this work, Co doped FeS2 thin films were prepared from Fe on Co bilayers in order to overcome these problems in a single step process: the reduction of the density of cation vacancies by the introduction of Co and the investigation of the Co doping of the pyrite layer, which might permit the ultimate control of the Co diffusion and, thus, the one step preparation of a p-n junction. The transport properties (resistance (R) and Seebeck coefficient (S)) were measured in situ during the sulphuration, showing different processes involved in the formation mechanism. In order to identify these processes, several quenches were carried out along the sulphuration. The structural, morphological, optical and transport properties were measured before and after the sulphuration processes. Composition of the samples was also measured by EDX and ion beam techniques (RBS/ERDA).

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TÍTULO: **Heat capacity and direct determination of the magnetocaloric effect in Mn1-xCoxAs (0 < x 0.02)**

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CONTENIDO:

A series of Mn1-xCoxAs (0 < x 0.02) samples have been prepared by the arc melting method. The X-ray diffraction (XRD) results at 373 K show that all the samples crystallize in the orthorhombic MnP-type single-phase structure. The heat capacity measurement reveals that the transition temperature from ferromagnetic hexagonal NiAs-type structure to paramagnetic orthorhombic MnP-type one decreases from 310.6 K to 275.5 K on heating and from 298.4 K to 251.7 K on cooling, respectively, with increasing concentration of Co from x=0.003 to 0.02, while the thermal hysteresis increases from 12.2 K to 23.8 K. Large thermal hysteresis and very sharp peaks in heat capacity indicate that up to 2% of Co doping does not change the nature of the first-order magnetostructural transition in MnAs, which also has been demonstrated by analysis of XRD at different temperatures. The giant magnetocaloric effect was observed in all compounds, the maximum values of direct isothermal entropy change ΔS and adiabatic temperature change ΔT_{ad} in the vicinity of the respective transition temperatures are 27.0, 25.7, 26.9, 19.8 and 21.3 J/kg•K, and 17.3, 15.3, 17.7, 11.8 and 12.5 K upon the field change of 6 T for x = 0.003, 0.006, 0.01, 0.015 and 0.02, respectively. The entropy change obtained from direct measurement, heat capacity and isofield M(T) are well consistent with each other, but much smaller than that deduced from isothermal M(H) due to the fact of the spurious spike effect.

TÍTULO: **Structural and optical study of Ga incorporation into the lattice of InxGa1-xN nanocolumns**

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CONTENIDO:

The energy band gap of the InxGa1-xN alloy can be tuned between those of the two binary compounds over a wide energy range from the near IR to the near UV region [1]. Such degree of freedom along with its radiation resistance locates InxGa1-xN as the most suitable material for high-efficiency multijunction solar cells. Furthermore InxGa1-xN is used in blue and UV light emitting diodes and laser diodes . However, the limited miscibility of In induces composition inhomogeneities and a strong drop-off in the emission efficiency for high In concentration. It has been pointed out that nanocolumnar morphologies could favor strain relaxation and therefore help improving InxGa1-xN tunability [2]. While InN and GaN nanocolumns have been successfully grown by several means, ternary nanocolumns are still rather unexplored. The aim of this work was achieving InxGa1-xN nanocolumns with a controlled Ga incorporation into the InN lattice. The morphology and composition of ensembles of InxGa1-xN nanocolumns grown by molecular beam epitaxy on bare Si (111) under different conditions have been investigated by means of SEM, photoluminescence, Raman scattering and XR-fluorescence. The structural and optical properties of single nanocolum were also investigated by SEM and photoluminescence. According to the overall results, the ternary nanocolumns present a good shape and can emit in the visible region. But the existence of In-rich zones was also confirmed even within a single nanocolumn.

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TÍTULO: **Magnetoresistance in Hydrogenated Graphene Nanoribbons**

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CONTENIDO:

Functionalization of graphene has become a promising strategy to reversibly tune its electronic and chemical properties [1,2]. The formation of sp3 type defects breaks the pz network symmetry transforming it into an insulator. Recent experimental methods [3,4] have shown a great versatility to reversibly hydrogenate graphene by means of hydrogen plasma or electron beam techniques which opens new venues towards carbon-based spintronic applications.

In this work we study the magnetic and transport properties of an infinite armchair graphene nanoribbon (AGNR) with two hydrogen atoms chemisorbed on different sublattices. Calculations using density functional theory (DFT), within the local spin density approximation (LSDA), and the one-orbital mean-field Hubbard model show that hydrogen atoms covalently bonded to the honeycomb lattice gives rise to localized magnetic moments which interact ferro or antiferromagnetically with one another depending on the relative adsorption graphene sublattice [5,6]. The case in which the sublattice is compensated and magnetic moments align antiferromagnetically (S=0) is energetically favored. This result extends the range of applicability of Lieb's theorem beyond simple Hubbard model.

Transport calculations using the Landauer formalism and the Green's function method show that, under the influence of an external magnetic field, a ferromagnetic state can be induced which is more conductive than the antiferromagnetic ground state. This difference can be translated into a magnetoresistive response.

In this context, we have studied the case of a finite hydrogenated AGNR attached to conductive graphene using the one-orbital mean-field Hubbard model as a function of the distance between hydrogen atoms. We find that negative TMR values between -50 and -100% can be attained for the configurations studied.

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TÍTULO: **Magnetic Phthalocyanines on surfaces. Theoretical approach**

ÁREA TEMÁTICA: **Materiales y electrónica molecular**

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CONTENIDO:

Magnetic Phthalocyanines are organic molecules hosting unpaired electrons in their structure. When these molecules are deposited on a surface, the magnetic structure can change in non trivial ways. Motivated by recent experimental works [1,2], we try to understand the Interaction between the molecules and the surface. To this aim we have performed computational studies based on Density Functional Theory (DFT).

We present results of the iron-phthalocyanine on an insulating surface of CuO/Cu(110). We have obtained that the magnetic moment of this molecule is conserved after deposition, in agreement with the experiment [2]. Furthermore, a very small charge transfer is observed. We have also studied the Iron-Phthalocyanine on Cu(110) surface, finding that the magnetic moment is conserved, in apparent contradiction with the experimental result .

Finally, we also report our results of the Manganese Phthalocyanine adsorbed on a manganese surface. It is well known that the manganese grown on iron (001) has an antiferromagnetic coupling between layers [3]. Nevertheless, when a manganese phthalocyanine is adsorbed on this surface it is not easy to ascertain the sign of the coupling [4]. To understand this interaction, we have computed this system with two different levels of theory (finite approximation and periodic approximation) based on DFT. An Attempt to evaluation of the current as in STM experiments is also presented. We have applied the Tersoff-Hamman equation, using Green's functions to obtain the density of States.

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TÍTULO: **Pressure-induced phase transition in CuWO4: A study of the vibrational, electronic and structural properties**

ÁREA TEMÁTICA: **Materiales y electrónica molecular**

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CONTENIDO:

The discovery of high-temperature superconductivity and the role of Cu coordination with O atoms and the linking of these polyhedra to networks, renewed the interest in the crystal structure of Cu compounds. Although quaternary oxides are in the center of interest, the effects of pressure in the Cu environment in systems like CuWO4 could help in the search of routes for superconductivity. Cuproscheelite, CuWO4, crystallizes in a triclinic structure (P-1), topologically related to the monoclinic wolframite structure (P2/c), with both cations octahedrally coordinated by oxygens. However the CuO6 octahedra present a strong Jahn-Teller distortion giving rise to an approximately elongated (D4h) octahedron that causes a lattice distortion and lowers the crystal symmetry from P2/c to P-1. In spite its interesting and unexplored physical properties CuWO4 has been previously poorly studied under high-pressure conditions, due to the difficulties inherent to its low crystal symmetry. In this work we report a systematic study of the vibrational, electronic, and structural properties of CuWO4 under high-pressure beyond 20 GPa. We performed Raman scattering spectroscopy, optical absorption in the band-edge as well as in the Cu 3d→3d* transitions, and angle dispersive synchrotron x-ray powder diffraction. Within this pressure range a phase transition has been detected at 10 GPa and the HP phase assigned to a structure with P2/c symmetry. We also determined the pressure evolution of the lattice parameters. Using a third-order Birch-Murnaghan equation, we determined the equation of state of CuWO4, being a bulk modulus of B0 = 139 GPa obtained. We also found that the band-gap energy decreases with pressure in the low-pressure phase. A change of the band-gap pressure coefficient is detected at the phase transition. The unusual shape of the band-edge optical absorption around the phase transition is explained through apparition of domains of both the low and high pressure phases. This assumption is supported by the visual observation of fringes in the sample and the gradual change the Cu 3d→3d* absorption bands. Finally, the Raman modes become harder upon compression. Several modes discontinuities were observed at the transition.

TÍTULO: **Rotational reorganization of microscopic objects using chiral switch doped liquid crystals**

ÁREA TEMÁTICA: **Materia blanda, polímeros y materiales mesoporosos**

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CONTENIDO:

Nature makes use of the collective action of diverse biomolecular motors to precisely move objects many times the size of the individual biomolecules. During the last decades a large number of synthetic systems such as molecular switches, shuttles, elevators and motors have been synthesized. These devices could in principle be used to transfer work to objects of a much larger length scale, however this has proven to be difficult. Recently Eelkema and coworkers have shown that the collective action of molecular motors embedded in a liquid crystal (LC) matrix can rotate objects over ten thousand times larger than the size of the motors themselves. The system comprises a chiral molecular motor embedded in a liquid crystalline host. The fingerprint texture rotationally reorganize under UV light exposure. This reorganization is ascribed to the light induced conversion of the molecular motor to an isomer with different helical twisting power that changes the helix pitch of the LC. This rotational reorganization is used to rotate microscopic objects of tens of microns size [1].

Trying to gain insight in the underlying mechanism for the rotation of fingerprint texture and of the microscopic objects in chiral switch doped LCs we have undertaken a study on the inclusion of photoisomerizable azobenzene chiral switches on different nematic hosts. The systems under study present a fingerprint texture that reorganizes upon UV irradiation. The texture reorganizes back under visible light. We have explored the influence of the boundary conditions imposed by the substrate (planar or homeotropic), film thickness and the amount of dopant on the texture reorganization and the micro-object movement under illumination. In this communication we present these results and a possible mechanism based on the anisotropic elastic interactions of the LC.

Acknowledgement:

This work was supported by the MICINN, Spain, under the project MAT2008-06522-C02, FEDER fundings and Gobierno de Aragón.

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TÍTULO: **Diffusive behaviour of benzene molecules adsorbed on graphite basal plane**

ÁREA TEMÁTICA: **Grandes instalaciones: sincrotrón, neutrones**

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CONTENIDO:

Graphitic systems offer a wide range of applications in nanotechnology. Dressing a complete picture of their diffusive behaviour is essential for fully develop all their possibilities.

Motion of benzene molecules adsorbed on graphite basal planes has been studied. Neutron and Helium spin-echo coherent scattering measurements (ILL and Cambridge) show a Brownian diffusive behaviour at large range with low activation energies (17meV ±12meV compared with thermal energy 12meV at 140K) [1]. The benzene molecules move on a surprisingly flat potential energy surface. This continuous diffusion behaviour is related to translations and group dynamics on the surface. The experimental results are consistent with MD simulations [2].

At short range the situation is different. MD simulations predict deviations from the Brownian model. Incoherent scattering measurements on benzene/graphite system suggest the presence of rotational modes where the molecules undergo rotations around their six-fold symmetry axis. The diffusive behaviour related to rotations is better described by jump-diffusion models.

Understanding the physical mechanisms underlying in the molecules motion is essential for analysing this change in diffusive behaviour. The study of new systems like naphthalene/graphite will help us to nail down the problem.

[1] Hedgeland, H., Fouquet, P., Jardine, A. P., Alexandrowicz, G., Allison, W. and Ellis, J., Measurements of a single-molecule frictional dissipation in a prototypical nanoscale system, Nature Physics 5, 2009.

[2] Fouquet, P., Johnson M. R., Hedgeland, H., Jardine, A. P., Ellis, J. and Allison, W. , Molecule dynamics simulations of the diffusion of benzene submonolayer films on graphite basal plane surfaces, Carbon 47,2009.

TÍTULO: **XtremeD – un nuevo difractómetro de neutrones para altas presiones y campos magnéticos desarrollado por España**

ÁREA TEMÁTICA: **Grandes instalaciones: sincrotrón, neutrones**

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CONTENIDO:

En los últimos años se ha observado un importante aumento en el interés por los problemas científicos relacionados con el comportamiento de la materia en condiciones extremas. La difracción de neutrones ofrece posibilidades únicas para este tipo de investigaciones y el interés por esta técnica se ve reflejado en el número de experimentos propuestos en las diferentes fuentes de neutrones, por la cantidad de proyectos instrumentales en desarrollo en todo el mundo y por la calidad y cantidad de las publicaciones en este ámbito. Los problemas en los que la difracción de neutrones puede hacer su aportación se agrupan principalmente en dos grandes áreas: cristalografía/geociencias y magnetismo/física del estado sólido. En España existe una fuerte comunidad de investigadores dedicada a los estudios bajo altas presiones, federada en el grupo MALTA (Materia a Alta Presión – Consolider), cuyo interés en la difracción de neutrones en condiciones extremas coincide con la primera de las áreas antes mencionadas. Por otro lado, los científicos encuadrados en el área de magnetismo/física del estado sólido, que constituyen la mayor parte de los usuarios españoles de las técnicas neutrónicas, han mostrado en los últimos años un creciente interés por los estudios en condiciones extremas. Este interés ha llevado a proponer la construcción en el Institut Laue-Langevin (ILL) de un nuevo difractómetro de neutrones optimizado para estudios a alta presión y alto campo magnético tanto en muestras en polvo como en monocristales, XtremeD, que funcionará en régimen de CRG y que será presentado en esta comunicación.

TÍTULO: **Understanding Magnetic Interaction Mechanisms in Molecule Based Magnets: Spin Densities Studies**

ÁREA TEMÁTICA: **Grandes instalaciones: sincrotrón, neutrones**

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CONTENIDO:

A good understanding of the magnetic interaction mechanisms has a great importance in the design of new molecular magnets with high ordering temperatures. Moreover these magnetic interaction mechanisms are strongly influenced by the spin density distribution on the molecules, e.g., spin delocalization effects in the super-exchange mechanism or spin polarization effects.

The aim of this work is to understand the particular magnetic behaviour, through the analysis of the experimental and computational determination of the spin density distribution and the magnetic coupling constants, of two kind of magnetic molecular materials, the family A2FeX5·H2O (A=alkali or NH4, X=Cl, Br) and the thiazyl-based magnets p-X-C6F6CNSSN· (X=Br, NO2, CN).

Although the family A2FeX5·H2O had been extensively studied we were interested in these 3D low anisotropy antiferromagnetic series because still remained an interesting open question: why are their transition temperatures relatively high considering that in these compounds there are no m-bridging groups between the iron ions, such as Fe-O-Fe or Fe-X-Fe linkages, but all the super-exchange pathways are of the type Fe-X··· X-Fe or Fe-O ··· X-Fe? Our results shown a high spin density delocalisation (~20%) to the halogen atoms being the more imporant at the X4-halogen belonging to the H bond [1,2]

On the other hand the sulphur based free-radical family represents an alternative to the classical nitrogen-oxygen one for the design of purely organic magnets. In fact, the dithiadiazolyl radical family includes the organic material with the highest known transition temperature into a phase showing spontaneous magnetization and the organic magnet with the second highest transition temperature into a ferromagnetic phase. The subject addressed in our studies was to explore and understand the magnetic interaction mechanisms, via the spin density determination and ab initio modelisations, in this free-radical family and to investigate its suitability for achieving ferromagnetic interactions [3].

[1] J. Campo, et al Phys Rev B. 78, 054415 (2008).

[2] J. Luzón, et al Phys Rev B. 78, 054403 (2008).

[3] J. Campo, et al. in "Magnetism of Carbon Based Materials" Edts: T. Makarova and F. Palacio, Elsevier (2006).

TÍTULO: **Magnetic structure of the metal-organic complex [Co2(bta)]n**

ÁREA TEMÁTICA: **Grandes instalaciones: sincrotrón, neutrones**

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CONTENIDO:

Ones of the areas of solid-state chemistry that has shown remarkable growth over the last two decades is those that involving the synthesis and characterization of metal-organic magnetic materials. As part of our ongoing study of molecular materials, we are reported several studies of correlation between crystal structure and magnetic properties [1].

Exchange mechanisms and magnetic structure in the organic-inorganic layered molecule-based magnet [Co2(bta)]n have been investigated with measures in SQUID magnetometer and supported by a combination of neutron diffraction studies. Cryomagnetic studies demonstrate antiferromagnetic ordering with transition temperature of 16 K, and a subsequent ferromagnetic order at 11 K, for the [Co2(bta)]n complex. The weak interlayer magnetic interaction plays an important role in this complex in spite of the long interlayer separation. A slow relaxation magnetization is observed in [Co2(bta)]n. This is associated with the appearance of the ferromagnetic phase. The magnetic structure of [Co2(bta)]n has been solved at low temperature in zero field by powder neutron diffraction measurements. The structure was found to be antiferromagnetic where the cobalt spins are aligned ferromagnetically in the ac-plane and coupled antiferromagnetically along the b-axis. No evidence of the ferromagnetic long-range order, below 11 K, was observed in neutron experiment.

[1] (a) Fabelo, O; Canadillas-Delgadot, L; Pasan, J; Delgado, FS; Lloret, F; Cano, J; Julve, M; Ruiz-Perez, C. Inorg.chem., 2009, 48, 23, 11342-11351 (b) Fabelo, O; Pasan, J; Canadillas-Delgado, L; Delgado, FS; Labrador, A; Lloret, F; Julve, M; Ruiz-Perez, C. Crystal Growth & Desing, 2008, 8, 11, 3984-3992 (h) Canadillas-Delgado, L; Fabelo, O; Pasan, J; Delgado, FS; Lloret, F; Julve, M; Ruiz-Perez, C. Inorg.chem., 2007, 46, 18, 7458-7465 (c) Fabelo, O; Pasan, J; Lloret, F; Julve, M; Ruiz-Perez, C. CrystEngComm, 2007, 9, 9, 815-827 (d) Canadillas-Delgado, L; Pasan, J; Fabelo, O; Hernandez-Molina, M; Lloret, F; Julve, M; Ruiz-Perez, C. Inorg.chem., 2006, 45, 26, 10585-10594.

TÍTULO: **Possible magnetic anisotropy and interplay of magnetic interactions in a trimer of Mn(II)**

ÁREA TEMÁTICA: **Grandes instalaciones: sincrotrón, neutrones**

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CONTENIDO:

The molecular cluster [Mn3L4](ClO4)2(H2O)2, (HL=2-methoxy-6-(pyridine-2-ylhydrazonomethyl)phenol), has been described as an almost lineal trimer of Mn(II) in a high spin configuration with two isotropic magnetic interactions: nearest neighbours and next nearest neighbours interactions [1]. One striking fact is the experimental EPR g factor of 2.14 for such an isotropic system. Moreover, due to its isotropic and not degenarate nature, the system is an ideal benchmark to investigate the interplay of the magnetic interactions in systems with several magnetic centers and more than one electron per magnetic center.

In this contribution we will present an in deep study of the system through the combination of several experimental and theortical methods (polarized neutron diffraction, magnetic measurements, Density Functional Theory, Multiconfigurational ab initio methods and spin Hamiltonian models) which has allow us to clarify the possible anisotropy of the system and the nature and interplay of the different magnetic interactions.

[1] J. Tang et al., Eur. J. Inorg. Chem., 4119 (2007).

TÍTULO: **Los CRG´s D1B y D15 en el ILL: aplicación de las técnicas neutrónicas para el estudio de la materia**

ÁREA TEMÁTICA: **Grandes instalaciones: sincrotrón, neutrones**

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CONTENIDO:

Los difractómetros D1B y D15 del Instituto Laue Langevin (ILL) tienen un carácter especial ya que trabajan como instrumentos CRG (Collaborating Researching Group). Esto hace que la comunidad científica española tenga acceso privilegiado a los mismos. Ambos CRG´s gestionados por España, a través del Instituto de Ciencia de Materiales de Aragón (CSIC-Universidad de Zaragoza)[1], disponen de un equipo técnico y científico, que se encarga de dar el soporte necesario a los científicos que acuden a realizar experimentos en tiempo de haz ILL o CRG.

El instrumento D1B es un difractómetro de polvo de alto flujo. Tiene un detector de 400 canales abarcando una región angular de 80º. Se pueden realizar experimentos bajo condiciones y entornos diferentes(criostatos [1.5-300K], hornos [20-1000°C], 4-círculos para texturas, campos magnéticos, celdas de presión, etc). Dos monocromadores, proporcionan neutrones con longitudes de onda de 1.28Å (germanio) y 2.52Å (grafito pirolítico). D1B está adaptado para investigar estructuras y transiciones de fase magnéticas, además de para realizar experimentos en tiempo real y/o in situ.

Asímismo el equipo español está trabajando en la construcción de un nuevo detector de neutrones térmicos con tecnología MWGC para D1B. Las características mejoradas de dicho detector, (rango angular (128º), definición (0.1º), y eficacia de detección) permitirán realizar el mismo tipo de experimentos en menos tiempo. También el grupo está diseñando y construyendo un colimador radial oscilante(ROC).

D15 es un difractómetro para monocristales pudiendo funcionar en configuración de 4-círculos o en configuración de normal-beam. Consta de dos tipos de detectores, uno monodimensional y otro bidimensional. Su monocromador de cobre suministra neutrones con tres longitudes de onda, 0.84,1.17 y 1.54Å. D15 tiene su propio criostato que puede trabajar entre 300 y 2K y un crioimán que permite trabajar en el mismo rango de temperatura y aplicar un campo magnético de hasta 8T. Otros entornos como hornos, criostatos de muy bajas temperaturas (50mK) o celdas de presión, también pueden ser empleados. En configuración de 4-círculos se dispone de criostatos tipo displex capaces de enfriar hasta 1.5K. Sus características hacen de D15 un instrumento ideal para estudios cristalográficos, determinación de diagramas de fase H-T,P-T,etc, y determinación de estructuras magnéticas.

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[1] http://spins.unizar.es/

[2] http://www.ill.eu/instruments-support/instruments-groups/

TÍTULO: **Termo-difracción de neutrones in situ en aleaciones binarias de Fe: transformaciones structurales y anomalías magneto-volúmicas**

ÁREA TEMÁTICA: **Grandes instalaciones: sincrotrón, neutrones**

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CONTENIDO:

Hoy en día, la termo-difracción de polvo con neutrones es una técnica ampliamente utilizada en Ciencia de Materiales debido a que permite estudiar "in situ" transformaciones estructurales y/o magnéticas inducidas por cambios de temperatura. Por otra parte, es posible obtener una gran diversidad de aleaciones metaestables, fuera del equilibrio termodinámico, ya sea en estado amorfo o nanocristalino utilizando la molienda mecánica (BM). Esta técnica permite la síntesis de compuestos a partir de elementos que son inmiscibles mediante otras técnicas convencionales de aleado como por ejemplo, las soluciones sólidas nanoestructuradas Fe-Cu [1] o los vidrios metálicos Fe-Zr [2], dando lugar a nuevos compuestos metaestables con propiedades fisico-químicas relevantes. Además, el procesado mecánico mediante BM es también utilizado para alterar de forma severa la microestructura de materiales masivos (disminución del tamaño promedio de grano cristalino a la escala de algunos nanómetros y/o introducción de microdeformaciones a través de la generación de una gran cantidad de defectos, con la consecuente modificación de los entornos atómicos), y provocar la modificación de sus propiedades. Sin embargo, muchos de estos materiales fabricados o procesados mediante BM muestran cambios estructurales drásticos cuando son calentados por encima de temperatura ambiente. Estas transformaciones estructurales pueden ser estudiadas "in situ" mediante termo-difracción de neutrones. En esta contribución se mostrarán varios ejemplos de experimentos de termo-difracción de neutrones realizados en aleaciones binarias de Fe obtenidas mediante BM como son: procesos de segregación de fases en Fe-Cu [3], cristalización de amorfos Fe-Zr [2], fuerte aumento de la temperatura de Curie en aleaciones Fe-Ni invar. [4] o anomalíaas magneto-volúmicas en compuestos Fe-Pr nanoestructurados [5].

[1] A. R. Yavari et al., Phys. Rev. Lett., 68 (1992) 2235.

[2] P. Gorria et al., Phys. Stat. Solidi (RRL) 3 (2009) 28.

[3] P. Gorria et al., Phys. Rev. B 69 (2004) 214421; 72 (2005) 014401.

[4] P. Gorria et al., Phys. Stat. Solidi (RRL) 3 (2009) 115; Phys. Rev. B 80 (2009) 064421.

[5] P. Gorria et al., Acta Mater. 57 (2009) 1724.

TÍTULO: **Structure and transport of LaFeO3 - Sm2CuO4 superlattices**

ÁREA TEMÁTICA: **Física de Superficies e interfases**

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CONTENIDO:

When materials with different work functions are stacked to form a superlattice, charge transfer occurs until the electrostatic potential due to charge build up compensates the difference in work functions. This interfacial charge transfer process is a new route to dope materials. We have grown fully epitaxial superlattices consisting of Sm2CuO4 (SCO), the parent compound of the electron doped cuprates, and LaFeO3 (LFO) an antiferromagnetic insulator. A detailed structural characterization by means of x-ray diffraction, scanning transmission electron microscopy (STEM) and atomic force microscopy (AFM) demonstrates the high structural quality of our samples. Because the chemical potential of LFO is higher than the chemical potential of SCO we expect electrons to be transferred from the LFO to the SCO. We will show electronic transport measurements of the superlattices, and SCO and LFO individual thin films supporting the possibility of electron doping the Sm2CuO4 in these samples.

Work at UCM supported by MAT2008 06517

Work at ORNL supported by the Division of Materials Sciences and Engineering of the US DOE

TÍTULO: **Organic-inorganic hybrid surfaces: a double bottom-up strategy to tune mechanical and electrostatic responses at the nanoscale**

ÁREA TEMÁTICA: **Física de Superficies e interfases**

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CONTENIDO:

Hybrid materials based on oxide supported organic films are the subject of increasing interest because of the many practical applications they may find in nanotechnology. The control of growth and properties of these hybrid structures, on a length scale down to nanometric dimensions, is one of the major challenges in the field and surface science strategies based on the use of nanostructured substrate surfaces can be employed to initiate and control the growth. Besides the appealing properties of the substrates and those of the materials growing on their surface, the capability of confining these properties at the nanoscale in a controlled, although challenging, is of major technological interest in a variety of fields. Here we will show that STO is a promising substrate due to the flexibility in this type of design.

We firstly address the dynamics of surface diffusion that allows chemical-termination nano-patterning in STO single crystals and, secondly, the growth selectivity driven by such termination is applied to stearic acid. As a result of the adsorption of this molecule both the mechanical and electronic properties of the surface are modified. The properties of the resulting surface in terms of friction and surface potential are given and discussed in reference to the bare substrates. The obtained results allow us to conclude that the STO surface properties can be locally tuned by employing a double bottom-up strategy which combines the use of chemically nanopatterned substrates with molecular self-assembly.

TÍTULO: **Andreev Reflection in FEBID-Co - FIBID-W nanocontacts**

ÁREA TEMÁTICA: **Física de Superficies e interfases**

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CONTENIDO:

The quality and functionality of materials grown by focused electron/ion beam techniques are of primary importance in a vast range of applications such as photomask repair, scanning probe sensors, circuit editing, nanophotonics, micro- and nano-electronics, etc.

We report a novel and flexible method to create ballistic nanocontacts for current-in-plane Andreev reflection (AR) measurements via the joint use of Co-based magnetic nanodeposits and W-based superconducting nanodeposits to create ballistic superconductor-magnetic metal nanocontacts showing AR. Below the critical temperature of the superconductor, the bias-voltage dependence of the differential conductance can be nicely fitted using the model proposed by Blonder, Thinkam and Klapwijk (BTK) for a contact between a normal metal and a superconductor, but extended to include the spin polarization P of the metal. The spin polarization of the FEBID-Co nanodeposit obtained from fittings is about 40%, which confirms that the FEBID-Co nanodeposits exhibit suitable properties for its implementation in Spintronics devices. The high quality of the fits allows a detailed analysis of the temperature dependence of the superconducting gap of the FIBID-W nanodeposit. The fitted value of the superconducting gap follows the standard BCS dependence, as it has been observed by Scanning Tunnelling Spectroscopy [1], with a critical temperature of 4.5 K, which confirms that FIBID-W nanodeposits are very promising for applications in AR measurements and in other applications in nanotechnology.

[1] I. Guillamon, H. Suderow, S. Vieira, A. Fernandez-Pacheco, J. Sese, R. Cordoba, J. M De Teresa, M. R. Ibarra, New Journal of Physics 10, 093005 (2008).

TÍTULO: **'In situ' assessment of non-magnetic phase formation in (Fe/Si)n films by magnetic measurements**

ÁREA TEMÁTICA: **Física de Superficies e interfases**

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CONTENIDO:

The diffusion of Si atoms in Fe nanometric layers is known to occur when (Fe/Si)3 nanometric multilayers are submitted to temperatures over 400 K. An "in situ" method to asses this process has been developed recently by performing magnetization measurements at high temperature, reaching 800 K [1]. The detailed characteristics of the Fe/Si interface was proposed to influence the process strongly. To study this question a different type of (Fe/Si)3 multilayers has been studied by high temperature SQUID magnetometry.

The samples have been prepared by thermal evaporation in a molecular-beam epitaxy system on a GaAs substrate previously covered with an Fe buffer layer and a silver layer. This method creates smooth pin-hole free interfaces in the subsequent Fe/Si layers. Four samples with Fe thickness between 1.2 and 3.8 nm were prepared [2] and measured with the high temperature oven option in a SQUID magnetometer.

The magnetization measurement as a function of the temperature is done by annealing the sample at a rate of heating 5K/min. It reveals the irreversible process that starts in the temperature range of 400-650K due to the formation of nonmagnetic silicides. The temperature and time dependence of the magnetization could be correlated with the non-magnetic silicide formation determining the loss of magnetization as temperature raised. The process is irreversible thus in cooling measurements the remaining non-transformed magnetic Fe was determined and subtracted from the heating magnetization. This correlation allows to determine the kinetic parameters for the solid phase reaction producing iron silicide formation at the interface. Fitting the relative mass of the transformed Fe as a function of time the diffusion activation energy and the diffusion constant of each sample have been determined.

We can conclude that the degree of silicide formation has decreased in comparison with previous works. The technique used for preparing the samples (ion-beam sputter epitaxy) has a strong influence on the diffusion process. Therefore, these multilayers have a better crystalline quality and a interface with lower roughness.

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TÍTULO: **Spin-lattice relaxation via quantum tunnelling in molecular nanomagnets**

ÁREA TEMÁTICA: **Física del sólido para la información cuántica**

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CONTENIDO:

The fundamental equations of Magnetism, including Curie's law, rely on the ability of magnetic moments to attain thermal equilibrium with the solid lattice. In spite of the progress achieved in studying and manipulating individual spins in solids. the spin-lattice relaxation mechanisms are not well understood. A most intriguing situation arises when spins flip via quantum tunnelling [1-2]. The difficulty stems from the fact that tunnelling modifies the magnetization, but conserves the energy of the spin ensemble (which includes nuclear spins as well as electronic spins). In the present work, we have investigated the spin-lattice relaxation rates of very simple molecular clusters [3-4], containing individual lanthanide ions, by means of ultralow-temperature ac susceptibility experiments, which cover a wide region of frequency ($0.01\ Hz < f < 1MHz$). We find that the rates are independent of temperature and enhanced by dipolar interactions between their electronic spins. In contrast, they are rapidly suppressed by external magnetic fields. These results show that spins transfer energy to the "dipolar bath" via quantum tunnelling processes, and then the latter delivers this energy very efficiently to the lattice. This new mechanism is expected to be involved in diverse magnetic phenomena such as the spin-glass freezing of lanthanide-based materials, the spin-lattice relaxation of nuclear spins, or the low-frequency noise of superconducting devices. Since the spin-lattice interaction is a source of quantum decoherence, our results could also help to design "robust" molecular spin qubits based on the polyoxometalate molecules reported in this work.

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TÍTULO: **Quantum switches in circuit QED**

ÁREA TEMÁTICA: **Física del sólido para la información cuántica**

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CONTENIDO:

Controlling the interaction between two quantum objects is a challenging task. However, it represents a fundamental requisite for any quantum information processing.

Circuit QED is the solid state analogue to Cavity ElectroDynamics in Quantum Optics, where atoms and light are coupled in a controlled way. In the solid state the photons are carried through vsuperconducting transmission lines, while the atoms are now superconducting qubits (few level and controllable systems).

In this talk I will present theoretical proposals for controlling the interaction between the qubit and the cavity. Besides, we alsobpresent complex architectures where the control is on the coupling between different transmission lines or qubits. In summary we provide theoretical tools for building different quantum switches.

Finally I will advance the experimental status for all these theoretical proposals.

TÍTULO: **Permanent magnetism in phosphine- and chlorine-capped gold clusters and nanoparticles**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Recent experimental results regarding the magnetic character of thiol-capped gold nanoparticles with element specific techniques (X-ray magnetic circular dichroism, XMCD, and Mössbauer spectroscopy) [1,2] have shown that magnetism is bounded to the gold surface atoms bonded to the thiol-protecting ligands. The research work presented here concerns the detailed study of the magnetic behaviour measured in phosphine-chlorine-capped gold nanoparticles (with core diameters around 2 nm). The investigation has been extended to subnanometric phosphine-chlorine-capped undecagold clusters. Both systems were synthesized in-house by a chemical route [3,4].

Transmission electron microscopy (TEM), scanning electron microscopy (SEM), X-ray absorption spectroscopy (XAS) and superconducting quantum interference device magnetometry (SQUID), have been used to discern the necessary conditions that give raise to a permanent magnetic moment. In addition, electron paramagnetic resonance measurements are used to rule out contributions to the magnetic moment from eventual ferromagnetic impurities. These experimental results reinforce the conclusions drawn from the previous works: the magnetic moment is located in the surface gold atoms. Additionally, when the NPs size decreases to the subnanometric size range the permanent magnetism disappears. The near edge structure of the XAS data points out that charge transfer between gold and the capping system occurs in both cases. These results strongly suggest that nearly metallic Au bonds are also required for the induction of magnetic response.

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[3] P.A. Bartlett, B. Bauer, S.J. Singer, Journal of the American Chemical Society 100, 5085–5089 (1978).

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TÍTULO: **Control del campo coercitivo de láminas delgadas de hierro mediante redes periódicas de agujeros**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

The coercive magnetic field of Fe thin films can be tailored with the inclusion of antidots arrays, that will act as pinning centers for the motion of domain walls. Experiments showing this phenomenon have been performed in micrometrical range [1,2], and simulations have described the behavior in nanometrical range [1,3].

We are performing a systematic study in nanometrical range, in order to compare directly experiments and simulations. Crystalline Fe films of thickness 10nm are grown on MgO substrates by sputtering. Nanopatterning of antidots is achieved with e-beam lithography and ion-milling. It follows an optical lithography step to define contacts for transport measurements. The antidots geometries are square arrays of circles with similar diameter and interdistance in the range 50nm - 1000 nm. Results have been obtained for 1000 nm diameter antidots, which are responsible of duplicating the coercive field, and for 700 nm diameter antidots, achieving a three times larger coercive field.

[1] I. Ruiz, L. Lopez, A. Hirorata, J. Rothman, C. M. Guertler, J. A. C. Bland, L. M. García, J. M. Torres, J. Bartolomé, F. Bartolomé, M. Natali, D. Decanini, Y. Chen., Journal of Magnetism and Magnetic Materials 242-245, 597-600 (2002).

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[3] J. M. Torres, J. Bartolomé, L. M. García Vinuesa, F. Garcia Sanchez, J. M. Gonzalez, O. A. Chubykalo, Journal of Magnetism and Magnetic Materials 290-291, 149-152 (2005).

TÍTULO: **Analysis of the Kondo Effect in Low Coordinated Ferromagnets**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Recently we reported the observation of Kondo Physics in one-atom contacts between pure ferromagnetic metals such as Fe, Co, or Ni [Nature 458, 1150 (2009)]. Using a Scanning Tunneling Microscope (STM) or Electromigrated Break Junctions we fabricated atomic contacts on these ferromagnetic materials and Fano-Kondo resonances where found in the conductance with the characteristic behavior of a Kondo system.

One of the advantages of our setup configuration is the capability of the STM to study and analyze hundreds of atomic contacts. This has given us the unique opportunity of performing statistics on the Fano parameters of our conductance curves. Here we show a complete analysis of the Fano parameters of a Kondo system consisting in a one-atom contact with a localized magnetic moment interacting with the conduction electrons. A statistical analysis shows the dependence of the Kondo system with the different degrees of couplings to the environment. We will compare the cases of Ni, Fe and Co which could reflect differences in the localization of the magnetic moment.

TÍTULO: **Imaging of magnetic domain walls in cobalt nanowires grown by focused-electron-beam-induced deposition**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Focused electron beam induced deposition (FEBID) is a one step maskless technique for the growth of nanostructures. A gas injection system (GIS) allows to insert a needle near the substrate´s surface. The GIS releases precursor gas molecules (usually organo-metallic materials) which are then adsorbed on the substrate. The focused electron beam is scanned at the substrate's surface interacting with the precursor gas molecules and decomposing them, creating a metallic deposit.

Using this technique we have been able to deposit magnetic Co nanowires with a high Co content, above 90% [1]. The dependence of the coercive field with the width of the wires has been systematically measured using MOKE at the Imperial College in London [2]. In this contribution we present a MFM study in order to image the magnetic domains formed in wires of varying apect ratios (AR) and investigate their magnetization reversal. The images obtained provide us with data to analyze the multidomain-monodomain transition when the AR is varied. At high AR the shape anisotropy forces the magnetizacion to lie along the wire. The magnetization reversal on these wires is achieved by domain wall nucleation and propagation. On the contrary at low AR the most favorable magnetization state in the wire is the creation of closure domains at the edges or a multidomain stucture avoiding the creation of magnetic charges on the edges which are now comparable to the lenght of the wires, as previously studied in permalloy [3,4]. The dependence of the coercive field with the thickness of the nanowires has also been explored using the 3D modes of MFM studying 250 nm wide wires with thicknesses varying from 10 to 150nm.

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TÍTULO: **Origin of the enhanced magnetic moment in epitaxial Fe3O4 ultra thin films**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Recent studies performed by S. K. Arora et al. [1, 2] on well characterized epitaxial Fe3O4 thin films grown on MgO [100] show that the ultrathin films (<5 nm thickness) are ferromagnetic and their magnetic moments are much greater than those of bulk magnetite. The main factor contributing to the observed enhanced magnetic moment is inferred to be the noncompensation of spin moments between the tetrahedral and octahedral sublattices at the surface, at the interface with the substrate and at the antiphase-domain boundaries. However, the origin of this unexpected behavior is still unclear.

The same tendency has been observed in our Fe3O4 thin films grown on MgO (001) substrates by pulsed laser deposition [3]. Structural, magnetic and electrical characterizations reveal a 001-oriented epitaxial growth with high crystallinity of the films and with no other iron oxide phases.

In order to understand the magnetic behaviour of the Fe3O4 thin films, polarized neutron reflectivity (PNR) measurements were performed revealing no "giant" magnetic moment, either at the interfaces or homogenously distributed over the film thickness; and the presence of metallic iron clusters, which could also lead to an enhanced magnetic moment, was discarded from X-Ray Photoemission Spectroscopy (XPS) measurements.

It has been recently reported the possible sources of experimental errors in the observation of nanoscale magnetism [4], as when measuring small signals (below 10^-4emu) magnetic signals introduced in our samples when handling them or due to impurities in the sample substrates must be considered. Therefore, a study of the as-cast standard MgO substrates was performed by means of Inductively Coupled Plasma Mass Spectroscopy (ICP) and SQUID magnetometry measurements, finding the origin of the anomalous magnetic moment in the Fe impurities presence within the commercial substrates.

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TÍTULO: **Synthesis and self-assembled of 1-D nanostructures based on La0.3Sr0.7MnO3 from template directed chemical solution deposition**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

A method of preparing complex oxides nanostructures by sol-gel based polymeric precursor solution is performed by using a novel version of track etched polymer templates directly buffering substrates. The main goal here is to generate with this method nanostructures inducing nanostructuration across the entire substrates, the dimensions and localization of these nanostructures being pre-set by the polymeric nanotemplate. We demonstrate that self standing single crystalline La0.7Sr0.3MnO3 (LSMO) nanowires with diameters ranging from 50 to 200nm and lengths varying from 2 to 40 μm can be successfully synthesized on top of Si substrate; we prove that these nanowires exhibit a monoclinic crystallographic structure not known up to now for manganite [1]. In addition, self-assembled epitaxial LSMO monoclinic nanowires are obtained when the same methodology is used on fluorite (doped-CeO2) buffered substrates. Further self-organization and coarsening of the nanowires up to 40 μm in length is achieved through kinetic evolution at high temperatures.

As a model system, La0.7Sr0.3MnO3 polycrystalline vertical nanorods in the range of 100 to 300 nm in lateral sizes and up to 1 μm in height have been also grown on STO and LAO single crystal substrates at mild temperatures (800 ºC), using a polycarbonate nanotemplate buffer layer. The nanorods suffer a profound transfo rmation into vertical single crystalline (La,Sr)xOy nanopyramids sitting onto a LSMO epitaxial wetting layer, upon strong thermal activation (1000ºC). The driving force for this outstanding nanostructural evolution is the minimization of the total energy of the system that is reached by reducing the grain boundary energy and total surface and strain relaxation energies. Finally, advanced electron microscopy techniques were used to highlight the complex phase separation and structural transformation occurring when the metastable state is overcome [2].

[1] A. Carretero-Genevrier, N. Mestres, T. Puig, A. Hassini, J. Oro, A. Pomar, F. Sandiumenge, X. Obradors, E. Ferain, Adv Mater. 20, 3672(2008).

[2] A. Carretero-Genevrier, J. Gázquez, T. Puig, N. Mestres, F. Sandiumenge, X. Obradors, and E. Ferain, Adv. Funct. Mater., 10.1002/adfm. 200901971(2009).

TÍTULO: **Magnetotransport properties of Fe-based nanowires grown by focused-electron-beam-induced-deposition**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Focused-electron-beam-induced-deposition (FEBID) using gas precursors containing magnetic elements allows the direct writing of magnetic nanostructures [1]. We have demonstrated that the use of Co-based precursors allows the growth of highly-functional magnetic nanostructures by FEBID, with Co content up to 95 at.% [2-4]. It is also possible to grow (under UHV conditions) high-quality Fe deposits with Fe content up to 95 at.%, but no magnetic characterization of such deposits has been reported so far [5].

In the present contribution we describe the ongoing research on the use of the Fe2(CO)9 precursor to grow functional Fe-based nanowires by FEBID in a FEI Nova Nanolab 600i dual-beam equipment. The Fe wires contain up to ~80 at.% Fe as measured by in-situ Energy Dispersive X-ray spectroscopy (EDX). Magnetic characterization of the Fe nanowires by longitudinal MOKE at room temperature show a ferromagnetic response. The coercive fields measured with MOKE coincide with those observed in the measurements of longitudinal magnetoresistance. The systematic study of the room-temperature magnetoresistance in longitudinal, transversal and perpendicular configurations indicate the existence of anisotropic magnetoresistance with value ~0.4%. The room-temperature resistivity is a factor of ten larger than that in bulk Fe. Hall effect measurements indicate the existence of ordinary and anomalous Hall contributions, which further confirms the ferromagnetic character of the nanowires. The set of results will be used to evaluate the degree of ferromagnetism attained in these nanowires and their potential use in magnetic applications.

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[3] A. Fernández-Pacheco et al, Nanotechnology, in press.

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TÍTULO: **Superconducting vortex dynamics in Nb thin films induced by the magnetic states of Ni nanoring arrays**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

We have used Electron Beam Lithography to prepare hybrid systems consisting of arrays of nanometric Ni rings (elliptical and circular) covered by a superconducting Nb film. These nanometric rings (typically 700nm diameters and 125nm widths) were characterized by a First Order Reversal Curve (FORC) method to realize the onion and vortex magnetic state at remanence. The transport properties of the superconducting Nb film were measured in the mixed state by applying a magnetic field (H) perpendicular to the sample. Classical pinning matching effects of very high order were observed in resistance vs H, which vary with the magnetic state of Ni rings. Interestingly, a ratchet effect characterized by a dc output voltage produced by an applied ac current is found. Moreover, the ratchet effect is drastically modified by the remanent magnetic state of the Ni rings. The systematic and origin of the ratchet effect will be discussed.

TÍTULO: **Formación de contactos atómicos de Au y Ag**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Mediante el uso de un Microscopio de Efecto Túnel (STM) es posible formar contactos de un único átomo entre dos electrodos metálicos. El proceso de formación de contactos atómicos suele acompañarse de un salto abrupto de la conductancia conocido como "Jump to Contact".

En este trabajo presentamos un estudio estadístico de este efecto en Au y Ag.En particular estudiaremos la probabilidad de formación de contactos atómicos monoméricos, diméricos o de doble enlace.

TÍTULO: **Electrical and optical study of Si-doped GaN nanowires**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Silicon doped GaN nanowires (NWs) grown by plasma assisted molecular beam epitaxy with ~3 μm length and ~40 nm diameter, have been studied. For morphological characterization we employed a high resolution scanning electron microscope. The electrical properties of the samples have been studied by means of an Atomic Force Microscope in dark and at room temperature using two different geometric configurations: as-grown and dispersed on a non-intentionally doped GaN substrate with deposited Al stripes of various sizes. Both configurations have provided I-V curves characteristic of single selected nanowires. All curves show a rectifying behaviour which is ascribed to the AFM tip contact and the possible presence of an oxidized shell around the wire [1]. The slope of the curves, in forward bias, and the threshold voltage, in backwards bias, both increase with the nominal amount of silicon. From these measurements, and making adequate geometrical assumptions, we have estimated the electron concentration in the samples [2,3], which covers the range between 7•1017 and 4•1018 cm-3.

The photoluminescence spectra of the samples show one asymmetric peak. Both the peak energy and its width increase with silicon concentration, while its intensity decreases. This behaviour is ascribed to band filling and potential fluctuations due to the random distribution of impurities [4]. On the other hand Raman results show a small red-shift of the E2h mode with increasing silicon content, attributed to the tensile strain induced in the lattice by doping and in agreement with previous works [5].

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TÍTULO: **Metal-Insulator transition in graphene**

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CONTENIDO:

We have studied the quantum Hall states in graphene at the transition from $\nu=-2$ to $\nu=0$. We observed a MI transition when the magnetic field is tuned across a critical field $B_c=16.7\,$T. Using the standard scaling theory analysis we have obtained the critical exponent of the transition $\kappa=0.58\pm0.03$, in agreement with the common value observed for this exponent for the MI transition between quantum hall plateaus in conventional 2D systems. To our knowledge this is the first measurement of this exponent in graphene and therefore the first measurement in a truly 2D system. We observe, that both the Hall conductivity and the Hall resistance remains quantized deep into the insulating phase suggesting that we are in the quantized Hall insulator regime as for the plateau-insulator transition in low mobility 2D systems. Our results reproduce the usual picture for QH plateau to insulator transitions in conventional quasi 2D systems. Therefore two distinct MI transitions exists near the Dirac point in graphene, namely a conventional QH-insulator transition as the observed in our experiment and the recently observed Kosterlitz-Thousless transition by Checkelsky (et al). Further studies at lower temperatures and higher magnetic fields are needed to confirm our results in a larger range of temperatures and magnetic fields, and in particular to try to find the conditions were both transitions could be observed at the same time.

TÍTULO: **Chemically Grown La0.7Sr0.3MnO3/Single Crystal Heteroepitaxies**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

The development of self-assembly processes to pattern large areas with epitaxial ferromagnetic manganite nanostructures will provide a model system to establish the influence of the ferromagnetic behaviour at the nanoscale. This requires a good understanding of the formation mechanisms of these nanostructures (strain relaxation and surface energies) as well as a good control of growth parameters.

in this work we study self-assembled la0.7sr0.3mno3 (lsmo) nanoislands grown onto different (001) single crystalline substrates, namely srtio3 (sto), yttria-stabilized zro2 (ysz), mgo, and zr doped ceo2 (czo) buffers deposited on ysz, from ultradiluted chemical solutions based on metal propionates. the different crystallographic structure and lattice mismatch between lsmo and each substrate results in either atomically flat thin films (lsmo/sto), or in highly uniform self assembled lsmo nanoislands with a narrow size distribution (lsmo/ysz, lsmo/mgo, lsmo/czo). The crystallographic orientation and texture were characterized by x-ray diffraction. tem studies evidence the different degrees of strain obtained through the tuning of the substrate/island interface and confirm the fine control of their shape and orientation. Squid measurements show that the nanostructures exhibit ferromagnetic ordering with tc=350k. The local magnetic structure was investigated using magnetic force microscopy.

TÍTULO: **Ordered Arrays of Manganite Oxide Nanostructures from Electron Activated Water Developable Precursors**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

TOPIC: **Electron Beam Lithography**

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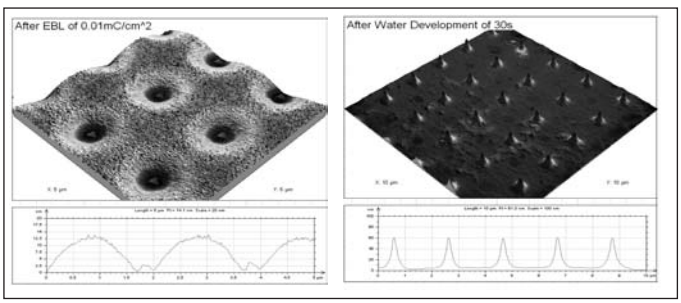
CONTENIDO:

Many physical properties like magnetism are anisotropic and its magnitude can be strongly influenced by nanomorphology. We demonstrate a versatile approach for site specific fabrication of ferromagnetic nanostructures by way of electron beam lithography (EBL) on a dual positive/negative type resist. In this way, ordered nano-metric patterns of the ferromagnetic mixed valence oxide $La_{0.7}Sr_{0.3}MnO_3$ have been produced on single crystalline oxide substrates. La, Sr, and Mn in nitrate salt form are mixed in the stoichiometric ratio of 0.7:0.3:1.0 with polyvinyl alcohol (PVA) in an aqueous solution. The precursor solution is then spin coated onto a single crystal wafer including $LaAlO_3$, $SrTiO_3$, and yttria-stabilized zirconia (YSZ). The electron sensitive and water developable resulting precursor thin film is irradiated with various electron dosages in vacuum to define the nano-structures, causing the film to be polymerized locally at low dosages (0.01mC/cm^2). This polymerized film is water insoluble and thus when developed in water, the rest of the hydrophilic film is cleaned away leaving those remaining structures. At medium dosages (0.1 mC/cm^2), an auto-ignition reaction between the nitrates and the PVA takes place, and finally a localized crystallization at very high dosages occurs (100 mC/cm^2) [1]. Later the developed nanostructures are subjected to a high temperature treatment at 800ºC for 8h to produce finally structures. These written structures can be both positive and negative depending on the irradiation dosage and are magnetic and crystalline due to the adoption of the substrates crystallographic spacing [2,3]. We have observed structures going from an average height of 65nm after water development to 20nm after oven treatment due to crystallization and loss of organic components. This methodology is very general and can be applied to make nanostructures of any functional oxide in the desired stoichiometry.



[1] M.C. Wu *et al.*, J. Appl. Phys. 104 (2008) 024517.

[2] M. C. Wu *et al*., J. Mater. Chem. 18 (2008) 780.

[3] C. M. Chuang *et al*., Nanotechnology 17 (2006) 4399.

TÍTULO: **Magnetic response of cobalt nanoparticles embedded in gold and vanadium-gold systems**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Magnetic nanoparticles have generated an increasing interest because their reduced dimensions lead to drastic changes in the physical properties of the systems in which they are incorporated. In this work, cobalt nanoparticles are grown with an Ion Cluster Source under ultra high vacuum conditions. The nanoparticles fabricated by this method present a homogeneous and random distribution over an extended area (few cm2). With this study we aim to establish, for a given nanoparticle size, the maximum coverage density for which the interactions between magnetic nanoparticles are negligible and the nanoparticles behave as individual domains. The nanoparticle size have a fixed value of around 10 nm in all the samples and the coverage density of the nanoparticles is varied from 10 % to 60 % of a monolayer. With these conditions, two different systems are studied: the first with the Co nanoparticles embedded in gold and the second with the Co nanoparticles embedded in vanadium in a gold/vanadium multilayer. The comparison between both systems give information about the interactions between Co nanoparticles and the V matrix on the magnetic response of the systems. Morphological characterization of the systems was carried out by using Atomic Force Microscopy (AFM) and High Resolution Transmission Electron Microscopy (HR-TEM). The magnetic characterization was performed by SQUID. The analysis of the hysteresis loops revealed that the vanadium matrix has an influence on the coercivity of the systems, making magnetically harder these systems, and on the saturation magnetization due to an antiferromagnetic coupling between vanadium and cobalt.

TÍTULO: **Control of magnetization in epitaxial Fe planar nanowires**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

The in-plane magnetization reversal processes of planar nanowires, with widths of a few hundred nanometers, fabricated from epitaxial Fe/MgO(001) thin films have been investigated using vectorial Kerr magnetometry. At low angles between the applied field and the axis of the wires, the magnetization reversal follows a nucleation-propagation sequence in which the coercivity is associated with a pinning mechanism. When the field is applied almost perpendicular to the wires, a reversible linear region is observed at low field values, followed by a high susceptibility step that occurs at fields higher than the anisotropy field of Fe and takes the magnetization close to saturation. The magnetization configuration at remanence is, for both considered applied field directions, quasi-uniform and corresponding to an average magnetization directed parallel to the wires long axes. The observed hysteretic behaviour can be quantitatively understood in terms of the anisotropy energies associated to

the well defined in-plane magnetocrystalline easy axes and the in-plane easy axis originated by the magnetostatic energy. More concretely, the perpendicular to the wire axis hysteresis process of the nanowires can be accurately described in terms of the Fe intrinsic properties and the shape and dimensions of the wires.

TÍTULO: **Controllable Manganite Nano-Islands Formation from Electron Beam Lithography on Single Crystals**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Many physical properties like magnetism are anisotropic and its magnitude can be strongly influenced by nano-morphology. We demonstrate a versatile approach for site specific fabrication of ferromagnetic nanostructures by way of electron beam lithography (EBL) on a dual positive/negative type resist. In this way, ordered nanometric patterns of the ferromagnetic mixed valence oxide La0.7Sr0.3MnO3 have been produced on single crystalline oxide substrates. La, Sr, and Mn in nitrate salt form are mixed in the stoichiometric ratio of 0.7:0.3:1.0 with polyvinyl alcohol (PVA) in an aqueous solution. The precursor solution is then spin coated onto a single crystal wafer including LaAlO3, SrTiO3, and yttria-stabilized zirconia (YSZ). The electron sensitive and water developable resulting precursor thin film is irradiated with various electron dosages in vacuum to define the nano-structures, causing the film to be polymerized locally at low dosages (0.01mC/cm2). This polymerized film is

water insoluble and thus when developed in water, the rest of the hydrophilic film is cleaned away leaving those remaining structures. At medium dosages (0.1 mC/cm2), an auto-ignition reaction between the nitrates and the PVA takes place, and finally a localized crystallization at very high dosages occurs (100 mC/cm2) 1. Later the developed nanostructures are subjected to a high temperature treatment at 800ºC for 8h to produce finally structures. These written structures can be both positive and negative depending on the irradiation dosage and are magnetic and crystalline due to the adoption of the substrates crystallographic spacing2,3. We have observed structures going from an average height of 65nm after water development to 20nm after oven treatment due to crystallization and loss of organic components. This methodology is very general and can be applied to make nanostructures of any functional oxide in the desired stoichiometry.

[1] M.C. Wu et al., J. Appl. Phys. 104 (2008) 024517.

[2] M. C. Wu et al., J. Mater. Chem. 18 (2008) 780.

[3] C. M. Chuang et al., Nanotechnology 17 (2006) 4399.

TÍTULO: **Tunning spr in Au films by trermal treatments**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Surface Plasmon Resonance (SPR) is one of the most outstanding properties of Au nanostructures, as it enhances the electric field locally up to 1000 times. For Au NPs SPR corresponds to localized plasmons, while in the case of Au films surface plasmons are itinerant, traveling along the Au/dielectric interface. In this work we present a study on both itinerant and localized SPR in Au films prepared by thermal evaporation and submitted to thermal treatments in order to modify the film morphology. Au films deposited onto glass substrates with different thicknesses, between 30 and 70 nm, exhibit itinerant surface plasmons that can be measured with the Attenuated Total Reflection (ATR) method. During thermal annealing diffusion is activated and the continuous Au film transforms into a distribution of Au three-dimensional clusters on the glass surface, as evidenced by Atomic Force Microcopy. The final morphology of the islands depends on the initial thickness of the Au film and the temperature of the thermal treatment. By controlling these parameters it is possible to obtain either small Au islands exhibiting localized SPR or large islands where the surface plasmons retain their itinerant character. Thus, we show in this work how thermal treatments qualitatively modify the optical response of a Au thin film.

TÍTULO: **Control of the chirality and polarity of magnetic vortices in triangular nanodots**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Magnetic vortex dynamics in lithographically prepared nanodots is currently a subject of intensive research, particularly after recent demonstration that the vortex polarity can be controlled by in-plane magnetic field. This has stimulated the proposals of non-volatile vortex magnetic random access memories. In this work, we demonstrate that triangular nanodots offer a real alternative where vortex chirality, in addition to polarity, can be controlled. In the static regime, we show that vortex chirality can be tailored by applying in-plane magnetic field, which is experimentally imaged by means of Variable-Field Magnetic Force Microscopy. In addition, the polarity can be also controlled by applying a suitable out-of-plane magnetic field component. The experiment and simulations show that to control the vortex polarity, the out-of-plane field component, in this particular case, should be higher than the in-plane nucleation field. Micromagnetic simulations in the dynamical regime show that the magnetic vortex polarity can be changed with short-duration magnetic field pulses, while longer pulses change the vortex chirality.

TÍTULO: **Modelling and Elucidating Magnetic Properties of Colloidal Nanostructures based on Interparticle Interactions**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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Autor 4: ***David Serantes*** (Universidade de Santiago de Compostela)

Autor 5: ***Daniel Baldomir*** (Universidade de Santiago de Compostela)

CONTENIDO:

Several technological applications rely on the promising scenario of nanoscale-based magnetic materials. Bearing this option in mind, colloidal synthetic approaches have proven to be very effective for the synthesis of morphologically different magnetic nanostructures. These nanostructures present a magnetic behavior that arise due to a complex interplay between the intrinsic properties of the constituents (microstructure, finite size or surface effects) and the interactions among the entities forming them.

Herein we study a few systems composed by superparamagnetic nanoparticles with characteristic magnetic behaviors directly dependent of these parameters and underlying the fundamental role of the magnetic interparticle interactions established.

TÍTULO: **Nonlinear response of molecular nanomagnets: a journey across the quantum to classical border**

ÁREA TEMÁTICA: M**ateriales nanoestructurados y nanotecnologías**

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CONTENIDO:

We report recent studies, experimental and theoretical, of the nonlinear magnetic response of single-molecule magnets [1-3] and ferritin. Compared with the linear ac susceptibility, the nonlinear susceptibility provides additional information on the relaxation process at a little cost in terms of experimental time and complexity. The nonlinear dynamic susceptibility depends not only on the relaxation times, as the linear susceptibility does, but also on its fragility against the application of external magnetic fields and on the influence of the environment. We show that the presence of resonant spin tunnelling, and its strong dependence on external bias that detune the discrete tunnelling levels, gives rise to a very large contribution to the nonlinear response of Mn12 clusters, which has the reversed sign with respect to the classical nonlinear contributions. This technique therefore offers an unambiguous method to investigate whether quantum phenomena survive as the macroscopic, or continuum limit is approached [4]. Experimentally, this can be achieved by either decreasing the magnetic anisotropy, therefore increasing the density of energy levels, or by increasing the size and thus also the spin of a nanomagnet. A realisation of the former possibility is provided by "fast relaxing" Mn12 clusters. Our data reveal that, compared with the standard Mn12, this species shows a ten times smaller quantum nonlinear response. For natural spleen-horse ferritin molecules, which store about 4500 iron atoms each and possess a net magnetic moment of approximately 240 μ_B, the nonlinear dynamical response is found to be fully compatible with classical predictions.

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TÍTULO: **SQUID-microsusceptometry on nanoparticle layers fabricated by dip-pen nanolithography: a new combination towards the direct characterization of surface** PATTERNED NANOPARTICLES

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CONTENIDO:

Nanosized magnets are promising candidates for different applications such as quantum computing or high-density information storage, all of them requiring thin films or monolayer particle arrangements. Although much effort has been done in this field, the preservation of the magnetic properties in these conditions remains still unclear. We report experimental results showing magnetic measurements performed over a thin film of magnetic nanoparticles using a high sensitivity SQUID-microsusceptometer. This device, recently developed in our laboratories*, enables us to measure AC magnetic susceptibility in a broad bandwidth of frequencies (0.01 Hz-1 MHz) and down to very low temperatures (T≈13 mK). Monolayer detection is possible due to its high spin sensitivity of 10E4 Bohr magneton/Hz^1/2 below 300 mK and 100 kHz for a sensing area of approximately 50 micron ? 200 micron. Nanoparticle arrays were deposited over this surface using dip-pen nanolithography. This technique provides total control of the amount and location of particles which can be deposited over the most sensitive areas of the pick-up coils. The samples used in this study were antiferromagnetic cobalt oxide 3 nm diameter sized particles mineralized inside the cavity of ferritin, the iron storage protein of living beings. Measurements show superparamagnetic behaviour with a net magnetic moment of 9 Bohr magneton/particle. The susceptibility follows Curie's law down to very low temperatures indicating thermally activated reversion of the magnetic moment. Below 80 mK, a narrow peak appears but the susceptibility continues rising until 13 mK. This behaviour can be accounted for if the magnetic relaxation is dominated, in this extreme temperature region, by quantum tunnelling of the magnetization. The fabrication of new devices with improved spin sensitivities is in progress, the latter is essential to measure different magnetic particles or molecules in diverse arrangements. The combination of our SQUID-susceptometer and dip-pen nanolithography will provide a powerful tool in the study of nanosized magnets, not only because of the ability of single layer or even isolated single spins detection but also because of its ability of measure in extreme conditions of frequency and temperature.

* M.J. Martínez-Pérez et al. Rev. Sci. Instrum. 80. In press.

TÍTULO: **Red de vórtices superconductores en películas superconductoras sobre nanoestructuras magnéticas: Experimentos y simulaciones**

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CONTENIDO:

El movimiento de vórtices superconductores en películas superconductoras crecidas en sustratos donde existen redes de nanodefectos magnéticos da lugar a una gran riqueza de comportamientos experimentales. Por ejemplo, cambiando el valor del campo magnético aplicado (número de vórtices) se encuentran condiciones de conmensurabilidad entre la red de vórtices y la red de nanodefectos. Este llamativo efecto se manifiesta experimentalmente por mínimos en la resistencia eléctrica ("frenado" en el movimiento de los vórtices) al variar el campo magnético. En este trabajo se comparan los resultados experimentales con simulaciones numéricas donde los únicos parámetros utilizados son la interacción vórtice-vórtice (dada por la función de Bessel de orden cero) y la simetría impuesta por la red de nanodefectos.

TÍTULO: **Growth of TFA-YBCO nanocomposite films with added preformed nanoparticles**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

In the last years vortex pinning capabilities of coated conductors have been enhanced by the introduction of controlled secondary phases in the YBCO matrix. Generally, the strategy has been to use the in-situ approach where the secondary phase is formed during the same thermal treatment as the YBCO film. In that case, density and distribution of the secondary phase is controlled by modifying the growth parameters. However, tuning the size of the nanoparticles inside the YBCO matrix has been prove to be a very tough task. Chemical solution deposition techniques offer a different option: the ex-situ approach where preformed nanoparticles are added to the YBCO starting precursor solution, Here we will present our efforts in this approach to achieve enhanced and controlled pinning properties in YBCO.Therefore, nanoparticles have been synthesized as colloidal suspensions in organic, alcoholic and aqueous solvents using a reduction and precipitation process with nanoparticles concentrations in solution in the range 10-2-10-6M. Subsequently, we have grown YBCO thin films by the trifluoroacetates route with added preformed nanoparticles. An initial study of nanoparticles solution compatibility with YBCO TFA solution was required. The influence of both oxide and metallic nanoparticles in the YBCO growth will be analyzed. Microstructure of the nanocomposite YBCO films has been characterized by x-ray diffraction, SEM and TEM. Superconducting properties have been measured by both inductive (SQUID) and transport techniques. We will assess the role of size and density of the nanoparticles in the YBCO nanocomposite performances and, in particular, in the vortex pinning behaviour. Finally, we will discuss the introduction o magnetic nanoparticles inside the YBCO matrix to achieve magnetic pinning.

TÍTULO: **Biodistribution of magnetic nanoparticles by magnetization measurements**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Magnetic nanopartilces (NP) synthesized by high temperature decomposition of iron (III) acetylacetonate in the presence of oleic acid [1] have high crystallinity that renders the particles high saturation magnetization, Ms, similar to that of bulk material [2]. The values of Ms found are practically independent of the particle size, with the ussual surface efects due to the high surface to volme ratio being minimal [3]. Its high response to magnetic field allows to easily detect them at lower concentrations inside organic tissues. In particular it has been possible to determine with precission their concentration in organs means magnetization measurements. This enables to preevaluate in a simple way the degree of internalization of magnetic NPs, e.g., for targeted drug delivery. Extra processes to hydrophilize and to achieve colloidal stabilility in phisiological conditions are needed. For particles of 4 nm of mean particle size coated with oleic acid, the ligand exchange with dimercaptosuccinic acid allowed a good preservation of the magnetic porperties, and did not produce substantial aggregation of the particles, as evidenced by experiments. Six rats were inoculated with these NPs either intravenously or subcutaneously. A total dose of 2,4 mg of nanopartilces was administrated in nine equal injections during following days. Magnetization was measured for Liver Kidney and Spleen. Magnetization curves show the simultaneous presence, of diamagnetic material (tissue), paramagnetic natural ferritin, and superparamagnetic particles. The comparison of the signal of 'inoculated' samples and controls enabled to determine the de percentage of internalization of NPs with respect to the total dose. The intravenous way was proved as the most efficient being the percentages of internalization 35% for liver, 1.5 for spleen, and 0.5 for kidney.

Acknowledgements

CSIC (Intramural Grant 200820I084), Spanish Ministry of Science and Innovation (NAN2004-08805-C01-04 CSD2007-00010, MAT2006-03999, MAT2009-08667, CSD2006-00012, and SAF2008-00471), Comunidad de Madrid (S-0505/MAT/0194 and CCG08-CSIC/SAL-3451), Generalitat de Cataluña (2009SGR856), Instituto de Salud Carlos III (RETICS Program, RD08/0075 (RIER)).

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TÍTULO: **Nanostructuration in complex oxide thin films**

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CONTENIDO:

Oxide thin films often exhibit a tendency toward self-organized growth forming regular arrays of three dimensional nanostructures. This behaviour offers enormous potential for the implementation of new nanodevices, while at the same time attracts great attention due to their rich physics. Among them, manganese perovskites showing colossal magnetoresistance and half metallic characteristics have emerged as promising candidates for miniature spintronic devices.

Complex oxide thin films are often elastically strained, due to film-substrate lattice mismatch, and this lattice strain can, in some cases, select preferential growth modes leading to the appearance of different self-organized morphologies. In this work we report on the controlled fabrication of self-assembled nanostructures in highly epitaxial La2/3Sr1/3MnO3 (LSMO) thin films [1, 2]. By carefully controlling growth rate dramatic changes of the surface morphology of LSMO films grown on top of SrTiO3 substrate can be induced: from very flat surface, through nanometric mounds and antidots to hatches [1]. All nano-objects form long-range ordered arrays running in the steps direction defined by the miscut angle of underlying substrate [2]. Therefore, it is manifested that self-organization process is directly promoted by the topological features of the substrate and indicate the importance of kinetic effects (adatom diffusion process on surface terrace, over substrate steps, along edges,…). On the other hand, the influence of the lattice strain on antidots formation is studied using different substrates (LaAlO3, NdGaO3, La0.3Sr0.7Al0.35Ta0.35O9) and analyzed within an energetic model proposed by J. Tersoff and F.K. LeGoues [3]. The implementation of self-assembled gold nanoparticles on the top of the nanostructured antidots is explored.

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TÍTULO: **Evolution of the dielectric, magnetic and optical properties of iron doped CaCu3Ti4O12 ceramics with the sintering time**

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CONTENIDO:

CCTO is one of the most studied materials due to its colossal dielectric constant. This high values of the dielectric constant is based on the presence of semiconducting grains and insulating grain boundaries, trough the so-called insulating barrier layer capacitor (IBLC) effect.

In this work, CCTO is doped with iron in order to change the conducting properties of the semiconducting grains. The electric, dielectric, magnetic and optical properties of the material have been studied as a function of the sintering time. A clear increase of the dielectric constant with the sintering time is observed and related to the microstructure changes applying the IBLC model and to the antiferromagnetic properties of the material. Magnetic measurements demonstrate that iron gradually incorporates into the material with the sintering time. The changes produced by the doping on the optical properties of the semiconducting grains are explained as a function of the compositional evolution of the grains interior whit the sintering time.

TÍTULO: **Transport properties of superconducting amorphous W-based nanowires fabricated by focused-ion-beam-induced-deposition**

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CONTENIDO:

The nanofabrication of superconducting materials is opening interesting research fields in Nanotechnology and its applications [1,2]. Focused-ion-beam-induced-deposition (FIBID) is an exciting one-step technique that allows the local deposition of nanostructures where precursor gas molecules are adsorbed and dissociated on a substrate by the focused-ion-beam (FIB) scanning [3]. W-based deposits fabricated by FIBID can produce superconducting nanostructures with TC ~5 K [4-8]. The superconducting gap closely follows the BCS theory with a well-defined Abrikosov vortex lattice [5-7] that has recently allowed the direct observation of the two-dimensional melting transition [8].

In the present work, we report transport measurements of superconducting amorphous W-based ultra-narrow nanowires (NWs) fabricated by FIBID using W(CO)6 as a precursor material. We have fabricated superconducting NWs with width ~50 nm by means of this versatile technique. The values obtained for TC are in the range from 4.8 K to 4.2 K. The critical current density and field (HC2) at 2 K are, respectively, in the range of 0.1 MA/cm2 and 6 T [9]. Furthermore, finite-size effects in these ultra-narrow NWs related to the matching of the vortex lattice within the sample width have been observed. All these features suggest that W-based NWs could serve for fascinating basic studies as well as for a wide range of applications in the field of Nanotechnology.

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TÍTULO: **Surface anisotropy, orbital moment and biomedical applications in magnetic nanoparticles**

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CONTENIDO:

Magnetic nanoparticles (NP) systems have long been subject to study finite-size and surface effects [1]. Besides, their potential application for biomedical purposes relies on high quality magnetic materials. The thermal decomposition of an organic iron precursor in an organic medium [2] allows the preparation of highly crystalline iron oxide NP with excellent magnetic parameters [3]. Particles in the 5-50 nm range were synthesized in the presence of a variety of coatings with controlled shapes. All the materials show a narrow size distribution with high crystal quality. Saturation magnetization was size independent in the 5-20 nm range and almost reached the expected value for bulk magnetite at low temperatures, higher in those NP with the surfactant covalently bonded to the surface. In 5 nm particles the surface contribution to magnetic anisotropy could be stablished via an analitical method that relies on the Tln(t/t0) scaling and demonstrates that surface anisotropy causes the broadening of their energy barrier distribution [4,5]. X-ray absorption spectra (XAS) suggested charge transfer from the NP to the covalent bonded surfactant. X-ray magnetic circular dichroism (XMCD) confirmed the dependence of the magnetic moment on the surface bond and suggested that the orbital momentum is more effectively quenched in covalently bonded NPs. Besides, the low-temperature <Sz> = 3.63 μB/f.u. obtained in the latter, is very close to those reported for bulk samples (3.90-3.95 μB/f.u.). High resolution TEM suggests that the foregoing is related to the crystal quality of the NP [6].

Acknowledgements

MEC (NAN2004- 08805-CO4-02, NAN2004-08805-CO4-01, CONSOLIDER CSD2006-12, MAT2005–02454 and MAT2006-03999), Generalitat de Catalunya (2005SGR00969)

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TÍTULO: **Influence of the substrate and deposition temperature on the magnetotransport properties of Fe/MgO discontinuous multilayers**

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CONTENIDO:

Discontinuous metal insulator multilayers (DMIMs) are an active research topic because of the relatively high tunnelling magnetoresistance (TMR) ratios at room temperature (RT) with low applied magnetic fields. In previous works we have studied the TMR ratio as a function of the Fe layer thickness.

In this work we present the study performed by varying the substrate (Corning glass or MgO single crystal) and the deposition temperature (from room temperature to 250 ºC). High-resolution transmission electron microscopy (HRTEM) and X-ray diffraction reveal that increasing the deposition temperature enhances the textured growth of the multilayers in the case of MgO(001) substrates. However, this effect is negligible when glass substrates are used, giving rise to polycrystalline films.

These results are directly supported by magnetotransport measurements. Higher TMR ratios up to 9 % at RT have been achieved for samples deposited on MgO(001) substrates at 250 ºC, while the TMR ratios remain constant for various deposition temperatures when glass substrates are used. Electron diffraction suggests that increasing the deposition temperature induces the partial oxidation of the Fe grains. This feature correlates with our transport measurements, where the resistivity values increase dramatically with the deposition temperature.

TÍTULO: **Nonlocal proposals for the Exchange Energy Density Functional**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

We present several fully nonlocal exchange energy density functionals that reproduce the linear response function of the free electron gas. These fully nonlocal functionals are constructed following the ideas previously used for nonlocal kinetic energy density functionals (KEDFs), from the original ideas for XC by Gunnarsson, M. Jonson and B.I. Lundqvist: [1] and for the KEDFs by Chacón-Alvarellos-Tarazona [2], to those of García-González et al. [3], Wang-Govind-Carter [4] and finally García-Aldea-Alvarellos [5].

For the KEDF, the exact linear response function of the free electron gas is analytically known. For the case of the exchange energy the response function is not known, but several approximated formulas has been proposed. In this work we have used the response function proposed by Utsumi and Ichimaru [5], even we must remark that the ansatz we propose here can be used to reproduce any other response function with the same scaling properties.

We have developed two families of new nonlocal functionals for the exchange energy. The first family is constructed with the mathematical structure of the LDA approximation – i. e. the Dirac functional for the exchange. The second family has the structure of the gradient correction in the second order gradient expansion approximation. All the functionals are constructed is such a way that they can be used in localized systems and in extended systems. As an important property, all these functionals, when using a constant reference electron density and making the evaluation in the momentum space, can achieve a quasilinear scaling with the system size.

Keywords

Exchange Energy Density Functional, Free Electron Gas, Linear Response Function, Linear Scaling

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TÍTULO: **Self-consistent modelling of electron surface accumulation in InN nanocolumns**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Since its revision of the band gap to a value of 0.67 eV, InN has received increased attention for its potential in various areas of nanotechnology [1,2]. Specifically, several works have pointed out the existence of an electron accumulation layer in the lateral surfaces of InN nanocolumn grown along [0001] axis [3,4]. This degenerate electron gas may have its origin in the donor impurities localized inside and at the surface of the nanocolumns. A theoretical model designed for this specific column-like geometry can help in the interpretation of the available measurements performed so far and can predict yet unexplored trends in the optical response.

In this work, we have calculated the charge and electrostatic potential profile inside the nanocolumn applying a self-consistent procedure to solve the coupled Schrödinger and Poisson equations, using as an input the nanocolumn radius, and the donor concentration in the volume and at the surface. We have also obtained the optical absorption and the Fermi energy at the surface. In contrast to existing models for InN layers, the optical properties shown here are also affected by the radius of the structure. The dependence on the donor concentration of the absorption profile is also investigated. Lastly, we fit our theoretical results to spectra of photoluminescence excitation spectroscopy, for a set of samples fabricated under different growth conditions, finding an acceptable agreement. We deduce that the shift of the absorption edge is mainly due to the volume donor concentration, and the absorption profile is governed by the density of surface donor states.

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TÍTULO: **Functional oxide epitaxial layers obtained by Ink jet printing**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Chemical solution decomposition has been revealed as an efficient and low cost methodology to obtain functional oxide epitaxial layers, but additionally it enables to study new phenomena associated to ex-situ growth processes. Solution deposition on a substrate, control of the strain released during the decomposition of metal-organic salts and ulterior high temperature thermal treatment to grow the epitaxial oxide layer are the critical points in this methodology. Our group has long tradition in growing oxide epitaxial layers from chemical solutions. In this presentation, we intend to demonstrate the benefits that Ink jet printing is able to bring in this area of research. Ink jet printing enables a precise control of the impregnation by controlling the solution volume dispensed and drop localization, at expenses of a fine control of the solution rehology. In addition, it has the added value to permit pattern drawing thus simplifying the process of device manufacturing. In the present work, we report on the growth of several oxide epitaxial layers (La0.9Sr0.3MnO3, YBa2Cu3O7-x and CeO2) on SrTiO3, LaAlO3 or YZS single crystals by ink jet printing using two different print heads (an electromagnetic and a piezoelectric) of different resolution. The corresponding structural, magnetic and superconducting properties of the layers will be discussed.

TÍTULO: **Nano-cuerdas superficiales en películas delgadas de Co: origen de su anisotropía magnética**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Películas delgadas de Co nano-estructurado μ_0 Ms ≈ 1.4 T, se obtuvieron por deposición con láser pulsado, PLD. La deposición oblicua, con un ángulo $\theta \neq 0$ entre la normal al substrato y la dirección del plasma generó una nano-morfología superficial. La microscopía de efecto túnel, STM, reveló la generación de nano-cuerdas, con dirección perpendicular al plano de incidencia del plasma, longitud entre 200-300 nm y anchura media controlada, w, entre 6-8 nm y 30 nm [1]. La dependencia de w con el tiempo de depósito, (o el espesor de la película, t), satisfizo el comportamiento descrito por las soluciones de la ecuación de la cinética de una superficie sometida a bombardeo iónico, según Kuramoto-Sivashinsky y modificación de R. Cuerno [2]. Ha sido medida una anisotropía magnética con dirección fácil para la imanación en el plano de la película y paralela a las nano-cuerdas. La dependencia de esta anisotropía con el ángulo θ fue: para θ entre 0 y 45° el campo de anisotropía, Hk, fue muy pequeño, entre ≈ 0 y 1 kA/m; entre 45° y 55° Hk aumentó, alcanzando el máximo de ≈ 70 kA/m; desde 55° Hk descendió siendo Hk=0 para 80-85°. Además, esta anisotropía presentó una dependencia con el tiempo de depósito (o con el espesor t). El máximo de Hk fue para t ≈ 8-9 nm cuando precisamente también w ≈ 8-9 nm. Para espesores hasta ≈ 90 nm, Hk disminuyó y w aumentó hasta ≈ 30 nm. El análisis de este descenso de Hk fue abordado considerando la anisotropía superposición de dos aportaciones: una anisotropía de forma producida por las nano-cuerdas superficiales y otra presente en toda la película debida posiblemente a tensiones residuales ejercidas por el substrato, generando ambas la misma direc- ción fácil para la imanación. El ajuste de los valores experimentales se consiguió con el valor de constante de ani- sotropía interna ks ≈ 10 kJ/m3 y un factor desimanador para la dirección perpendicular a las nano-cuerdas d/w ≈ 0.0054 /nm.

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TÍTULO: **Microstructure and magnetic properties of ultrathin Co/Ag multilayers grown by MBE on Si(111) and MgO(001)**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Previous works in the literature have shown the singular and still controversial behaviour of the Co/Ag system as compared to other metallic multilayers. In particular, perpendicular magnetic anisotropy and oscillations of the magneto resistance and exchange coupling have only been reported for very thin Co layers (<10 Å). To explain some of the magnetic results, the formation of a granular system has been suggested to arise when Co layers are extremely thin. We report here on the microstructure and magnetic properties of molecular beam epitaxy (MBE) grown samples consisting of a periodic repetition of Co/Ag layers on top of an Ag buffer layer. The thickness of the Co layers is restricted to the 1-4 Å range, being the Ag layers 15 to 40 Å thick. Identical multilayers were grown on clean Si(111)-7x7 and MgO(001) surfaces in order to compare results on two substrates and orientations. Several techniques such as RHEED, LEED and AES have been used in-situ to assess the crystallinity and composition of the samples during growth. The microstructure and periodicity of the layers was studied by X-ray diffraction, reflectometry and reciprocal space mapping using conventional sources and synchrotron radiation. Field emission SEM was employed to investigate sample morphology. The magnetic properties (temperature dependencies of the magnetization and of the hysteretic parameters) were measured, down to 5 K, by means of a vibrating sample magnetometer. From the results obtained for the low field temperature dependence of the magnetization, measured after zero field cooling (ZFC) and field cooling (FC) the samples, we can conclude that all the samples exhibit magnetic order up to room temperature. This was confirmed through the measurement of the thermal dependencies of the remanence and the coercive force. Also, and interestingly, the samples having a Co layer thickness of 3.5 Å showed, independently of their substrate, a blocking-like temperature at ca. 35 K. In clear correlation to the Co layers thickness, the samples having 1.8 Å per Co layer exhibited a similar process at ca. 15 K. Results are discussed in relation to the microstructure and morphology analysis.

TÍTULO: **Magnetotransporte en el milikelvin sin helio líquido**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Durante los tres últimos años hemos instalado en colaboración con la empresa Oxford Instruments un refrigerador capaz de alcanzar temperaturas inferiores a 280 milikelvin en presencia de altos campos magnéticos (12 Teslas) sin utilizar ningún tipo de líquido criogénico. Este refrigerador entró en servicio en febrero de 2008 y su funcionamiento esta demostrando que sus prestaciones no solo igualan sino mejoran las de los equipos convencionales. En la actualidad estamos comenzando la instalación de un nuevo equipamiento también completamente libre de líquidos criogénicos capaz de alacanzar temperaturas inferiores a 20 milikelvin en presencia de campos magnéticos de hasta 12 Teslas. Se revisarán las ventajas y desventajas de estas tecnologías basadas en tubos-pulsados y cryocoolers y sus aplicaciones en el estudio de nanodispostiivos electrónicos mediante magnetotransporte así como magnetoóptica.

http://www.azonano.com/news.asp?newsID=6113

TÍTULO: **STM Study of Magnetic Polyoxometalates on HOPG Surfaces**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Polyoxometalates (POMs) are a large class of discrete oxides composed of early transition elements (especially vanadium, molybdenum, and tungsten) exhibiting extensive applications in diverse fields such as catalysis, electronics, magnetism and medicine [1]. From a magnetic point of view the heteropolynuclear complexes of W and Mo form diamagnetic frameworks that can coordinate paramagnetic metal ions while keeping them well isolated from the neighbouring magnetic clusters. In fact, mononuclear lanthanide-based POMs have recently demonstrated the occurrence of Single Molecule Magnet (SMM)-like relaxation in this sort of compounds [2].

In these metal-oxide molecular clusters, a variety of physical techniques including the spectroscopic technique of inelastic neutron scattering (INS), can be used to determine the energies and wave functions of the different spin state of the cluster [3,4]. However, all these measurements are performed on bulk samples. In order to obtain information about the low energy levels from a single polyoxometalate, scanning tunneling spectroscopy (STS) at low temperatures can be used when the molecules are deposited on a conducting substrate. Therefore the interaction of the metal-oxide cluster with the surface has to be taken in consideration.

Herein we will describe the controlled deposition of magnetic POMs onto High Oriented Pyrolitic Graphite (HOPG) with two different examples: the Preyssler-type K12[DyP5W30O110] (SMM) and the Keggin-type K10[Co4(H2O)2(PW9O34)2]. Scanning Tunneling Microscopy (STM) was used to image the shapes, packing, and orientation of the two molecules at room temperature.

STM images show the formation of highly regular 1D and 2D molecular arrangements. Therefore it is possible to find single molecules to perform spectroscopy experiments as a preliminary step for the development of the study of the lowest electronic levels of magnetic molecules by STM and to determine the molecule-substrate interaction complementing the INS studies.

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TÍTULO: **Interfacial effects in LSMO and LCMO manganite thin films**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Interfaces and free surfaces do play a very active role on the final properties of thin films and heterostructures. It has been shown that the magnetic and electronic properties of oxide based superlattices can be tuned through interfacial effects, such as strain, charge transfer and spin exchange interactions. In this work we report on preliminary results regarding the effect of different capping layers (MgO, LAO, STO, NGO and gold) on the on chemical and magnetotransport properties of LSMO and LCMO manganite thin film interfaces prepared by the sputtering technique. For this study we have used both macroscopic techniques (SQUID magnetometry) and local probes (X-ray absorption spectroscopy and X-ray magnetic circular dichroism (XMCD) and AFM in the current sensing mode). For XAS and XMCD measurements samples were magnetically saturated by applying magnetic fields of up to 6T. The spectroscopic data was acquired by using the total electron yield detection mode thus, guaranteeing surface sensitivity. The results show that LAO and STO capping almost do not modify the bulk-like Mn valence of the interface. Besides, MgO and NGO capping lead to an increase of the Mn valence oxidation state for both LSMO and LCMO thin films. Au induces divalent Mn formation on LSMO only. These results hare correlated with the XMCD data showing a concomitant decrease of the magnetization saturation of the interface.

TÍTULO: **Self-assembling of Magnetic Nanoparticles onto Technological Substrates**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Obtaining monolayers of highly ordered magnetic nanoparticles (NPs) onto technological substrates is a very interesting issue from both basic research and technological points of view. Long range ordered arrays of magnetic NPs have a great potential for applications in magnetic and electronic devices. Nevertheless, obtaining highly ordered monolayers of magnetic NPs on top of technological substrates has revealed to be a hard attainable issue. The common method to produce ordered two-dimensional arrays of NPs is self-assembling. Self-assembling is a complex process in which several interactions between NPs, substrate, and solvent are involved. As a result of the complexity of the process, a mixture of mono- and bi-layers with order in the few nanometers range is usually obtained when dealing with substrates with technological interest, such as complex oxides. In this work we report on self-assembly processes of Co NPs (10 nm in diameter) on top of silicon substrates by using different techniques, namely: drop-casting, spin coating and Langmuir-Blodgett techniques. The influence of different parameters, such as substrate temperature, evaporation time, NPs concentration, etc., is analyzed. By using the two first techniques self-assembled monolayers of Co nanoparticles in the micrometric range have been obtained. The Langmuir-Blodgett technique has also been used to study self-assembly processes of silica NPs of about 400 nm in diameter on Silicon and glass substrates.

TÍTULO: **Conductividad térmica de circona estabilizada con itria (10%-YSZ) nanocristalina obtenida por aleación mecánica**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

La mejora de los recubrimientos de barrera térmica ("thermal barrier coatings" o TBCs) para motores y paletas de turbinas de gas es esencial para aumentar su rendimiento, ya que les permitiría operar a temperaturas más altas [1]. Los TBCs son películas gruesas de materiales cerámicos refractarios que protegen el metal de la alta temperatura del gas. La circona estabilizada con itria (YSZ) es el material estándar en la tecnología de estos TBCs, por su buena estabilidad química, propiedades mecánicas y baja conductividad térmica [2]. La posibilidad de mejorar aún más su rendimiento es la razón del interés de estudiar las propiedades de transporte térmico de YSZ nanoestructurado [3,4].

En este trabajo presentamos los resultados de medidas de conductividad térmica en circona estabilizada con 10% molar de itria (10%-YSZ) en el rango de temperatura entre 173 y 773 K. Las muestras estudiadas, con tamaños de grano entre d = 17 nm y d ≈ 1000 nm, se prepararon mediante compactación en frío y sinterización de polvos de 10%-YSZ obtenidos por aleación mecánica [5]. Se observa una fuerte reducción de la conductividad térmica al disminuir el tamaño de grano. Discutiremos nuestros resultados en términos de dos modelos diferentes: i) el modelo de la resistencia térmica de Kapitza, que considera la baja conductividad térmica como efecto de la resistencia térmica de contacto en las fronteras de grano [6], y ii) el modelo de salto de fonones ("phonon hopping model") [7], basado en la localización de fonones de longitud de onda corta debido al intenso scattering en las fronteras de grano.

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TÍTULO: **Raman scattering on InAs single nanowires near the E1 transition**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

The study of semiconductor nanowires (NWs) is an exciting field of research with many possible applications triggered by their very large surface/volume ratio, an almost absence of structural defects, or the possibility of obtaining a distinct structure compared to their bulk counterpart. In the particular case of InAs NWs, their physical properties such as the high electronic mobility and the narrow band gap [1], make them suitable for electronic applications.

InAs NWs are generally grown via the vapor-liquid-solid (VLS) mechanism using metal nanoparticles to catalyze the NW growth. This technique permits the control over size, shape and location of the NW [2]. Depending on the growth temperature, one can fabricate InAs NWs with different compositions of the wurtzite and the zincblende phases.

We have investigated InAs single NWs, grown by chemical beam epitaxy, at three different temperatures (420ºC, 450ºC and 480ºC). Using various excitation energies of an Ar laser, we have studied the Raman scattering near the E1 transition of the InAs NWs. We have observed two resonances at approximately 2.5 and 2.6, which were assigned to the E1 transition of the wurtzite and zincblende structures of InAs NWs, respectively. The relative intensity of these resonances changes with the growth temperature and is related to structural changes in the InAs NWs [3].

Furthermore, we compared the intensities of the Raman scattering for different incident and scattered light polarizations with the expected selection rules for the different phases of the InAs NWs. The strongest scattering intensity was achieved for a crossed polarization configuration in which the incident light is polarized with the electric field orthogonal to the growth-axis of the NWs. This result is explained by an ab-initio calculation of the electronic band structure of wurtzite InAs NWs.

[1] Thelander et al.; Solid State Comm. 131 (2004) 573.

[2] Bao et al.; Adv. Mat. 21 (2009) 1.

[3] Tizei, L. H. G. et al.; Nanotechnology 20 (2009) 275604.

TÍTULO: **Study of third Hund's rule compliance on W polarized moment in Co-W amorphous nanoparticles**

ÁREA TEMÁTICA: **Materiales nanoestructurados y nanotecnologías**

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CONTENIDO:

Co-W amorphous nanoparticles are formed by sequential sputtering of Co on amorphous alumina substrate and subsequent W capping. The magnetic behavior of such particles is superparamagnetic. The magnetic moment per Co atom in the Co-W particles is systematically reduced as the nominal thickness of W capping layer, tW, increases and as the amount of Co deposited in the sample, tCo, decreases [1]. In this work, we present X – Ray magnetic circular dichroism (XMCD) measurements performed at the W L2,3 edges, in samples with tCo=0.7nm and 1.0nm, and tW=0.6nm and 1.5nm. Application of sum's rules to XMCD data reveal a polarization of about 10-3 μB at W magnetic moments antiparallel coupled to Co moments. Since W has a less-than-half-filled 5d band, according to the third Hund's rule, its spin and orbital moments should be always antiparallel. We have found that when the Co/W ratio overcomes a threshold value, the induced W orbital moment orients parallel to its spin moment. Therefore, there is a crossover from compliance to pseudo-violation of the third Hund's rule in W, as a function of 3d-5d bands hybridization. Then we have found a pseudo-violation of the third Hund's rule, and we have identified a way to tailor this behaviour by varying the amount of Co or W deposited in the sample. Although this pseudo-violation has been previously identified in systems of Fe/W multilayers [2], it is the first time it is observed in nanoparticles systems.

[1] A.I. Figueroa, J. Bartolomé, L.M. García, F. Bartolomé, C. Magén, A. Ibarra, L. Ruiz, J. M. González-Calbet, F. Petroff, and C. Deranlot. JAP, in press.

[2] F. Wilhelm, P. Poulopoulos, H. Wende, A. Scherz, K. Baberschke, M. Angelakeris N. K. Flevaris and A. Rogalev. PRL 87, 20 (2001) 207202.

Cronograma

2010	miércoles 3 de febrero	jueves 4 de febrero	viernes 5 de febrero
09:00	09:00 Entrega de Documentatión e Inscripción; Colocación POSTERS (Sala Josefa Amar y Borbón)	09:00 153: Hans Hilgenkamp, U. Twente; Effects of interface conductance and magnetism between insulating, non-magnetic oxides	09:00 1: Sergio Valenzuela, CIN2; Large amplitude driving of a superconducting artificial atom
10:00	10:00 Presentación GEFES 2010 Aula Magna	10:00 32: Dra. Maria Varela. Oak Ridge; Real space atomic resolution mapping of María Varela, Structure, electronic properties and spin in the aberration corrected scanning transmission	10:00 3: Dra. Belén Valenzuela, ICMM, CSIC; Microscopic description of the new high temperature iron superconductors
	10:15 4: Kostia Novoselov. U. Mancnester; Graphene & Its Chemical Derivatives	10:20 28: Dr. Gervasi Herranz, ICMAB. CSIC; Transiciones metal-aislante vistas desde la espectroscopia magnetoóptica	10:20 155: Dra. Francesca M. Marchetti, UAM; Persistent currents and quantised vortices in a matter--light superfluid
		10:40 38: Dr. Zouhair Sefrioui, U Compl., Spin filtering at interfaces of oxide magnetic tunnel junctions	10:40 71: Dr. Albert Romano, U Barcelona: Focused ion beam techniques and individual nanowires: from the contact strategy and characterization of the nanowires to the fabrication of functional
11:00	11:15 Pausa Café (instalación de posters en la misma sala)	11:00 Pausa Café (sala posters)	11:00 Pausa Café (sala posters)
		11:30 14: Dr. Gustau Catalán. CIN2; Nanodomains and their walls	11:30 20: Dr. Álvaro Blanco, ICMM, CSIC; Self-assembled disorder in photonic nanostructures
	11:50 5: Dra. Elsa Prada, ICMM, CSIC; Quantum pumping in graphene	11:50 42: Dr. Victor Pardo, USC; Maximally anisotropic point Fermi surface system: VO2 films embedded in TiO2	11:50 12: Dr. Fernando Lahoz Zamarro Hybrid organic-inorganic structures for optical amplification in waveguides
12:00	12:10 108: Dr. Gonzalo Otero; ICMM, CSIC; Fullerenes from aromatic precursors	12:10 49: Bianchi Méndez, U Comp.; Nanohilos y nanocintas de óxido de galio: sintesis y propiedades ópticas	12:10 95: Dr. Jose I. Martin, UO: Crossed ratchet effects on domain wall motion in nanostructured Co-Si amorphous films with 2D arrays of asymmetric holes
	12:30 157: Julia Herrero Albillos, BESSY: Microscopic investigations of exchange bias in FeMn/Co bilayers on the nm length scale	12:30 152: Dr. Daniel Torrent, U Pol. Valencia; Invisibilidad acústica en dos y tres dimensiones	12:30 54- Dr. Antonio Garcia Martin, IMM. CSIC; Magnetoplasmonics: an overview on the fundamentals and applications
13:00	12:50 150: José Luis Martínez, Director ILL, Institut Laue Langevin (ILL); En la vanguardia de las técnicas de neutrones	12:50 156: Salvador Ferrer: ALBA Light source: Present status and perspectives	12:50 122: Dr. Fernando de León-Pérez, ICMA, CSIC-UZ; The role of surface plasmon polaritons in the optical interaction of a hole pair in a metal film
			13:10 57: Dr. Angel Barranco. ICMS. CSIC-USe: Luminescent plasma nanocomposites for the fabrication of photonic sensing devices
			13:30 clausura
14:00	14:00 Pausa comida: Restaurante Elíseos, Paseo Sagasta 4	14:00 Pausa comida: Restaurante Elíseos, Paseo Sagasta 4	14:00 Comida de despedida, en Edificio Paraninfo
16:00	16:00 59: Dr. Xavier Trepat, U Barcelona: What can material science teach us about biology?	16:00 19: Dra. Reyes Calvo, U Alicante: The Kondo effect in ferromagnetic atomic contacts	
	16:20 80: Dra. Noelia Marcano, ICMA, CSIC-UZ; Quantum effects and surface states in the magnetotransport properties in two- and one-dimensional Bi-Nanostructures	16:20 29: Dr. Marco Evangelisti, ICMA, CSIC-UZ; Molecular coolers	
	16:40 23: Fernando Delgado, U Alicante; Spin-transfer torque on a single magnetic adatom	16:40 145: Dr. J.J. Sáez Garitaritaonandia, EHU-UPV; ¿hay detrás del oro magnético?	
17:00	17:00 9: Dr Juan Ignacio Climente, UJI; Holes in quantum dot molecules	17:00 63: Dr. David Serrate. INA, UZ; Interplay between spin-polarized and spin-orbit coupling STM contrast in non-collinear magnetic order	
	17:20 113: Dr. Javier Sesé. INA, UZ; Properties and applications of focused-ion-beam-induced- deposition material using W(CO)6 as precursor gas	17:20 CAFE con POSTERS	
	17:40 2: Dr. Oliver Friedrichs, EMPA, ETH; Diboran - The key to reversible hydrogen storage in borohydrides		
18:00	18:00 CAFE con POSTERS	18:30 33: Pietro Gambardella, CIN2; Spin-orbit phenomena in metal-organic and metal-oxide layers	
19:00		19:25 148: Wolfgang Wernsdorfer, CNRS; Molecular Spintronics using Molecular Nanomagnets	

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