Magnetism in Portugal 2021

Virtual Meeting

NPM

NÚCLEO PORTUGUÊS
DE MAGNETISMO

DAY 1
Tuesday, September 14
9h - 12h

DAY 2
Wednesday, September 15
9h - 12h

Resumo

Nos dias 15 e 16 de setembro de 2021 decorreu o primeiro encontro "Magnetism in Portugal", organizado pelo NPM, o Núcleo Português de Magnetismo. Agradecemos a todos os 12 oradores convidados pelas suas excelentes apresentações, assim como à presença do público, que enriqueceu o evento com a sua interação com os oradores e plateia. O NPM considera que o encontro foi um sucesso, esperando que seja o primeiro de muitos!

Overview

The first "Magnetism in Portugal" meeting took place at the 15 and 16th of september 2021, organized by the NPM, the Portuguese Magnetism Core (Núcleo Português de Magnetismo). The NPM would like to thank again the 12 invited speakers for their excellent presentations, as well as the audience, who enriched the even with their interaction with speakers and attendees. The NPM considers this event to have been a success, with hopes that this is the first of many to come!

A Comissão Organizadora - The Organizing Committee

- Célia Sousa (IFIMUP/FCUP)
- Carlos Amorim (CICECO/UA)
- Diana Leitão (TU/e)
- Elvira Paz (INL)
- João Amaral (CICECO/UA)
- João H. Belo (IFIMUP/FCUP)
- Laura Pereira (C2TN/IST)

ANDRÉ PEREIRA ampereira@fc.up.pt

IFIMUP - Departamento de Física e Astronomia, Faculdade de Ciências, Universidade do Porto

Role of magnetism on multifunctional materials: from research to technological applications

Magnetic materials present a plethora of physics and technological applications. This presentation will present a general review of the work that has been developed at IFIMUP, namely in the area of multifunctional materials such as magnetocalorics, magnetorefrigeration, magnetostrictives and magnetic nanoparticles. Several areas of science will be addressed, namely from materials fabrication (macro, micro and nanofabrication), numerical simulation and technology applications.

Contacts and conditions for access:
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http://www.necl.pt/qa/#

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Solid State, C2TN, IST, ULisboa

Molecular Magnetism in Fe(III) Spin Crossover Materials

For the last 30 years the Solid State group at C2TN has focused its research in the development of new multifunctional and nanostructured materials with unconventional electrical and magnetic properties. One example of this research is Spin Crossover (SCO) materials. The SCO phenomenon can be found in a variety of 3d4−3d7 transition metal complexes and has been extensively studied in past decades. In these complexes, the spin state of the transition metal can be reversibly switched between the low-spin (LS) and high-spin (HS) states by the application of an external perturbation (such as temperature, pressure, magnetic field, light irradiation). The spin transition induces changes in the physical properties (crystal structure, magnetism, color, etc.) and the complete characterization of these materials involves a variety of techniques from structural (single crystal and powder X-ray diffraction) to magnetic characterization (Mössbauer spectroscopy and magnetization measurements). In recent years, our research has focused on the identification of correlation between structural features and a specific magnetic behaviour. These studies are expected to allow for the intelligent design of these types of materials which would enable for an easier integration in applications of technologic interest.

Equipment for magnetic characterization:

- 57Fe Mössbauer Spectrometer
- 6.5T SQUID Magnetometer with 3He insert (0.3-2; 1.6-320K)
- 12T Maglab 2000
- 14T VSM Magnetometer(1.6-375K) for DC magnetization and a Susceptometer for AC magnetic susceptibility with the frequency range 1Hz-20kHz.

Contacts and conditions for access:
http://c2tn.tecnico.ulisboa.pt/index.php/r-d/research-groups/solid-state

MANUEL BAÑOBRE-LÓPEZ manuel.banobre@inl.int

International Iberian Nanotechnology Laboratory

Magnetism and Nanomedicine: from materials science to the application

In this talk I provided an overview of the research activities of our Nanomedicine group at INL. Our research makes use of magnetic nanomaterials as building blocks to form more complex functional nanosystems that find application in the medical area. Currently, our research interest is focused on smart magnetic theranostics, where the magnetic component enables both imaging and therapy performances, thus enabling conventional and rapidly growing medical technologies, such as magnetic resonance imaging, magnetic hyperthermia and magnetically assisted-drug delivery. In particular, in this talk I revisited fundamental aspects of magnetic nanomaterials in order to highlight their relevance in nanomedicine, as well as provided a few examples of recent developments from our research group in this area. This included fundamental and applied studies, all aiming at developing more safe and efficient MRI contrast agents, smart drug delivery systems and theranostic systems, with which through 'safe-by-design' methodologies we approach different challenges in the medical field, mainly in cancer therapy.

Equipment for characterization:

- Vibrating sample magnetometer
- SQUID
- Magnetic hyperthermia (solution, in vitro, in vivo)
- Relaxometer (1.41 T)
- MRI scanner (3 T)

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JAVIER RIAL javier.rial@fc.up.pt

Universidade do Porto IFIMUP

Magnetic Nanofibers for 3D Racetrack Memory Devices

We propose a novel 3D racetrack memory configuration based on functional segments inside cylindrical nanowire arrays. The innovative idea is the integration of the writing element inside the racetrack itself, avoiding the need to implement external writing heads next to the track. The use of selective magnetic segments inside one nanowire allows the creation of writing and storage sections inside the same track, separated by chemical constraints identical to those separating the bits. Using micromagnetic simulations, our study reveals that if the writing section is composed of two segments with different coercivities, one can reverse its magnetization independently from the rest of the memory device by applying an external magnetic field. Spin-polarized current pulses then move the information bits along selected tracks, completing the writing process by pushing the new bit into the storage section of the wire

JOSÉ MALTA josemalta@ctn.tecnico.ulisboa.pt

University of Coimbra - C2TN/IST

Development of Novel Chiral and Topological Magnets

Chiral magnets (magnets where the non-collinear arrangement of atomic moments lacks inversion symmetry) are currently attracting much attention, not only because such magnets may also display other interesting properties such as natural optical activity, piezoelectricity and second harmonic generation, enabling them for applications as multifunctional materials, but also because new chiral magnetic arrangement of spins that have been theoretically predicted to possibly exist in acentric structures have recently been observed. In this new class of exotic spin structures, skyrmionic magnets are particularly interesting. A magnetic skyrmion lattice has been in some chiral magnets. Skyrmions are stabilized by the competition between ferromagnetic exchange and Dzyaloshinskii-Moriya (DM) interactions. Such skyrmions have been shown to couple with electric currents and this property can be used in devices. Due to topological nature of these spin structures, that is also relevant for the electronic states, these systems are now being recognized as topological magnets in close connection to the also emerging field of topological insulators. In this work we presented three families of compounds that host skyrmions. The copper-oxo-selenite derivatives, that includes the chiral topological magnet Cu2OSeO3 and the poor monoclinic Cu4O(SeO3)3. The beta-Mn type alloys, based on Co7Zn7Mn6 stoichiometry, with low substitutions of Mn by Fe, Cr and Ni. The Lacunar spinels GaV4S8 and GaMo4S8, compounds that crystalize into a centrosymmetric space group but the pattern of DM vectors, specific to the polar C3v point group, produce the different internal spin configurations, similar to those observed in chiral magnets. The analysis of such compounds by XRD and SEM-EDS will be presented in this work. Magnetization studies based on VSM and AC susceptibility as well as Heat Capacity measurements will be presented and discussed.

Equipment for characterization:

- PPMS Quantum Design

ALEX JENKINS alex.jenkins@inl.int

International Iberian Nanotechnology Laboratory

Spintronics @ INL: Magnetic tunnel junctions for emerging ICT technologies

Overview of the activities at INL in the domain of spintronics, specifically detailing how the magnetisation dynamics of magnetic vortices can be harnessed for a range of ICT applications, including sensing, wireless communications and novel computing architectures.

Equipment for characterization:

- Fully equipped cleanroom for fabrication of devices
- High frequency characterisation set-up
- CIPT
- VSM
- Automated prober

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DCt-FCTUC

Magnetism in Geology / O magnetismo em Geologia

Equipment for characterization:

- Minispin magnetometer
- IRM impulse
- AF demagnetizer
- Magnetic susceptibility (Bartington)

CLARA PEREIRA clara.pereira@fc.up.pt

LAQV-REQUIMTE, Departamento de Química e Bioquímica, Faculdade de Ciências, Universidade do Porto

Engineered Magnetic Nanomaterials as Building Blocks for High-Performance Technologies: From Eco-Sustainable Catalysis to Textile Applications

In this talk, the achievements of our research group on the fabrication of engineered magnetic nanomaterials with fine-tuned properties and on their application as remarkable building blocks in eco-sustainable catalysis and textile applications will be presented.

Contacts and conditions for access and/or external users:
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CARLOS AMORIM amorim5@ua.pt

CICECO & Universidade de Aveiro

A geometry-independent moment correction for the MPMS3 magnetometer

In my talk I performed a short presentation of CICECO and the laboratory where I work (MagLab). I showed all the facilities and equipment available in our lab, as well as the research topics that we have been focusing on. Finally I also presented a geometry-independent moment correction method which solves the geometry and radial offset effects on the measured magnetization for the MPMS3 magnetometer, which result in deviations as high as 35%.

Equipment for characterization:

- Quantum Design MPMS3 SQUID-VSM (working between -7 and 7T, and 1.8-400K);
- Magnetoresistance setup with magnetic filed (-1 to 1T) and temperature control (from 10-10K);
- NMR,
- Cryogenics VSM ((working between -10 and 10T, and 5-310K)

For more information please contact one of the following:
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PEDRO TAVARES ptavares@utad.pt

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Magnetism in perovskite oxides A quick look through 25 years of research

The perovskite oxides are fascinating structures to investigate because of the wide range of properties they can present. The general formula, ABO3, is mainly characterized by the octahedral coordination of the B ion by the oxygen. In addition, the perovskites can be extended to Ruddlesden-Popper structures (AO)(ABO3)n or (RO)m[(AO)(MBO3-δ)n] as in the case of high-Tc Cu based superconductors. This talk resumes the investigation of our group (UTAD + U. Aveiro + FCUP + IST/CTN) during the last 25 years, in terms of the magnetic properties of perovskites structures, either as bulk ceramics or as thin films, deposited by MOCVD, PLD or RF-sputtering. When the B is a mixed valence oxide ion such as Mn, their valence state can be tuned by doping the A position with a divalente metal, D, as in the case of RE1-xDxMnO3, where RE is a rare earth trivalent metal. The resulting magnetic properties can go from paramagnetic, canted spin, anti-ferromagnetic or ferromagnetic. Other studies included the magnetocaloric effect and multiferroic properties: magnetically induced electric polarization, magnetoelastic and magnetoelectric coupling.

Sample Preparation:

- Produce bulk ceramics and oxide ceramic thin films by MOCVD and RF sputtering
- Routine characterization includes XRD and SEM/EDS.

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http://ume.utad.pt/