Advanced Topics in Magnetism and Superconductivity

AToMS-2014

Conference Program

July 31^{st} - August 4^{th}, 2014

Hotel Amancay

San Carlos de Bariloche, Patagonia Argentina

	Thursday 31st	Friday 1st		Saturday 2nd		Sunday 3rd		Monday 4th	
8:45-9:00		**Opening**							
9:00-10:35		9:00	**Maple**	9:00	**Godfrin**	9:00	**Davis**	9:00	**Iimura**
		9:45	Samuely	9:45	**Aligia**	9:45	Farber	9:45	Valenzuela
		10:10	Núñez Regueiro			10:10	Szabó	10:10	Assman
10:35-11:00		Coffee Break		Coffee Break		Coffee Break		Coffee Break	
11:00-12:35		11:00	**Claeson**	11:00	**Bauer**	11:00	**Damascelli**	11:00	**Fradkin**
		11:45	Joyez	11:45	**Llois**	11:45	Pautrat	11:45	**von Löhneysen**
		12:10	Buzdin			12:10	Kolton		
12:35-14:30		Lunch		Lunch		Lunch		**Concluding Remarks**	
								Lunch	
14:30-16:05		14:30	**Grigera**	14:30	**Geibel**	14:30	**Triscone**		
		15:15	De Long	15:15	**Jaccard**	15:15	Dagan		
		15:40	Li			15:40	Boris		
16:05-16:30		Coffee Break		Coffee Break		**Poster Session**			
16:30-18:05	**Registration**	16:30	**Hirai**	16:30	Giovannini				
		17:15	Riseborough	16:55	Pedrazzini				
		17:40	Garbarino	17:20	**Sereni**				
	19:00-20:00 **Welcome Reception**	20:00-21:00 Dinner		20:00-23:00 **Conference Dinner** Porta de la Cruz de la Cruz		20:00-21:00 Dinner			
	20:00-21:00 Dinner								

WELCOME

to *Advanced Topics in Magnetism and Superconductivity* ATоMS-2014

This Conference is organized in San Carlos de Bariloche, Patagonia Argentina, from the 31st of July until the 4th of August 2014. It is the first of the Satellites of the 27th *International Conference on Low Temperature Physics* (LT-27), to be held in Buenos Aires, Argentina. AToMS has two main goals. The first one is to promote the exchange of new ideas on recent topics of Magnetism and Superconductivity between internationally distinguished scientists as well as local researchers in the field. The second one is to dedicate the Saturday session to celebrate the academic and scientific career of Julián Sereni, Professor at Instituto Balseiro, and one international distinghished scientist in the study of Cerium-based strongly correlated electronic systems. This Saturday session will conclude with the Conference Dinner.

We will have 13 sessions, typically opened by an Invited Speaker and followed by two shorter contributed talks. On Sunday afternoon we will have the Poster session with some 60 presentations. All the activities will be organized at the Hotel Amancay. The main topics of the conference include:

- frustration and exotic order in magnetic systems,
- quantum phase transitions,
- strongly correlated electronic systems,
- coexistence between superconductivity and magnetism,
- new superconductors,
- soft condensed matter in superconducting and magnetic materials,
- superconductivity at the mesoscopic-scale

We have over 100 participants from 25 countries. This includes a large number of students and young researchers under 40 who received financial support from the organization. We acknowledge Gerencia de Física (CAB-CNEA) and Instituto Balseiro, Fundación Balseiro, Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), International Centre for Theoretical Physics (ICTP), Centro Latinamericano de Física (CLAF), European Physics Letters (EPL), Fundación Sauberan and Fundación Williams for supporting this activity.
We look forward to a great meeting with fruitful discussions.

The Organizing Committee

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Laura Curuchet	Centro Atómico Bariloche

Friday, August 1st

8:45 - 9:00 **OPENING**

9:00 - 10:35 **SESSION 1**

10:35 - 11:00 **COFFEE BREAK**

11:00 - 12:35 **SESSION 2**

12:35 - 14:30 **LUNCH**

14:30 - 16:05 **SESSION 3**

16:05 - 16:30 **COFFEE BREAK**

16:30 - 18:05 **SESSION 4**

NOVEL ELECTRONIC PHASES AND COMPETING INTERACTIONS IN THE HEAVY FERMION COMPOUND URu_2Si_2

Brian Maple

University of California, San Diego, La Jolla, CA 92093, USA.

9:00-9:45 S1 1

The heavy fermion compound URu_2Si_2 undergoes a second order transition at $T_o = 17.5\,K$ into an ordered phase whose identity has eluded researchers for nearly three decades. This so-called hidden order (HO) phase coexists with a type of unconventional superconductivity (SC) that is found below $T_c \approx 1.5\,K$. The features in the electrical resistivity, specific heat and magnetic susceptibility associated with the HO phase are reminiscent of a charge or spin density wave that forms a gap over about 40% of the Fermi surface below T_o, with the remainder of the Fermi surface gapped by the SC below T_c. The compound URu_2Si_2 has been studied extensively by means of various experimental techniques (e.g., transport, thermal, magnetic, and spectroscopic measurements), and numerous theoretical models have been proposed for the HO phase. In this talk, we describe experimental studies of URu_2Si_2 under high pressure, high magnetic field, and chemical substitution that have revealed extraordinary behavior and novel electronic phases that are generated by competing interactions. For example, application of pressure suppresses the SC and induces a transition from the HO phase to an antiferromagnetic (AFM) phase at 10 kbar. High magnetic fields suppress the HO phase at ~ 35 Tesla and induce several new electronic phases at higher field, some of which exhibit non-Fermi liquid behavior. Substitution of Re results in the suppression of the SC and the HO transition, the nearby emergence of ferromagnetic (FM) order, and unique critical behavior associated with the FM phase. In contrast, substitution of Fe suppresses SC, induces a transition from the HO phase to an AFM phase, and produces a nearly two-fold increase in temperature of the HO/AFM phase boundary.

Acknowledgement: The support of the US DOE, NNSA, and NSF is gratefully acknowledged.

EXPERIMENTAL STUDIES ON CHARGE DENSITY WAVES AND SUPERCONDUCTIVITY IN Cu_XTiSe_2

Z. Pribulová[1], Z. Medvecká[1], V. Pal'uchová[1], J. Kačmarčík[1], P. Szabó[1], T. Klein[2], P. Husaníková[3], V. Cambel[3], J. Šoltys[3], J. Fedor[2], M. Iavarone[4], G. Karapetrov[5] and Peter Samuely[1]

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2 Institut Néel, CNRS and Université Joseph Fourier, F-38042 Grenoble Cedex 9, France.
3 Institute of Electrical Engineering, Slovak Academy of Sciences, 84104 Bratislava, Slovakia.
4 Department of Physics, Temple University, Philadelphia, PA 19122, USA.
5 Department of Physics, Drexel University, Philadelphia, PA 19104, USA.

A tunable transition from charge density wave state to superconductivity was discovered upon intercalation of $1T$-$TiSe_2$ by copper or palladium. A peculiar nature of the emergent superconductivity from a semimetallic state above T_c, as well as the coexistence of the superconductivity with the chiral CDW attracts attention. In this work CDW and superconductivity of Cu_xTiSe_2 have been studied within a wide range of doping concentrations by number of experimental techniques. Subkelvin scanning tunneling microscopy and spectroscopy reveal that amplitude of chiral charge density wave modulation is gradually suppressed upon copper doping nevertheless the CDW order coexists with superconductivity in much higher dopings than expected so far. Both scanning tunneling spectroscopy and heat capacity measured by ac calorimetry reveal consistently a single s-wave superconductivity with an intermediate coupling strength $2\Delta/k_BT_c \approx 3.7$ for all samples, regardless of how much the CDW order is developed or suppressed in the samples. The lower critical field and penetration depth have also been measured by the local magnetometry using an array of miniature Hall-probes. They cannot be described within a simple s–wave superconducting picture as given by STM and specific heat measurements. Magnetization properties, superconducting anisotropy, pinning and vortex phase diagram of Cu_xTiSe_2 will be discussed as well.

9:45-10:10 S1 2

1. E. Morosan *et al.*, Nat. Phys. **2** (2006) 544.
2. J. Kačmarčík *et al.*, Phys. Rev. B **88** (2013) 020508(R).
3. P. Husaníková *et al.*, Phys. Rev. B **88** (2013), 174501.
4. G. Karapetrov *et al.*, submitted to Phys. Rev. Lett.

QUANTUM FLUCTUATIONS AND SUPERCONDUCTIVITY IN DENSITY WAVES SYSTEMS

Manuel Núñez Regueiro

Institut Néel, Université Alpes Grenoble and C.N.R.S., BP166Cedex 09, 38042 Grenoble, France.

The superconducting dome arousing around a quantum critical point (QCP) is a phenomenon first discovered in density wave materials (DW) [1]. It was thoroughly studied in the heavy fermion field, where the physical problem is essentially magnetic. As for DW systems the lattice plays a more important role, it is thus instructive to analyze the behavior of the systems around DWQCP's. Recent studies [2] have provided a detailed view of them. In particular, the passage with changing pressure or doping parameter δ from a "classical" BCS behavior to the quantum fluctuations (QF) regime preceding the QCP has been determined on the spin-charge density wave of chromium metal. As δ increases the transition temperature $T_{\rm N}$ first follows a $-\log(\delta)$ behavior. At a certain value of $T_{\rm N}$, the behavior of $T_{\rm N}$ crossovers to a QF power law $(1-\frac{\delta}{\delta_{\rm c}})^{1/2}$ that continues down to the QCP.

10:10-10:35 S1 3

The analysis of known cases of DWQCP concludes that several DW materials evidence the same behavior, but that many others do not show the classical BCS region, but just the QF region. Comparison of their respective intrinsic correlation lengths shows that only those with large intrinsic coherences lengths reflect the classical BCS regime. This allows deducing that the crossover from the classical to the QF regime is controlled by the ratio of the intrinsic (i.e. BCS) to the QF coherence length.

The fact that many DW systems do not follow the classical BCS behavior in their way to the QCP invalidates the application of the well-known Bilbro-McMillan relation $T_0^{1-n_0}(p)T_{\rm c}^{n_0}(p)=T_{\rm cmax}$, where n_0 is the fraction of the Fermi surface under the CDW gap and $T_{\rm cmax}$ the superconducting transition with no CDW. Using scaling properties of both the DW and the superconducting state near QCP's a novel different relation, valid in the QF region, is obtained: $\frac{T_{\rm c}^2(p)}{T_{\rm cmax}^2}+\frac{T_0^2(p)}{T_{0\rm max}^2}=1$. Its application to different systems, including heavy fermions and pnictides is discussed.

[1] A. Briggs *et al.*, J. Phys. C: Solid State Phys. **13** (1980) 2117.
[2] R. Jaramillo *et al.*, Nature **459** (2009) 405.

SUPERCONDUCTING DEVICES TO STUDY BASIC PHENOMENA AT CHALMERS

Tord Claeson

Chalmers University of Technology, Dept. Microtechnology and Nanoscience, SE41296 Gothenburg, Sweden.

Dynamical Casimir Effect: By shaking a mirror rapidly, it is possible to transform vacuum fluctuations to detectable photons, but the mirror ha to move close to the speed of light to obtain a finite number of events and this has prevented their detection. Varying the inductance at microwave frequency of a Superconducting Quantum Interference Device, SQUID, which terminated a transmission line, it was possible to rapidly change the effective length of the cavity and detect photons within a broad range around half the pump frequency.

11:00-
11:45
S2
1

Gap Contribution at Nodes in a High Temperature Superconductor: A d-wave symmetry of the superconducting order in a high Tc cuprate is well established but there are suggestions of an additional (imaginary) gap contribution. Using a superconducting single charge transistor (SET) it is possible to obtain an estimate of the minimum energy gap of a bulk nano-island. The sensitivity of the SET is orders of magnitude higher than in typical surface methods. A small contribution to the energy gap, of the order of micro-eV, was detected in an YBCO island and it grew linearly with applied magnetic field.
I will review novel experiments at Chalmers, they are described in [1] and [2].

[1] C.M. Wilson *et. al.*, Nature **479** (2011) 376.
[2] D. Gustafsson *et. al.*, Nature Nanotechnology **8** (2013) 25.

NONCLASSICAL PHOTON PAIRS EMITTED BY A JOSEPHSON JUNCTION

Phillipe Joyez[1], O. Parlavecchio[1], C. Altimiras[2], M. Hofheinz[3], D. Vion[1], D. Esteve[1], P. Roche[1], F. Portier[1]

1 Quantronics Group, Service de Physique de l'Etat Condensé, CEA-Saclay, France.
2 Instituto Nanoscienze CNR and Scuola Normale Superiore, Piazza San Sylstro 12, 56127, Pisa, Italy.
3 CEA-Grenoble, France.

11:45-12:10
S2
2

When a Josephson junction is biased at finite sub-gap voltage V the energy 2 eV delivered by the voltage source when a Cooper pair tunnels can only be evacuated as photons emitted in the electromagnetic environment. This emission process is similar to the radiative decay of an atom and can be strongly enhanced by connecting the junction to a high impedance environment.
We have designed experiments where the junction's electromagnetic environment consists of high impedance resonant modes at microwave frequencies and where we can measure the radiation emitted in this modes. With such an environment consisting of two modes, it is possible to produce pairs of photons, one in each mode. We have investigated experimentally the properties of this two-photon source. In particular, we have checked the recent prediction by Leppagankas [1] and co-workers that the radiation emitted by these two photon-processes violates a Cauchy-Schwarz inequality characteristic of classical radiation. More specifically, this inequality shows the suppression of fluctuations in the difference of populations between the two modes below the classical limit.

[1] J. Leppäkangas *et al.*, Phys. Rev. Lett. **110** (2013) 267004.

DOMAIN STRUCTURE OF FERROMAGNETIC SUPERCONDUCTORS

Alexander Buzdin[1], A.S. Melnikov[2], I. Khaimovich[2]

1 University of Bordeaux, LOMA UMR-CNRS 5798, F-33405, France.
2 Institute for Physics of Microstructures, Russian Academy of Sciences, 603950 Nizhny Novgorod, Russia.

12:10-12:35
S2
3

The domain structure is inherent to all ferromagnets and therefore an interesting question how it changes in the superconducting ferromagnets arises. We study the domain structures in ferromagnetic superconductors taking account of the nucleation of vortices and antivortices coupled to the magnetic texture. It is demonstrated that the coupling between domains and vortices results in the formation of two energetically favorable domain configurations: (a) a Meissner - type vortex free configuration with dramatic domain shrinking and (b) a more rare domain configuration with a dense vortex – antivortex lattice. The switching between these configurations is shown to result in the first order phase transitions which could be observable in triplet superconducting uranium based compounds URhGe, UGe_2, and UCoGe. The studies of the domain structure evolution could provide important information on the mechanisms of superconductivity and magnetism interplay.

ORDER AND DISTORTIONS IN A FRUSTRATED SYSTEM

S.A. Grigera[1,2]

1 Instituto de Física de Líquidos y Sistemas Biológicos, UNLP-CONICET La Plata, Argentina

2 School of Physics and Astronomy, University of St. Andrews, Fife KY16 9SS, Scotland.

14:30-15:15 S3 1

Spin ice is a deceptively simple frustrated system composed of Ising spins on the vertices of a pyrochlore lattice with effective ferromagnetic nearest neighbour interactions and an additional dipolar term. In this talk I will briefly discuss some of the properties of this system's ground state and low temperature excitations, and show that they are described in a very compact way by associating the latter with emergent magnetic charges. Using this description I will discuss experimental magnetisation processess where the excitations are topologically protected, and non-equilibrium effects. I will finish the talk by discussing the effects distortions play in determining the phase diagram of this system as a function of temperature and magnetic field.

DIRECT IMAGING OF COMPLEX SPIN ICE BEHAVIOR IN ARTIFICIAL FERROMAGNETIC QUASICRYSTALS

V.S. Bhat[1], A. Balk[2], J. Unguris[2], B. Farmer[1], E. Teipel[1], N. Smith[1], J.T. Hastings[3], Lance E. De Long[1]

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2 National Institute of Standards and Technology, Center for Nanoscale Science and Technology, 100 Bureau Dr., Gaithersburg, MD 20899, USA.
3 University of Kentucky, Department of Electrical and Computer Engineering, 453F Paul Anderson Tower, Lexington, KY 40506-0046, USA.

Spontaneously formed quasicrystals are rare and difficult to fabricate, but exhibit highly unusual properties due to their signature lack of periodic translational symmetry [1]. Fortunately, recent advances in nanofabrication have permitted ferromagnetic (FM) thin films to be patterned into artificial quasicrystals, and this novel class of metamaterials exhibits complex magnetic reversal and dynamics that can be systematically controlled via tiling design [2]. We have acquired the first direct, two-dimensional images of magnetization textures of permalloy films patterned into Penrose P2 tilings (P2T) using scanning electron microscopy with polarization analysis (SEMPA) [3]. Our SEMPA images demonstrate P2T behave as geometrically frustrated networks of narrow FM segments having uniform, bipolar (Ising-like) magnetization, similar to square and honeycomb artificial spin ices (ASI). The most heavily studied ASI are *periodic* arrays of identical Ising segments with symmetric vertices of low coordination that obey local spin ice rules (SIR), undergo stochastic FM switching on field cycling, and resist full equilibration into a magnetically ordered ground state [4]. In contrast, we find the unique aperiodic translational symmetry and diverse vertex coordination of P2T induce novel, *complex spin-ice behavior* driven by vertex domain wall energies, which differs markedly from disconnected, periodic ASI governed only by dipolar interactions. Novel Monte Carlo simulations and SEMPA images of as-grown (never-field-cycled) P2T corroborate the existence of *highly degenerate, magnetically ordered sublattices* that are low-energy building blocks for the emergent ground state of a quasicrystal of classical Ising spins.

15:15-15:40 S3 2

Acknowledgement: Research at University of Kentucky supported by U.S. DoE Grant No. DE-FG02-97ER45653, the UK Center for Advanced Materials under U.S. NSF Grant No. EPS-0814194, and the UK Center for Computational Sciences.

[1] A.I. Goldman *et al.*, Nat. Mater. **12** (2013) 714.
[2]V.S. Bhat *et al.*, Phys. Rev. Lett. **111** (2013) 077201.
[3] M.R. Scheinfein *et al.*, Rev. Sci. Instrum. **61** (1990) 2501.
[4] C. Nisoli, R. Moessner and P. Schiffer, Rev. Mod. Phys. **85** (2013) 1473.

QUANTUM CRITICAL POINT IN THE SUPERCONDUCTING TRANSITION ON THE SURFACE OF TOPOLOGICAL INSULATOR

Dingping Li[1], B. Rosenstein[2,3], I. Shapiro[4] and B. Ya. Shapiro[4]

1 School of Physics, Peking University, Peking, China.
2 Electrophysics Department, National Chiao Tung University, Hsinchu, Taiwan, R.O.C.
3 Physics Department, Ariel University, Ariel 40700, Israel.
4 Physics Department, Bar-Ilan University, 52900 Ramat-Gan, Israel.

15:40-16:05
S3
3

Pairing in the Weyl semi-metal appearing on the surface of topological insulator is considered. It is shown that due to an "ultra-relativistic" dispersion relation there is a quantum critical point governing the zero temperature transition to a superconducting state. Starting from the microscopic Hamiltonian with local attraction, we calculated using the Gor'kov equations, the phase diagram of the superconducting transition at arbitrary chemical potential, its magnetic properties and critical exponents close to the quantum critical point. The Ginzburg - Landau effective theory is derived allowing to consider effects of inhomogeneous configurations of order parameters in magnetic field. The GL equations are very different from the usual ones reflecting the chiral universality class of the quantum phase transition. The magnetization near the upper critical field is found to be quadratic in B, not linear like in usual Abrikosov vortex lattice. The order parameter distribution of a single vortex is found to be different as well. We discuss the application of these results to recentl experiments in which surface superconductivity was found that some 3D topological insulators and estimate feasibility of phonon pairing.

EXOTIC MAGNETISM PRODUCED BY STRONG SPIN-ORBIT COUPLING IN COMPLEX Ir OXIDES

Daigorou Hirai[1,2], T. Takayama[1,2] and H. Takagi[1,2]

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2 Max-Planck-Institute for solid state research, Heisenbergstrasse 1, Stuttgart 70569, Germany.

In 5d Iridium oxides, a large spin-orbit coupling of $\sim 0.5\,\mathrm{eV}$, inherent to heavy 5d elements, is not small as compared with other relevant electronic parameters, including Coulomb U, transfer t and crystal field splitting D, which gives rise to a variety of exotic magnetic ground states. In the layered perovskite Sr_2IrO_4, spin-orbital Mott state with $J_{eff} = 1/2$ is realized due to the novel interplay of those energy scales [1-3]. Despite the strong entanglement of spin and orbital degrees of freedom, $J_{eff} = 1/2$ iso-spins in Sr_2IrO_4 was found to be surprisingly isotropic, very likely due to a super-exchange coupling through almost 180° Ir-O-Ir bonds [4]. The temperature dependence of in-plane magnetic correlation length of $J_{eff} = 1/2$ iso-spins, obtained from inelastic x-ray resonant magnetic scattering, was indeed well described by that expected for two-dimensional $S = 1/2$ Heisenberg antiferromagnet [4]. Such $J_{eff} = 1/2$ 2D Heisenberg magnet was recently shown to be tailored using $SrIrO_3/SrTiO_3$ super-lattice structure [5].

When $J_{eff} = 1/2$ iso-spins interact with each other through 90° Ir-O-Ir bonds, very anisotropic bond dependent ferromagnetic coupling is expected, unique to strong SOC system. Complex Ir oxides with honeycomb and more recently identified hyper-honeycomb lattices [7], where $x-$, $y-$ and $z-$ 90° Ir-O-Ir bonds are realized, may be candidates for quantum spin liquid expected for the Kiatev model. Very likely due to the superposition of additional magnetic couplings not included in the Kitaev model [8], in reality, a long range magnetic ordering emerges at low temperatures in those compounds. Hyper-honeycomb β-Li_2IrO_3, though eventually show a marginal ordering, appears to be located at bthe critical vicinity to the Kitaev spin liquid.

In this talk, we focus on those exotic magnetisms in complex Ir oxides.

16:30-17:15
S4
1

[1] B.J. Kim *et al.*, Phys. Rev. Lett. **101** (2008) 076402.
[2] B.J. Kim *et al.*, Science **323** (2009) 1329.
[3] S. Fujiyama *et al.*, Phys. Rev. Lett. **112** (2014) 016405.
[4] G. Jackeli and G. Khaliullin, Phys. Rev. Lett. **102** (2009) 017205.
[5] S. Fujiyama *et al.*, Phys. Rev. Lett. **108** (2012) 247212.
[6] J. Matsuno *et al.*, submitted.
[7] T. Takayama, *et al.*, submitted.
[8] A. Kitaev, Annals of Physics **312** (2006) 2.

MAGNETIC EXCITON EXCITATIONS IN HEAVY FERMION SEMIMETALS

Peter Riseborough

Department of Physics, Barton Hall, 1900 N. 13th St., Temple University, Philadelphia, PA 19122, USA.

Recently, Mignot *et al.* [1] have reported the existence of spin-exciton excitations in single crystals of the orthorhombic cerium based material $CeFe_2Al_{10}$. Previous experiments on Ru doped samples [2] showed the existence of a spin gap which was also recently confirmed by time-of-flight (TOF) neutron scattering experiment on single crystal of $CeFe_2Al_{10}$ by Adroja *et al.* [3]. Thermodynamic, transport [4] and optical conductivity [5] measurements indicate that this material is an anisotropic heavy-fermion semiconductor but one with a pseudo-gap in the density of states. We consider the magnetic excitations of a model first introduced by Ikeda and Miyake [6], which describes heavy-fermion semiconductors with nodes in the gap. We find a branch of magnetic exciton excitations as expected for semi-conducting materials which are in close proximity to an antiferromagnetic quantum critical point [7]. The results are in qualitative agreement with the results of reference [1], but we also find that the nodes in the gap yield a small intensity quasi-elastic scattering peak which could be observable by neutron scattering at finite temperatures.

17:15-17:40
S4
2

[1] J.M. Mignot *et al.*, arXiv:1401.2892 (2014).
[2] D.T. Adroja *et al.*, Phys. Rev. B **87** (2013) 224415.
[3] D.T. Adroja *et al.*, to be published.
[4] Y. Muro *et al.*, J. Phys. Soc. Japan **78** (2009) 083707.
[5] S.I. Kimura *et al.*, Phys. Rev. B **84** (2011) 165125.
[6] H. Ikeda and K. Miyake, J. Phys. Soc. Japan **65** (1996) 1769.
[7] P.S. Riseborough, J. Magn. Magn. Matter. **226-230** (2001) 257.

MULTIPLE POLYAMORPHISMS AND SUPERCONDUCTIVITY IN Ce-BASED METALLIC GLASSES

Gastón Garbarino[1], P. Bruna[2,3], E. Pineda[4,5], M. J. Duarte[2], J. Serrano[2], D. Crespo[2,5], P. Bouvier[6], M. Núñez Regueiro[7]

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2 Departament de Física Aplicada, EPSC, Universitat Politècnica de Catalunya, 08860 Castelldefels, Spain.
3 Centre de Recerca en Nanoenginyeria, Universitat Politècnica de Catalunya, 08034, Barcelona, Spain.
4 Departament de Física i Enginyeria Nuclear, ESAB, Universitat Politècnica de Catalunya, 08860 Castelldefels, Spain.
5 Centre de Recerca de l'Aeronàutica i de l'Espai, Universitat Politècnica de Catalunya, 08034 Barcelona, Spain.
6 Laboratoire des Matériaux et du Génie Physique, CNRS and Grenoble Institute of Technology, 38016 Grenoble, France.
7 Institut Néel, CNRS and Université Joseph Fourier, 38042 Grenoble Cedex, France.

17:40-18:05
S4
3

Metallic glasses (MGs) are in the cutting edge of material science research for their unique properties that yield a variety of commercial applications [1]. For the fundamental point of view, they present several attracting features like polymer-like thermoplastic behavior, hard magnetic properties, polyamorphism or superconductivity [2]. In this work we combine synchrotron x-ray diffraction and electrical resistivity measurements under extreme pressure and temperature conditions in Ce70Al10Ni10Cu10 to report correlated electronic and structural transitions. These transitions are associated with the disapareance of a Kondo anomaly and delocalization of the Ce $4f$ electrons, a low to high density polyamorphic transition and a pressure induced superconducting state with a maximum critical temperature (T_c) at 5 K at 10 GPa. The observed transformations match the structural transformations reported for pure crystalline Cerium. Our measurements show that f electron delocalization and superconducting pressure transitions have an unexpected weakly dependence on translational symmetry.

[1] W.H. Wang *et al.*, Mater. Sci. and Eng. R **44** (2004) 45.
[2] W.H. Wang *et al.*, Adv. Mater. **21** (2009) 4524.

Saturday, August 2nd. Julián's sessions.

9:00 - 10:30 **SESSION 5**

10:30 - 11:00 **COFFEE BREAK**

11:00 - 12:30 **SESSION 6**

12:30 - 14:30 **LUNCH**

14:30 - 16:00 **SESSION 7**

16:00 - 16:30 **COFFEE BREAK**

16:30 - 18:05 **SESSION 8**

20:00 - 23:00 **DINNER**

About Julián...

We have known Julián for decades, which is the appropiate time scale in which time is measured counting from his (and our) times as a student. The decades have been filled by a quite large amount of measurements, patience, perserverence, and work which has earned him the respect of colleagues. The subject that has seen his contributions has mutated, in name at least, from "Intermediate Valence" to "Heavy Fermions" to "Highly Correlated Fermions" to "Quantum Critical Points". All this time, in Julián's own words, he has done "Cerious work" never losing interest in Cerium and its compounds.

Throughout, his passion has been to understand the systematics in these complicated systems, as a function of all the physical parameters, to get to the bottom of the underlying physical phenomena and to seek out whatever logic inferences can be made about them.

He has travelled untiringly from Patagonia to Europe searching for and exchanging samples, and visiting and inviting colleagues to the Low Temperature lab. As a native Italian and nationalized Argentinian, one of his first stops was Genova, Italy. By the way, in case some of our colleagues don't already know it, the explanation for his name of "Tano" is just the mixture of Argentinian and Italian roots of Dottore Sereni. But he has not stopped in Italy alone. He has good friends also in France, in Strasbourg and Grenoble, in Germany, Cologne, Dresden, Darmstadt, Karslruhe, Leipzig, Augsburg, as well as in Vienna, Austria. Nor should we forget those in Geneva, America and Japan. Many of those friends have also come to know our remote corner of the Earth.

He has formed many students, published many papers ($\sim$ 160 at last count) and has been a constant presence in the group, taking the administrative leadership at times, being a "foot soldier" at others, but always mantaining a strong interest in the well being of the laboratory and willing to talk about his work, in seminars, informal talks and courses.

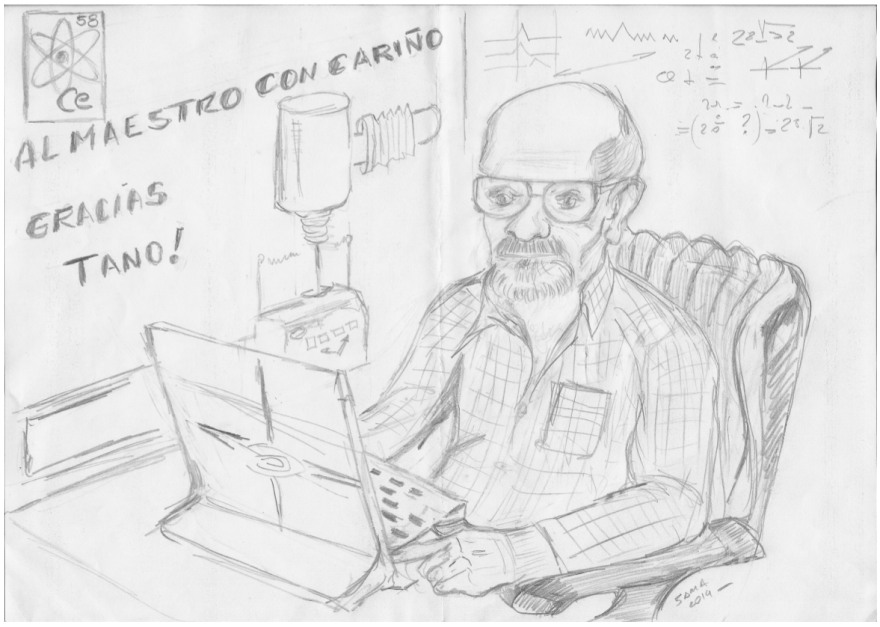
From the personal perspective, he has always been enthusiastic about his work, usually in a good mood, and with a positive attitude towards students and colleagues.

His sense of humor is legendary in the laboratory. Many think his jokes are so bad they make you laugh, others are still trying to fathom the hidden depths in them. The author of the jokes himself is proud of his reputation as an interesting and somewhat hard to understand humorist. On this track he has had some worthy students and colleagues as well. The trio Sereni, Frank and Godfrin have produced memorable get-togethers, which unfortunately (or fortunately) have not been recorded for posterity.

Not as famous as other italian Tenors like Pavarotti, nevertheless he is well known in the Bariloche Choir community, where he has sung as a Tenor in many choirs, again in a decades long experience. An enthusiastic mountain trekker and traveller to odd corners of Patagonia, he is often seen accompanied by Regi, another constant through the decades. They form a close knit family, with grandchildren included.

So, with this introduction to Dr. Julian Sereni, we hope the conference is a success and wish him all the best!

J. Luzuriaga, G. Nieva and H. Godfrin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AL MAESTRO CON CARIÑO
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TANO!

FROM FERMI LIQUID TO MOTT-HUBBARD LOCALIZATION IN 2D ^{3}He

Henri Godfrin and E. Collin

CNRS - Institut Néel, Grenoble, France.

9:00-9:45 S5 1

Two-dimensional ^{3}He films of atomic thickness adsorbed on graphite are experimental model systems where interesting characteristic features of two-dimensional highly correlated fermions can be investigated. We discuss the transition observed as density (i.e. interaction) is increased from a highly correlated Fermi liquid regime (high density fluid) to a Mott-Hubbard localized state.

INTERPRETATION OF EXPERIMENTAL RESULTS ON KONDO SYSTEMS INCLUDING CRYSTAL-FIELD EFFECTS

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1 Instituto de Desarrollo Tecnológico para la Industria Química (INTEC), U. N. del Litoral, 3000 Santa Fe, Argentina.

2 Centro Atómico Bariloche and Instituto Balseiro, Comisión Nacional de Energía Atómica, 8400 Bariloche, Argentina.

9:45-10:30 S5 2

We present a simple approach to calculate the thermodynamic properties of single Kondo impurities including orbital degeneracy and crystal field effects (CFE) by extending a previous proposal by K. D. Schotte and U. Schotte [1]. Comparison with exact solutions for the specific heat of a quartet ground state split into two doublets shows deviations below 10 % in absence of CFE and a quantitative agreement for moderate or large CFE. As an application, we fit the measured specific heat of the compounds $CeCu_2Ge_2$, $CePd_3Si_{0.3}$, CePdAl, CePt, Yb_2Pd_2Sn and $YbCo_2Zn_{20}$. The agreement between theory and experiment is very good or excellent depending on the compound, except at very low temperatures due to the presence of magnetic correlations (not accounted in the model).

[1] K. D. Schotte and U. Schotte, Phys. Lett. **55A** (1975) 38.

SUBSTITUTION DRIVEN MAGNETIC INSTABILITIES OF NON-FERMI LIQUID $Ce_3Pd_4Si_4$

N. Robisch[1], S. Khan[1], I. Messner[1], F. Kneidinger[1], H. Michor[1], Ernst Bauer[1], J.G. Sereni[2] and P. Rogl[3]

1 Institute of Solid State Physics, Vienna University of Technology, A-1040 Wien, Austria
2 Low Temperature Laboratory, Centro Atómico Bariloche, Argentina
3 Institute of Physical Chemistry, University of Vienna, A-1090 Wien, Austria

11:00-11:45 S6 1

An experimental study of ternary $Ce_3Pd_4Si_4$ evidenced non-Fermi liquid properties due to the proximity of this non-magnetic compound to a quantum critical point. The ground state observed for this Ce system appears to be a result of mutual interactions of the crystalline electric field, of the Kondo effect and of RKKY interactions. A subtle change of the balance of these interactions e.g., by pressure or by substitutions is expected to trigger some instability, presumably of magnetic origin.
The aim of the present investigation is to reveal the response of the system when certain atoms in $Ce_3Pd_4Si_4$ are exchanged by different other appropriate elements. Here we will show how long range magnetic order in the substituted materials develops on a substitution of Ce/La, of Pd/Ni and of Si/Ge from a study of temperature, pressure and magnetic field dependent transport properties, of magnetization and of specific heat.
Acknowledgement: Work supported by the Austrian FWF, P22295.

MAGNETIC INTERACTIONS IN LOW DIMENSIONAL SYSTEMS: FROM SUPEREXCHANGE TO SPIN DENSITY WAVES

Ana María Llois[1,2]

1 Condensed Matter Group, GIyA-CNEA, Centro Atómico Constituyentes, Avenida General Paz y Constituyentes, 1650 San Martín, Argentina.
2 Departamento de Física J.J. Giambiagi, Fac. de Ciencias Exactas y Naturales, Universidad Nacional de Buenos Aires, Argentina.

11:45-12:30 S6 2

I am going to talk in this presentation about the richness and the different mechanisms underlying low dimensional magnetism in the presence of covalent interactions. Several situations are going to be considered, among them:
i) the varying nature of the magnetic interactions that take place in transition metal nanostructures when they are separated by an isolating or quasi isolating ultrathin film from a metallic substrate, and
ii) the magnetic response triggered by the presence of edges in nanoribbons of non magnetic metallic transition metal dichalcogenides.

FROM ALLOYS TO PURE COMPOUNDS: GETTING NEW PHENOMENA AND MORE INSIGHT BY DOPING

Christoph Geibel

Max Planck Institute for Chemical Physics of Solids, Nöthnitzer Strasse 40, D-01187 Dresden, Germany

The long standing cooperation between our research group and the group of Julian Sereni was devoted to the investigation of Kondo physics in alloys of Ce-based compounds. Quite a number of these studies revealed interesting features and therefor resulted in long term projects devoted to an in depth studies of the related compounds, which in some cases led to decisive discoveries. I shall present and discuss a few examples, show how an apparently simple project may end with unexpected, unconventional and interesting physics, and report on very recent results.

The first system studied upon starting this cooperation was the alloys $CeCu_2(Si_xGe_{1-x})_2$ between the heavy fermion superconductor $CeCu_2Si_2$ and the antiferromagnet $CeCu_2Ge_2$ [1]. This study proved $CeCu_2Si_2$ to be exactly at the critical point separating the AFM from the non-magnetic state. This result initiated quite a number of projects in our group, e.g. the growth of large single crystals to allow for a neutron diffraction study of the magnetic structure as a function of Si content. Ultimately this led to the proof of the AFM nature of the mysterious A-Phase of $CeCu_2Si_2$, and a few years later to the observation of the resonance related to the formation of the superconducting state. Last year specific heat measurements down to very low temperatures very surprisingly evidenced the heavy Fermi surface to be fully gaped in the superconducting state, in complete disagreement with the d wave order parameter proposed up to now. I shall discuss the implication of this recent observation for our understanding of $CeCu_2Si_2$.

14:30-15:15
S7
1

A recent topic in this cooperation are CeTX compounds (T = Sc, Ti, Fe, Co, Ru; X = Si, Ge) crystallizing in the CeFeSi or the related CeScSi structure type. Although known for years, these compounds have only poorly been investigated. In the last year Julian Sereni investigated the transition from the AFM system CeCoSi to the non-magnetic valence fluctuating system CeFeSi, while at the MPI-CPfS we studied the effect of pressure on pure CeCoSi. We observed a very unusual phase diagram showing the appearance at moderate pressures (about 1.5GPa) of a high temperature phase with $T_S \cong 38\,K$, well above $T_N = 8.8\,K$ at low p [1]. A clear upturn in the resistivity at T_S initially suggest the formation of a Spin Density Wave, which is however excluded since T_S shows a strong positive magnetic field dependence. Therefore we discuss a metaorbital type of transition connected with quadrupole ordering as possible origin.

[1] O. Trovarelli *et al.*, Phys. Rev. B **56** (1997) 678.
[2] S. Kittaka *et al.*, Phys. Rev. Lett. **112** (2014) 067002.
[3] E. Lengyel *et al.*, Phys. Rev. B **88** (2013) 155137.

HIGH PRESSURE INVESTIGATION OF HEAVY FERMION COMPOUNDS

Didier Jaccard, Z. Ren, G. Giriat and G. Scheerer

DPMC, University of Geneva, 24 Quai E.-Ansermet, CH-1211 Geneva 4, Switzerland

In a first part we describe recent experimental progresses in high pressure electronic property investigations such as ac-calorimetry measurements up to 27 GPa, multiprobe setup including ac-magnetic susceptibility, complex-probe resistivity measurements or pressure cycling effect. Part 2 focuses on the discovery of pressure-induced superconductivity of $CeAu_2Si_2$ in a very broad pressure interval between 11 and 27 GPa with transition temperature T_c up to 2.5 K. Remarkably, both bulk T_c and the magnetic ordering temperature are enhanced when increasing the pressure from 16 to 21 GPa. Evidence are shown of a magnetic quantum critical point at $p_c \approx 22.5$ GPa as well as a critical end point at p^*, just above p_c, for the continuous delocalization of Ce $4f$ electron [1].

15:15-16:00 S7 2

In part 3 we show that the maximum T_c is observed for almost the same unit-cell volume as that of the isoelectronic and isostructural compounds $CeCu_2Si_2$ and $CeCu_2Ge_2$, where Kondo and crystal field splitting energies become comparable. Finally, we discuss our results in reference to the recently proposed orbital transition scenario [2,3].

[1] G. Seyfarth *et al.*, Phys. Rev. B **85** (2012) 205105.
[2] K. Hattori, J. Phys. Soc. Japan **79** (2010) 114717.
[3] L.V. Pourovskii *et al.*, Phys. Rev. Lett. **112** (2014) 106407.

THE ROLE OF CRYSTALLOCHEMISTRY IN $YbCu_{5-X}Au_X$

Mauro Giovannini

Dipartimento di Chimica e Chimica Industriale, University of Genova, Via Dodecaneso 31, I-16146 Genova, Italy

Several aspects make Yb compounds attractive for research studies, such as valence fluctuations and other low temperature anomalies. Recently a strong emphasis was given to the investigation of the solid solutions $YbCu_{5-x}M_x$ (M = Ag, Au, In) crystallizing in the cubic $AuBe_5$-type structure, where the substitution of Cu by M offers the possibility to study the different evolution of the ground state properties depending on the M element. The common starting point with $x = 0$, $YbCu_5$, showing dense Kondo behavior, has been synthesized in the cubic single phase only under high pressure and melt spinning. In particular, the $YbCu_{5-x}Au_x$ system is an emblematic case of the various aspects (such as crystallochemistry [1,2] and geometric frustration [3] which have to be considered in the study of ground state properties of materials. Much effort has been done in order to determine the possible location of a quantum critical point (QCP) within this solid solution [4,5]. Starting from $x = 1$, an antiferromagnetic long range order was confirmed for $YbCu_4Au$ below 1 K [6], and Au/Cu substitution towards lower x increases the Kondo interactions giving the possibility to approach quantum criticality.

16:30-16:55 S8 1

In this presentation the current status of the studies on the intriguing $YbCu_{5-x}Au_x$ system will be reviewed, with a particular focus on the role of crystallochemistry, trying to shed some light on the possible existence of a QCP in the system.

[1] M. Giovannini *et al.*, J. Phys. Cond. Matter **17** (2005) 877.
[2] M. Giovannini *et al.*, Intermetallics **16** (2008) 399.
[3] I. Curlik *et al.*, arXiv:1403.6004 (2014).
[4] K. Yoshimura *et al.*, J. Alloys Compd. **317-318**, (2001) 465.
[5] M. Galli *et al.*, Physica B **312-313** (2002) 489.
[6] E. Bauer *et al.*, Physica B **234-236** (1997) 676.

ELECTRICAL TRANSPORT AT HIGH PRESSURES OF Cr_3Te_4 FERROMAGNET

Pablo Pedrazzini[1], D. Franco[1], G. Nieva[1], D. Jaccard[2], G. Pristáš[3] and S. Gabáni[3]

1 Low Temperature Laboratory and Instituto Balseiro, Centro Atómico Bariloche (CNEA), Avda. Bustillo 9500, 8400 S.C. de Bariloche, Argentina.
2 DPMC, University of Geneva, 24 Quai E.-Ansermet, CH-1211 Geneva 4, Switzerland.
3 Institute of Experimental Physics, SAS, 47 Watsonova st., 040 01 Košice, Slovakia.

The chromium chalcogenide Cr_3Te_4 orders ferromagnetically at $T_C \sim 325\,K$, displaying a slight moment rearrangement at $T_N \sim 80\,K$. Although the pressure effect on both transitions has been studied through transport, thermodynamic and spectroscopic techniques, there is still room for different interpretations on the evolution of magnetism.
We show high pressure electrical resistivity $\rho(T)$ and thermoelectric power $S(T)$ measurements on single crystals performed inside liquid ($0 < p < 2.5\,GPa$) and solid ($0 < p < 8.5\,GPa$) media. We detect a possible tricritical point around $p1 \sim 2.2\,GPa$, where $T_C(p)$ and $T_N(p)$ seem to coincide. At pressures above $p2 \sim 3.5\,GPa$ we observe a change in the $\rho(T)$ curves: the magnetic transition anomaly can no longer be detected, while the residual resistivity $\rho_0(p)$ and thermopower coefficient $S_0(p) = S(T,p)/T$ display a sudden discontinuity. The electrical resistivity of Cr_3Te_4 is non-metallic at pressures $p > p_2$. We will discuss different alternatives that can explain these changes with applied pressures.

16:55-17:20 S8 2

ENTROPY BOTTLENECKS AT $T \to 0$ IN Ce-LATTICE AND RELATED COMPOUNDS

Julián Gustavo Sereni

Laboratorio de Bajas Temperaturas & Instituto Balseiro, Centro Atómico Bariloche, CNEA, Avda. Bustillo 9500, 8400 S.C. de Bariloche, Argentina.

A number of specific heat (C_m) anomalies were reported in Ce-lattice and related compounds around 1 K which cannot be associated to usual phase transitions despite the trivalent character of those ions. Instead of a $C_m(T)$ jump, those anomalies show coincident morphology: i) a significant tail in $C_m(T)/T$, with a power law thermal decay above the maximum ($T > T_m$), ii) whereas a $C_m(T^2)$ dependence is observed below T_m. iii) The comparison of their respective entropy gain ($S_m(T)$) indicates that about $0.7R\ln(2)$ is condensed within the $T > T_m$ tail, in coincidence with exemplary frustrated systems. Such amount of entropy arises from a significant increase of the density of low energy excitations, reflected in the divergent $C_m(T > T_m)/T$ dependence. iv) The lattice structure presents the conditions for magnetic frustration.
The origin of these anomalies can be attributed to the interplay between the divergent density of magnetic excitations at $T \to 0$ and the limited amount of available degrees of freedom: $S_m = R\ln(2)$ for these doublet-ground state compounds. Due to this "entropy bottleneck", the systems are constrained to search for alternative minima in their free energies. As a consequence, they are driven to exotic magnetic configurations below T_m in a continuous transition. One relevant observation is a possible existence of an upper limit of $C_m/T_{LimT\to 0} \approx 7 J/mol\,K^2$ as observed in four Yb- and Pr-based compounds.

17:20-18:05 S8 3

JULIÁN SERENI (A MAGNETIC MAN)

Francisco de la Cruz and María Elena Porta de la Cruz

Low Temperature Laboratory.

Dinner 1

In 1972 Julian started his pioneering work as a graduate student in the Low Temperature Laboratory of the Centro Atómico Bariloche. Since then, he spent most of his scientific life in this laboratory studying different aspects of magnetic materials in collaboration with students and colleagues all over the world. We will try to describe the outstanding effort and the particular approach Julian has to build the technical and scientific bases of an internationally respected group. It is an example of how the then young student was able to start and after develop the today active and successful scientific activity, in spite of the original scarce economical and scientific resources. It is quite appropriate to celebrate his success shared by his students and national and international friends and collaborators.

Sunday, August 3^{rd}

9:00 - 10:35 **SESSION 9**

10:35 - 11:00 **COFFEE BREAK**

11:00 - 12:35 **SESSION 10**

12:35 - 14:30 **LUNCH**

14:30 - 16:05 **SESSION 11**

16:05PM - 18:00PM **POSTER SESSION**

INTRA-UNIT-CELL SYMMETRY BREAKING AS FUNDAMENTAL TO CUPRATE PHYSICS

J.C. Seamus Davis[1,2,3,4]

1 Condensed Matter Physics and Materials Science Department, Brookhaven National Laboratory, Upton, NY 11973, USA.
2 Laboratory of Atomic and Solid State Physics, Department of Physics, Cornell University, Ithaca, NY 14853, USA.
3 School of Physics and Astronomy, University of St. Andrews, Fife KY16 9SS, Scotland.
4 Kavli Institute at Cornell for Nanoscale Science,Cornell University, Ithaca, NY 14853,USA.

Understanding the microscopic electronic structure of the CuO_2 plane represents the essential challenge in cuprate studies. Although often disregarded, intra-unit-cell (IUC) degrees of freedom associated with the two O sites of CuO_2 may actually represent the key. Studies of underdoped cuprates using X-ray scattering, RIXS, Neutron scattering, and NMR, have all revealed a remarkably rich $Q = 0$ phenomenology indicating that the IUC degrees of freedom are active and important; this is borne out strongly by direct visualization of electronic symmetry breaking within the CuO_2 unit cell [1-5]. In what has long been assumed a distinct phenomenology, $Q \neq 0$ density waves have also been reported in underdoped cuprates with recent demonstrations that they are the same the modulations detected by STM imaging [1,4,5]. Although distinct in terms of which symmetry is broken, we consider whether the $Q = 0$ (intra-unit-cell) and $Q \neq 0$ (density wave) phenomena of underdoped curates are linked microscopically.

9:00-
9:45
S9
1

The relationship between these phenomena and the $k-$space electronic structure underpinning the superconductivity has also not been established. We describe visualization of the $Q = 0$ (intra-unit-cell) and $Q \neq 0$ (density wave) broken-symmetry states simultaneously with the $k-$space topology, for a sequence of $Bi_2Sr_2CaCu_2O_{8+x}$ samples $0.06 \leq x \leq 0.24$. We demonstrate that both the $Q = 0$ and the $Q \neq 0$ symmetry breaking weakens with increasing p, and that they disappear at what appears to be a quantum critical point $p_c \approx 0.19$. By simultaneously visualizing the momentum space electronic structure, we demonstrate that the Fermi surface topology undergoes an abrupt transition, from arcs to closed contours, at the same p_c. This demonstrates that the conversion from Fermi 'arcs' to a full Fermi surface in cuprates is linked intimately with the disappearance of the electronic symmetry breaking [5].

[1] Y. Kohsaka *et al.*, Science **315** (2007) 1380.
[2] Y. Kohsaka *et al.*, Nat. Phys. **8** (2012) 534.
[3] M.J. Lawler *et al.*, Nature **466** (2010) 374.
[4] A. Mesaros *et al.*, Science **333** (2011) 426.
[5] K. Fujita *et al.*, Science **344** (2014) 612.

EVIDENCE FOR A NODAL-GAP IN THE OVERDOPED REGIME OF $Y_{0.9}Ca_{0.1}Ba_2Cu_3O_{7-\delta}$ THIN FILMS

N. Bachar[1], B. Gorshunov[2], Eliyahu Farber[1]

1 Laboratory for Superconductivity and Optical Spectroscopy, Ariel University, Ariel, 40700, Israel.
2 Submillimeter Spectroscopy Department, Prokhorov General Physics Institute, Russian Academy of Sciences, Moscow, Russia.

Terahertz complex conductivity was measured in Ca doped $YBa_2Cu_3O_{7-\delta}$ thin films in the frequency range of 0.1 to 3 THz (3 to 100 cm^{-1}) and in the temperature range of 20 K to 300 K. The films were measured using time domain and frequency domain THz methods. Results show a possible deviation from a pure $d_{x^2-y^2}$-wave superconductor, indicated by the existence of an energy sub-gap in overdoped $Y_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ samples. Evidence for this sub-gap appears as a sharp decrease in the real part of the optical conductivity, $\sigma_1(\omega, T)$, and a dip in the imaginary part of the optical conductivity multiplied by frequency, $\omega\sigma_2(\omega, T)$. These results were observed at frequencies equivalent to an energy of 1.2 meV as a direct evidence of this sub-gap in 10% Ca doped films. Our complex conductivity spectra are in agreement with the theoretical prediction obtained by using a mixed symmetry order parameter within the Born limit, shown by Schürrer *et al.* [1]. We suggest that these observations are direct evidence for a nodal gap obtained in a $d_{x^2-y^2}$-wave superconductor while adding an imaginary is or id_{xy} bulk component in the overdoped regime.

9:45-10:10 S9 2

[1] I. Schürrer, E. Schachinger and J.P. Carbotte, Physica C **303** (1998) 287.

SUPERCONDUCTOR-INSULATOR TRANSITION IN MoC ULTRA THIN FILMS

Pavol Szabó[1], P. Kulkarni[1], T. Samuely[1], J. Kačmarčík[1], M. Zemlicka[2], P. Neilinger[2], M. Grajcar[2], and P. Samuely[1]

1 Centre of Ultra Low Temperature Physics at the Institute of Experimental Physics, Slovak Academy of Sciences and FS UPJŠ, Watsonova 47, 040 01 Košice, Slovakia.
2 Comenius University, Department of Solid State Physics, SK-84248 Bratislava, Slovakia.

Experimental studies of the superconductor-insulator transition will be presented on strongly disordered MoC ultrathin films. The increase of disorder is achieved by depleting the films' thickness from 20 nm down to 3 nm. With decreasing thickness the superconducting transition temperature is systematically suppressed from 8 K down to 1 K followed by a transition into an insulating state. Different level of disorder in thin films is characterized by their sheet resistance and the Ioffe–Regel product $k_F l$, where k_F is the Fermi momentum and l is the electron mean free path as determined from the transport measurements. The same samples were subsequently used for the subKelvin scanning tunnelling microscopy and spectroscopy. The local studies of the superconducting density of states and simultaneous measurements of surface topographies and CITS conductance maps will be presented at temperatures below 1 K. The obtained data supports the fermionic picture the superconductor-insulator transition in MoC.

10:10-10:35 S9 3

THE UNCONVENTIONAL NORMAL STATE OF CUPRATE AND RUTHENATE SUPERCONDUCTORS

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2 Quantum Matter Institute, UBC, Vancouver, British Columbia V6T 1Z4, Canada.

Cuprates (singlet d-wave) and Sr_2RuO_4 (triplet p-wave) are among the most prominent examples of unconventional superconductors, for which the pairing mechanism –and for Sr_2RuO_4 even the symmetry of the order parameter– is still being highly debated. In this talk I will focus on the normal state of both families, to highlight the most unconventional aspects of the electronic structure that may set the stage for unconventional superconductivity (SC) to emerge, such as:

1) In underdoped cuprates, the discovery of charge density waves (CDW) connected to an instability of the pseudogap Fermi-arcs [1], and the 'd-wave bond order' as the local symmetry of charge modulations [2]. As revealed by REXS, this suggests that the same mechanism driving particle-particle Cooper-pairing may be also active in the particle-hole channel, and in turn that CDW and SC instabilities may originate from the very same attractive interactions [2].

11:00-11:45

S10 1

2) In Sr_2RuO_4, the strong momentum-dependent spin-orbital entanglement of the low-energyelectronic wavefunction [3,4] –resulting from the weakening of electron-electron correlations and the increase of spin-orbit coupling. As revealed by spin-resolved ARPES, this leads to the breakdown of pure singlet and triplet Cooper-pairing, necessitating a description of the superconductivity of Sr_2RuO_4 in terms of the newly found spin-orbital entangled eigenstates [4].

Remarkably, competing broken-symmetry phases as well as spin-orbit coupling might be at play in the emergence of unconventional superconductivity in the Fe-based pnictide superconductors.

[1] R. Comin *et al.*, Science **343** (2014) 390.
[2] R. Comin *et al.*, arXiv:1402.5415 (2014).
[3] M.W. Haverkort *et al.*, Phys. Rev. Lett. **101** (2008) 026406.
[4] C.N. Veenstra *et al.*, Phys. Rev. Lett. **112** (2014) 127002.

STUDY OF VORTEX CLUSTERS WITH ATTRACTING VORTICES IN SUPERCONDUCTING NIOBIUM USING VERY SMALL ANGLE NEUTRON SCATTERING

Alain Pautrat[1], Annie Brûlet[2]

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2 Laboratoire Léon Brillouin, UMR 12 CEA-CNRS, CE Saclay, 91191 Gif sur Yvette, France.

11:45-12:10

S10

2

We have investigated the intermediate mixed state of a superconducting niobium sample by Very Small Angle Neutron Scattering. We show that this state is stabilized through a sequence where a regular vortex lattice appears, which then coexists with vortex clusters before vanishing at low temperature. Vortices in clusters have a constant periodicity regardless of the applied field, exhibit a temperature dependence close to the one of the penetration depth. The clusters disappear in the high temperature limit, as expected if vortex attraction is due to non local effects. Phase coexistence between Abrikosov vortex lattice and vortex clusters is reported showing the first order nature of the boundary line.

CREEP AND DEPINNING OF ELASTIC INTERFACES IN RANDOM MEDIA

Alejandro B. Kolton[1], J. Gorchon[2], S. Bustingorry[1], J. Ferré[2], V. Jeudy[2,3], E.E. Ferrero[4], A. Rosso[5], T. Giamarchi[6]

1 Centro Atómico Bariloche, Comisión Nacional de Energía Atómica, Bariloche, Río Negro, Argentina
2 Laboratoire de Physique des Solides, Université Paris-Sud, CNRS, UMR8502, 91405 Orsay, France
3 Université Cergy-Pontoise, 95000 Cergy-Pontoise, France
4 LIPhy, Universite Joseph Fourier, 38041 Grenoble, France.
5 Universite Paris-Sud, CNRS, LPTMS, UMR 8626, Orsay F-91405, France.
6 DPMC, Univesity of Geneva, 24 Quai Ernest Ansermet, 1211 Geneva, Switzerland.

12:10-12:35
S10
3

Many physical phenomena such as magnetic and ferroelectric domain walls motion, fluid invasion in porous media, moving contact lines in wetting, crack propagation, as well as the motion of vortex lines in type II superconductors, charge density waves, or Wigner crystals of classical particles or of electrons, involve the displacement of elastic object or interface in a weakly disordered medium. How the velocity of motion depends on the driving force f poses important fundamental questions and is also of prime importance in the use of the host materials. In the absence of disorder, or for a large f, motion is limited by dissipation and the interface moves in a flow regime, with a velocity essentially proportional to f. However, in real materials the presence of disorder leads to pinning which dramatically modifies the response to the force, leading to the ultra-slow nonlinear regimes of creep and depinning. I will present novel theoretical results describing such non trivial regimes, and compare it with very recent experiments on magnetic field-driven domain wall motion in an ultrathin Pt/Co(0.45 nm)/Pt ferromagnetic film with perpendicular anisotropy, over a wide temperature and field range.

2-DIMENSIONAL SUPERCONDUCTIVITY AT THE $LaAlO_3/SrTiO_3$ INTERFACE

D. Li[1], A. Fête[1], W, Liu[1], D. Stornaiuolo[1], S. Gariglio[1], M. Gabay[2], and Jean-Marc Triscone[1]

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2 Laboratoire de Physique des Solides, Université de Paris-Sud, 91405 Orsay, Cedex, France.

The interface between $LaAlO_3$ and $SrTiO_3$, two good band insulators, which was found in 2004 to be conducting [1], and, in some doping range, superconducting with a maximum critical temperature of about 200 mK [2] is attracting of lot of attention. The electron gas has a thickness of a few nanometers at low temperatures and a low electronic density, typically 5×10^{13} electrons/cm^2. Being naturally sandwiched between two insulators, it is ideal for performing electric field effect experiments that allow the carrier density to be tuned and the phase diagram of the system to be determined [3].
I will discuss in this presentation superconductivity, the phase diagram of the system and the link with doped bulk $SrTiO_3$ [2,3]; spin orbit and an approach that allows superconducting coupling between different gases to be studied.

14:30-15:15 S11 1

[1] A. Ohtomo, H.Y. Hwang, Nature **427** (2004) 423.
[2] N. Reyren *et al.*, Science **317** (2007) 1196.
[3] A.D. Caviglia *et al.*, Nature **456** (2008) 624.
[4] A.D. Caviglia *et al.*, Phys. Rev. Lett. **104** (2010) 126803.
[5] A. Fête *et al.*, Phys. Rev. B **86** (2012) 201105.

SUPERCONDUCTIVITY AND MAGNETISM IN $SrTiO_3/LaAlO_3$ PROBED BY TRANSPORT THROUGH NANOWIRES

Yoram Dagan

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We fabricate nanowires (40 ,nm wide) of $SrTiO_3/LaAlO_3$. Resistance as a function of temperature down to 20 mK and magnetic fields up to 18 T for various carrier concentrations is measured for these nanowires. At high fields quantum magnetic oscillations and universal conductance fluctuations are observed. The narrow width of the wires (of the order of 50 nm) allows us to separate out the magnetic effects from the dominant superconducting ones at low magnetic fields. At this regime hysteresis loops are observed along with the superconducting transition. We discuss the anomalous magnetic domain structure and interactions suggested by our data. At high magnetic fields, the frequency of quantum oscillations follow the dependence of T_c on charge carrier concentration. This allows us to identify the charge carriers responsible for superconductivity.

15:15-15:40 S11 2

MAGNETIC AND SUPERCONDUCTING PHASES IN δ-DOPED (La,Sr)$_2$CuO$_4$ SUPERLATTICES

Alexander V. Boris[1], A. Suter[2], Z. Salman[2], T. Prokscha[2], E. Morenzoni[2], F. Baiutti[1], K. Kawashima[1], G. Cristiani[1], G. Logvenov[1] and B. Keimer[1]

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2 Laboratory for Muon Spin Spectroscopy, PSI, CH-5232 Villigen PSI, Switzerland.

15:40-16:05
S11
3

One of the most striking manifestations of the complex interplay between superconducting and magnetic phases occur in the La_2CuO_4 family of high-temperature superconductors (HTSC), where superconductivity and magnetism appear to have the same onset temperature. Dopant disorder has a strong impact on the electronic properties and may lead to a nanoscale phase separation with the coexistence of magnetic and superconducting states. To gain insight on the intimate connection between the ground states, one needs to control the dopant distribution with atomic precision. Oxide molecular beam epitaxy allows to grow thin films of HTSC in a layer-by-layer fashion. We report low-energy muon-spin-rotation and magnetic susceptibility studies on δ-doped (La,Sr)$_2$CuO$_4$ superlattices with the layer sequence (SrO|LaO|CuO$_2$)+$N\times$(LaO|LaO|CuO$_2$), where $N = 3, ..., 11$. All these δ-LCO$_N$ SLs are solely doped from a single layer of SrO within the structure and show superconductivity with T$_c$ ranging from 18 K to 29 K, and a London penetration depth of $\lambda_L \approx 220$ nm. The upper critical field, $H_{c2} = 1.5$ T, is significantly reduced compared to bulk $La_{2-x}Sr_xCuO_4$. The *SC−induced magnetism* is found below T_c on the background of the AFM long-range order state (as in bulk La_2CuO_4) below $T_N \approx 150$ K. The paramagnetic Meissner effect is observed in an external magnetic field parallel to the SC layers. Our results show that the close proximity of the AFM and SC ground states in δ-LCO$_N$ is leading to a non-trivial interplay between the two orders.

Monday, August 4th

9:00 - 10:35 **SESSION 12**

10:35 - 11:00 **COFFEE BREAK**

11:00 - 12:35 **SESSION 13**

12:35 - 12:50 **CONCLUDING REMARKS**

12:50 - 14:00 **LUNCH**

ANTIFERROMAGNETIC PARENT PHASES IN THE ELECTRON-DOPED IRON-OXYPNICTIDE

Soshi Iimura[1] and H. Hosono[1,2,3]

1 Materials and Structures Laboratory, Tokyo Institute of Technology, Japan.
2 Frontier Research Center, Tokyo Institute of Technology, Japan.
3 Materials Research Center for Element Strategy, Tokyo Institute of Technology, Japan.

Recently, we succeeded in doping of high concentration electrons by substituting hydride for oxygen sites ($O^{2-} = H^- + e^-$) in 1111-type iron oxypnictides LnFeAsO with Ln = La, Ce, Sm and Gd [1-3]. The superconducting properties of 1111-type are unique in that their superconductivity remained in a wide range of $0.05 < e^-/\mathrm{Fe}(x) < 0.40 - 0.50$, which is 2 or 3 times larger than that of 111 and 122-types. In particular, the $LaFeAsO_{1-x}H_x$, which is known as a prototype compound in iron pnictides, is a key material to understand the wide superconducting dome of the 1111-type, because it has a second superconducting dome in the range of $0.18 \leq x \leq 0.45$ in addition to the first dome adjacent to the antiferromagnetic (AFM) order.

9:00-
9:45
S12
1

Here, we present the discovery of an antiferromagnetic order as well as a unique structural transition in electron-overdoped $LaFeAsO_{1-x}H_x$ ($x > 0.4$) [4]. The characteristics of the physical properties in $x = 0.5$ ($x = 0$) can be summarized as follows; the Fe-spin arrangement is peculiar stripe-type (universal stripe-type), the gap between T_s and T_N is $\sim 5\,K$ ($\sim 20\,K$), the structural symmetry is non-centrosymmetric (centrosymmetric), the magnetic and superconducting states coexist (the magnetic and superconducting states are exclusive). In this talk, we present results of high pressure syntheses, transport measurements, neutron and X-ray diffraction and muon spin relaxation. After that, the magnetic and crystal structures in low temperatures are discussed in comparison with those in the parent compound.

[1] T. Hanna *et al.*, Phys. Rev. B **85** (2011) 024521.
[2] S. Matsuishi *et al.*, Phys. Rev. B **85** (2012) 014514.
[3] S. Iimura *et al.*, Nat. Commun. **3** (2012) 943.
[4] M. Hiraishi *et al.*, Nat. Phys. **10** (2014) 300.

HUNDNESS, NEMATICITY AND TOPOLOGY IN IRON PNICTIDES

Belén Valenzuela, L. Fanfarillo and A. Cortijo

Instituto de Ciencia de Materiales de Madrid, ICMM-CSIC, Cantoblanco, E-28049 Madrid, Spain.

There are two exciting research scenarios in iron pnictides believed to be key to understand superconductivity, nematicity [1] and Hundness [2]. In the nematic state the rotational symmetry of the ionic lattice is broken. Nematicity is also found in other strongly correlated electron systems such as cuprates or ruthenates. Iron pnictides experiments seem to indicate that the nematic state is driven by electronic degrees of freedom as evidenced by charge probes [3], spin probes [4], and orbital probes [5]. On the other hand, Hund's coupling has been proposed as the origin of columnar magnetic ordering and as the responsible for the bad metallic behavior and the orbital differentiation in the normal state [2] with some of the orbitals more correlated than others. In this work we derive an low energy effective model from a microscopic Hamiltonian[6] via a Hubbard-Stratonovich transformation. We extend the derivation done in [7] to address the dependence of the Landau coefficients on the Hund's coupling, Hubbard's coupling and on the orbital content. We also have into account the non trivial topology of the band structure[8]. We find that Hund's coupling reduces the critical magnetic temperature which agrees with the small Néel temperature found in iron superconductors. We define an orbital nematic order parameter that depend on the Fermi surface orbital weight. The topology of the Fermi surface enhance or reduce the nesting condition depending on the location on the Brillouin zone affecting to nematicity. We discuss how the dependence of nematicity on Hundness and on topology affects the physics of iron superconductors [9].

9:45-10:10 S12 2

[1] R.M. Fernandes *et al.*, Nat. Phys. **10** (2014) 97.
[2] A. Georges *et al.* Annual Reviews of Condensed Matter Physics **4** (2013) 137.
[3] J.-H. Chu *et al.*, Science **329** (2010) 824; M.A. Tanatar *et al.*, Phys. Rev. B **81** (2010) 184508; A. Dusza *et al.*, Eur. Phys. Lett. **93** (2011) 37002; M. Nakajima *et al.*, Proc. Natl. Acad. Sci. USA **108** (2011) 12238; Y. Gallais *et al.* Phys. Rev. Lett. **111** (2013) 267001; E.P. Rosenthal *et al.*, Nat. Phys. **10** (2014) 225.
[4] S. Kasahara *et al.*, Nature **486** 382–385 (2012); C. Dhital *et al.*, Phys. Rev. Lett. **108** (2012) 087001.
[5] M. Yi *et al.*, Proc. Natl. Acad. Sci. USA **108** (2011) 6878.
[6] M.J. Calderón, B. Valenzuela, E. Bascones, Phys. Rev. B **80** (2009) 094531.
[7] R.M. Fernandes, *et al.* Phys. Rev. B **85** (2012) 024534.
[8] Y. Ran *et al.* Phys. Rev. B **79** (2009) 014505.
[9] L. Fanfarillo, A. Cortijo, B. Valenzuela, in preparation.

WOPTIC: TRANSPORT PROPERTIES FOR STRONGLY CORRELATED MATERIALS

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3 Institute of Materials Chemistry, Vienna University of Technology, 1060 Wien, Austria.

10:10-10:35
S12
3

The combination of density-functional theory and dynamical mean-field theory (LDA+DMFT) has proven invaluable for the description of materials exhibiting strong electronic correlations. But the straightforward output of a typical LDA+DMFT calculation (a Green's function in imaginary time) does not correspond directly to any observable quantity. To obtain observables of interest and compare directly to experiment, costly post-processing calculations are often required.

Here, we present woptic, an algorithm and program package to compute the optical and DC conductivity, as well as the thermopower, from LDA+DMFT. Woptic uses the full momentum matrix elements from Wien2k, an adaptive integration scheme on the Brillouin zone, and interpolation techniques based on maximally-localized Wannier functions to compute these quantities both accurately and efficiently. We give an overview of the algorithm and present selected applications.

INTERTWINED ORDERS IN HIGH TEMPERATURE SUPERCONDUCTORS

E. Fradkin

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11:00-11:45 S13 1

I will argue that the orders that are present in high temperature superconductors naturally arise with the same strength and are better regarded as intertwined rather than competing. I illustrate this concept in the context of the orders that are present in the pair-density-wave state and the phase diagrams that result from this analysis. I will also briefly discuss some recent progress in the microscopic origin of this phenomenon.

TUNING MAGNETIC ORDER BY FRUSTRATION AND KONDO EFFECT

Hilbert von Löhneysen

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Quantum phase transitions (QPT) between paramagnetic and magnetically ordered ground states have been studied in lanthanide heavy-fermion systems, and itinerant-electron transition-metal compounds [1]. Two different routes have been identified by various experiments, i.e., the more traditional spin-density-wave (SDW) [2] and the Kondo-breakdown [3] approaches. Another route to quantum criticality not included in the above approaches might be geometric frustration of magnetic moments, a route well known for insulating magnets with competing interactions [4]. First experiments on metallic systems have recently been conducted. In particular, Shastry-Sutherland compounds such as Ce_2Pd_2Sn [5] and Yb_2Pt_2Pb [6] have been studied.

In the partially frustrated antiferromagnetic metal $CePd_{1-x}Ni_xAl$, the Néel temperature $T_N(x)$ decreases, with $T_N \to 0$ at the critical concentration $x_c \approx 0.144$. The low-temperature specific heat $C(T)$ measured at $p = 0$ evolves toward $C/T \sim \ln(T_0/T)$ at $x \approx x_c$ [7]. The unusual T dependence of C/T is compatible with the SDW scenario of quantum criticality [2] if the quantum-critical fluctuations are two-dimensional in nature. Here two-dimensionality might arise from antiferromagnetic planes that are effectively decoupled by frustrated Ce atoms in between. An exciting possibility is that the planes of frustrated Ce moments form a two-dimensional spin liquid. This idea is supported by thermal-expansion measurements revealing a rich $B - T$ phase diagram of the pure CePdAl compound.

11:45-12:35 S13 2

In the prototypical heavy-fermion system $CeCu_{6-x}Au_x$ the experiments by Schröder *et al.* [8] provided the initial evidence of local quantum criticality. While concentration and pressure tuning of the quantum phase transition (QPT) are well described by this scenario, magnetic-field tuning the QPT is in line with the SDW scenario [9]. Elastic neutron scattering experiments on $CeCu_{5.5}Au_{0.5}$ under hydrostatic pressure p [10] show that at $p = 8\,\mathrm{kbar}$, T_N and the magnetic propagation vector attain almost the values of $CeCu_{5.7}Au_{0.3}$. This $x - p$ analogy away from the QPT is highly remarkable since the ambient-pressure magnetic structures for $x = 0.3$ and 0.5 are quite different. These results give clues to a general (x, p, B) phase diagram at $T = 0$ and might explain the existence of different universality classes.

[1] H.v. Löhneysen *et al.*, Rev. Mod. Phys. **79** (2007) 1015.
[2] J.A. Hertz, Phys. Rev. B **14** (1976) 1165; J.A. Millis, Phys. Rev. B **48** (1993) 7113; T. Moriya and T. Takamoto, J. Phys. Soc. Japan **64** (1995) 960.
[3] Q. Si *et al.*, Nature **413** (2001) 804.
[4] B. Keimer and S. Sachdev, Physics Today **64** (2011) 29.
[5] J.G. Sereni *et al.*, Phys. Rev. B **80** (2009) 024428.
[6] M.S. Kim and M.C. Aronson, Phys. Rev. Lett. **110** (2013) 017201.
[7] V. Fritsch *et al.*, Phys. Rev. B **89** (2014) 054416.
[8] A. Schröder *et al.*, Nature **407** (2000) 351.
[9] O. Stockert *et al.*, Phys. Rev. Lett. **99** (2007) 237203.
[10] A. Hamann *et al.*, Phys. Rev. Lett. **110** (2013) 096404.

List of Posters

INFLUENCE OF THE Fe CONCENTRATION ON THE SUPERCONDUCTING PROPERTIES OF $Fe_{1-Y}Se$

María Lourdes Amigó[1,2], M.V. Ale Crivillero[1,2], D.G. Franco[1,2], J. Guimpel[1,2] and G. Nieva[1,2]

1 Comisión Nacional de Energía Atómica, Centro Atómico Bariloche and CONICET, S.C. de Bariloche, Río Negro, Argentina.
2 Instituto Balseiro and Universidad Nacional de Cuyo, S.C. de Bariloche, Río Negro, Argentina.

We present a comparative study between pure $\beta-$FeSe phase and Fe deficient $Fe_{1-y}Se$ single crystals. The Fe stoichiometry determines the presence of spurious phases like metallic Fe, Fe_7Se_8, etc. We discuss the influence of the intergrowth of magnetic hexagonal phase (Fe_7Se_8) in Fe deficient samples. The results are compared to those in pure $\beta-$FeSe samples, without spurious phases. We characterize the crystal structure through X-ray diffraction. This allows as to identify the phases present in the crystals and the possible defects that have important influence in the transport properties.
In the superconducting state, we measured the *ab*-plane electrical resistivity with magnetic field up to $16T$. We observe that for all Fe concentration the transition width slightly increases with field. This signals the possibility of a narrow region with a vortex liquid phase. We also measure the electrical resistivity as a function of the angle between the *ab*-plane and the applied field. The angular dependence at fixed temperature below T_c(H=0) are very diferent for both sets of crystals. The Fe deficient samples display a vortex pinning related feature at $\sim 56^o$ off the plane while the pure $\beta-$FeSe phase samples show the persistence of a strong angular dependent magnetoresistance characteristic of the normal state electronic structure.

Poster 1

STUDY OF THE ANISOTROPY OF THE VORTEX DYNAMICS IN THE IRON BASED SUPERCONDUCTOR $Fe_{1-Y}Se$

María Victoria Ale Crivillero[1,2], M.L. Amigó[1,2], D.G. Franco[1,2], J. Guimpel[1,2] and G. Nieva[1,2]

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2 Instituto Balseiro and Universidad Nacional de Cuyo, S.C. de Bariloche, Río Negro, Argentina.

Poster 2

We present a study of single crystals and polycrystals of the superconductor $Fe_{1-y}Se$ synthesized with different growth methods. We explored the flux method either with NaCl/KCl or KCl/$AlCl_3$, and the vapor self transport method. We performed X-ray, EDAX, transport and magnetization measurements with emphasis in the influence of intrinsec correlated defects on the critical currents. Some of the samples showed a coexistence between a superconducting phase and a magnetic phase. The crystaline match between these phases introduces correlated defects that could be relevant to the movement of the vortices.
We measured the electrical resistivity of the *c*-axis of single crystal with applied field in the basal plane up to 16 T. A dependence with the direction of the field is observed, which could be understood considering the effect of the surface barriers and/or the existence of intrinsic correlated defects. In order to clarify this point a different transport measurement in which the surface barriers were not relevant was performed. The results are compatible with an anisotropic critical current density with modulations each 60 degrees. This was confirmed with the measurement of the critical current versus basal angle obtained through magnetization loops at differents fixed angles.

MÖSSBAUER STUDY OF HYPERFINE INTERACTIONS IN $EuFe_2(As_{1-X}P_X)_2$ AND $BaFe_2(As_{1-X}P_X)_2$

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The objects of our investigation belong to the group of iron-based superconducting materials. These materials have been studied intensively, as they display a variety of interesting characteristics and even hitherto unexplored properties and new compounds continue to appear. Among these properties the coexistence of magnetism and superconductivity, reported for some of the pnictides and chalcogenides, has become an important research topic itself, and may be of crucial importance for the understanding of the mechanisms behind superconductivity.

The parent compounds of iron-based superconductors frequently undergo a structural transition and exhibit magnetic ordering at low temperatures. The superconductivity in these materials can be achieved by applying either external pressure, in cases where the superconductivity can appear in the unsubstituted parent compound, or chemical pressure by replacing a part of the elements in the substances by other elements that suppress magnetic ordering and induce superconductivity properties [1,2,3]. Chemical pressure by itself is not sufficient for explaining the appearance of superconductivity and application of chemical pressure in suitable chemical compounds does not automatically induce superconducting properties [4]. Further studies on substituted superconductors can cast light on this question. In this work samples of substituted $EuFe_2(As_{1-x}P_x)_2$ and $BaFe_2(As_{1-x}P_x)_2$ were prepared by solid-state reaction. The resulting parameters of hyperfine interactions obtained by ^{57}Fe and ^{151}Eu Mössbauer spectroscopy measurements at temperatures ranging from 6 K to 300 K are presented.

Poster 3

[1] J. Paglione and R.L. Greene, Nat. Phys. **6** (2010) 645.
[2] G. Wu *et al.*, Eur. Phys. Lett. **84** (2008) 27010.
[3] S. Jiang *et al.*, J. Phys.: Condens. Matter **21** (2009) 382203.
[4] A.S. Sefat *et al.*, Phys. Rev. B **79** (2009) 225524.

SUPERCONDUCTING GAP STRUCTURE OF OVERDOPED $BaFe_2(As_{1-X}P_X)_2$ SINGLE CRYSTALS THROUGH NANOCALORIMETRY

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Poster 4

We report on specific heat measurements on ultraclean overdoped $BaFe_2(As_{1-x}P_x)_2$ single crystals performed with a high resolution membrane-based nanocalorimeter working in differential mode. The normal state specific heat is obtained by suppressing superconductivity with high magnetic fields where possible. For the close to optimal doped samples a simple Debye model is used. The superconducting electronic specific heat is then extracted and analyzed through a two-band s-wave α model in order to investigate the gap structure. Close to optimal doping a single gap with $\Delta_0/k_BT_C \approx 2.2$ ($\Delta_0 \approx 5.3$ meV) represents the experimental data well. Increasing the P concentration x, the main gap reduces till a value of $\Delta_0 \approx 1.9$ meV for $x = 0.53$ and a second weaker gap becomes evident. This behavior suggests increasing gap anisotropy or a modification of the contributions from the different bands to the energy gap with P doping.

TOWARDS IDENTIFICATION OF THE 48 K SUPERCONDUCTING HIGH PRESSURE $AFe_{2-Z}Se_2$ PHASE: INPUT OF THE $p-T$ PHASE DIAGRAM OF THE Tl-BASED SELENIDE

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Following the discovery of superconductivity around 30 K in biphasic $AFe_{2-z}Se_2$ selenides (A = K, Rb, Cs or a mixed Tl/Rb, Tl/Cs, Tl/K site), high pressure (HP) measurements have shown that this state is destroyed around $9-11$ GPa and a second SC HP phase has been found with T_c around 48 K in the $11-13$ GPa range.
Combining multi-techniques, neutron (up to 9 GPa) and x-ray diffraction (up to 20 GPa) and transport measurement in the $4-300$ K range, we have studied the related pure antiferromagnet $TlFe_{1.6}Se_2$ selenide ($T_N = 450$ K) under HP. No bulk superconductivity was found in the transport measurements down to 4.2 K and up to 22 GPa. At room temperature (RT), and HP, the AFM ordered iron vacancies system undergoes a phase transition around 7 GPa towards a metallic state accompanied by the loss of its long range magnetic order. This new state is also characterized by a collapsed tetragonal lattice with iron vacancies order fully lost. Further XRD studies under HP at different T from 20 K up to 390 K allowed us to construct its full $p-T$ phase diagram. In particular, at low T ($20-150$ K), we have evidenced another phase above 11 GPa, different from the HP collapsed phase observed at 230 K and RT, which is probably closely related to the 48 K SC HP phase of alkaline based $AFe_{2-z}Se_2$ selenides.

Poster 5

PROBING THE ROLE OF TRANSITION METAL SUBSTITUTION IN IRON-PNICTIDES SUPERCONDUCTORS

Giorgio Levy[1,2], S. Chi[1,2], L. Chauviere[1,2], V. Strocov[3], L. Patthey[3], R. Sutarto[1,4], D. Chevrier[4], T. Regier[4], R. Blyth[4], J. Geck[5], S. Wurmehl[5], L. Harnagea[5], H. Wadati[6], T. Mizokawa[6], I.S. Elfimov[1,2], G.A. Sawatzky[1,2] and A. Damascelli[1,2]

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2 Quantum Matter Institute, University of British Columbia, Vancouver, British Columbia V6T 1Z4, Canada.
3 Swiss Light Source, Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland.
4 Canadian Light Source, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0X4, Canada.
5 Leibniz Institute for Solid State and Materials Research IFW Dresden, 01069 Dresden, Germany.
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Poster 6

The physical properties of iron-arsenide compounds can be tuned by substituting Fe with Co, however the microscopic role of Co in shaping the phase diagram of these materials is debated. It was originally proposed that Co is isovalent to Fe, and that the main role of the Fe-Co substitution is to introduce a random impurity potential [1]. This would lead to scattering of the itinerant charge carriers, consistent with a non-vanishing imaginary part of the self-energy even at the Fermi level.
To experimentally determine the role of Co-induced states, we study $Ca(Fe_{0.094}Co_{0.056})_2As_2$ by resonant photoemission spectroscopy (RPES) and $LiFe_{0.9}Co_{0.1}As$ by resonant ARPES, which are both element sensitivity techniques. We show that the center of mass of the Co-induced low-energy states in $Ca(Fe_{0.094}Co_{0.056})_2As_2$ is at 250 meV higher binding energy than Fe's, which provides a direct measure of the Co impurity potential [2]. The screening of the latter, as revealed by the experimental estimate of U_{dd} for Fe and Co and a density functional theory (DFT) analysis, leads to 1 extra 3d-electron being associated with Co. Yet, the Bloch states near the chemical potential have significant Co character. This is also revealed in the momentum-resolved electronic structure of $LiFe_{0.9}Co_{0.1}As$ by resonant ARPES. These findings point to the more active role of Co in determining the properties on these materials, and question the picture of a phase diagram driven by pure carrier doping.

[1] H. Wadati, I. Elfimov and G.A. Sawatzky, Phys. Rev. Lett. **105** (2010) 157004.
[2] G. Levy et al., Phys. Rev. Lett. **109** (2012) 77001.

INDUCTION OF A METALLIC STATE IN LaMnPO THIN FILMS

D.G. Franco[1,2], Gladys Nieva[1,2], Júlio Guimpel[1,2], J.W. Simonson[3] and M.C. Aronson[3,4]

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2 Instituto Balseiro, Comisión Nacional de Energía Atómica and Universidad Nacional de Cuyo, S.C. de Bariloche, Río Negro, Argentina.
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4 Brookhaven National Laboratory, Upton, NY 11973, USA.

Recently, superconductivity was discovered in Fe based pcnictides [1], contrary to the Mn based pcnictides where an insulating state is usually found. Recent studies on LaMnPO show that a transition from an insulating antiferromagnetic to a conductive ferromagnetic state can be induced with modest pressures [2]. In view of this, changing the electronic states with biaxial strains induced by a substrate on a thin film seems possible. In an attempt to stabilize a superconducting phase, we have grown LaMnPO thin films by dc magnetron sputtering on $SrTiO_3$ and MgO substrates. Preliminary results are presented on the magnetic and the electrical transport properties showing the induction of a metallic state down to 2K, probably due to the biaxial strains.

Poster 7

[1] Y. Kamihara *et al.*, J. Am. Chem. Soc. **130** (2008) 3296.
[2] J.W. Simonson *et al.*, Proc. Natl. Acad. Sci. USA **109** (2012) E1815.

GEOMETRICAL EFFECTS IN THE NUCLEATION OF THE MESOSCOPIC VORTEX-SOLID PHASE

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We studied the effect of confinement in mesoscopic vortex matter nucleated in micron-sized $Bi_2Sr_2CaCu_2O_{8+\delta}$ disks with diameters ranging 10 to 100 μm and 2 μm height. We characterize the structural properties of mesoscopic vortex matter at low vortex densities (less than 1000 vortices per sample) in the close-to-equilibrium field-cooling configuration with single-vortex resolution by means of magnetic decoration experiments. In addition, we probe the configurational changes introduced by flux penetration in zero-field-cooling experiments by means of differential magneto-optical measurements. The field and sample-size evolution of the orientation and positional orders of the structure indicates the order of vortex matter worsen on decreasing the number of vortices. The vortex displacements correlator evolves from a power-law to a linear behaviour on increasing confinement. These effects are due to the proliferation of topological disorder induced by edge-effects when decreasing the surface-to-volume ratio of the system.

Poster 8

EFFECT OF DISORDER IN THE ENTROPY-JUMP AT THE FIRST-ORDER VORTEX PHASE TRANSITION IN $Bi_2Sr_2CaCu_2O_8$

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Poster 9

In this work we study the effect of disorder introduced by heavy-ion irradiation in the thermodynamic magnitudes entailed in the first-order vortex phase transition in the layered $Bi_2Sr_2CaCu_2O_8$ compound. We track the evolution of the enthalpy and the entropy-jump per pancake vortex for this vortex solidification transition by means of AC local magnetic measurements. We study how the density of columnar-track pins affects the temperature-evolution of these thermodynamic properties. From this evidence we find that the electromagnetic coupling between pancake vortices lying in adjancent CuO layers plays a dominant role independently of the density of disorder.

VISUALIZATION OF QUANTUM TURBULENCE AROUND OSCILLATING OBJECTS

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Poster 10

Tracer particles are frequently used as a tool to study classical turbulence.In this work we present results in super-fluid helium obtained by analyzing the trajectories of solid hydrogen particles which trace the turbulent flow generated by mechanical oscillators of different geometries. Measurements were performed in a glass cryostat with a window and images were taken by a video camera at 240 frames per second. Trajectories are digitized either manually or using software developed in the MATLAB environment. Erratic trajectories for these micrometer sized particles were observed in many cases, but some show an oscillatory behavior which mimics that of the oscillator. This last case was contrasted with a similar experiment performed with the oscillator in air, for the case spherical geometry.We have processed and analyzed data to obtain the Discrete Fourier Transform (DFT) of individual particles, we also found that the average FFT of all particles can be characterized by a spectrum of $1/f$.

SPATIAL INHOMOGENEITIES IN VORTEX PINNING: A PROBE FOR NANOSCALE DISORDER IN CUPRATES AND PNICTIDE SUPERCONDUCTORS

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Quantifying the effects of material disorder is important for the understanding of the differences in the superconducting ground state of cuprates and new pnictides high-temperature superconductors. For both families of superconductors, the proximity of the superconducting state to anti-ferromagnetism may lead to phase segregation that will be heavily influenced by heterogeneity due to the chemical and crystalline disorder of the materials. In the case of the pnictides, the superconducting ground state in was proposed to have a $s_{\pm}$ symmetry, in which case superconductivity might be extremely sensitive to interband scattering. The effect of impurities for interband scattering is usually characterized by the quasiparticles scattering rate. A well-known but little exploited probe of microscopic disorder is the pinning of vortex lines in the superconducting mixed state. In this work we study the spatial inhomogeneities in the single-vortices pinning force in order to quantify the effect of nanoscale disorder introduced or naturally found in iron-based pnictides and high-temperature cuprates by combining vortex imaging with single-vortex resolution by means of magnetic decoration and microscopic disorder properties from critical current measurements.

Poster 11

THRESHOLD FIELD FOR RUNAWAY INSTABILITY OF BI-LAYER HARD TYPE-II SUPERCONDUCTORS

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Recently in papers [1,2], an increase of stability of the critical state of the superconducting wire with a core and a surface layer (for example, from Nb_3Sn and Nb [1], respectively) was found experimentally. The critical state stability of bilayer superconductor in the external magnetic field B_a has been investigated theoretically in present work. Such composite consist of inner part and thin surface layer of thickness δ_1 with appropriate parameters critical current J_{0i}, specific heat C_i, critical temperature T_{ci}. A criterion of stability, i.e. the field of the first flux jump B_{j1}, in adiabatic approximation ($\tau = D_t/D_m = 0$, D_t - thermal diffusivity, D_m - magnetic diffusivity) was found on the basis of method developed by Mints *et al.* [3]. As a result the criterion of bilayer (Nb_3Sn+NbTi) stability was calculated (the first instability magnetic field B_{1fj}):

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$$B_{1fj} = B_2(T)\left\{1-\frac{2}{\pi}\arctan\left[\sqrt{\frac{T_{c1}J_{1T}(T)C_2(T)}{T_{c2}J_{2T}(T)C_1(T)}}\frac{\tan\left(\frac{\pi\delta_1 J_{02}J_{1T}(T)}{2B_1(T)K}\right)}{K}\right]\right\}+\mu_0\delta_1\frac{J_{02}J_{1T}(T)}{K}.$$

Here $B_1(T)=\frac{\pi}{2}\sqrt{\mu_0 C_1(T)(T_{c1}-T)}$, $B_2(T)=\frac{\pi}{2}\sqrt{\mu_0 C_2(T)(T_{c2}-T)}$ is the criterion of stability for unmodified superconductors [3] (in Bean model),($i=1$ for the surface layer and $i=2$ for the bulk), T is the temperature of experiment, J_{iT} - the temperature dependence of critical current density, $K=\frac{J_{02}}{J_{01}}$ - the critical current densities ratio, $\mu_0 = 4\pi 10^{-7}$ H/m. Thus, the conducting and thermal properties strongly influence on the stability of the critical state of the superconducting bilayer. It has been found that if the heat capacity of the surface layer is greater than in the bulk of the superconductor, and $K \geq 1$, we can find the optimal thickness of the surface layer, which gives the greatest increase of the first jump field value. The criterion of stability has strongly dependence from thickness of coating and critical current ratio. For $J_{02} = 6\cdot 10^9\,\mathrm{A/m^2}$, $K=4$ and optimal coating ($T = 4.2\,\mathrm{K}$) the relative increase of first flux jump field $\frac{\Delta B}{B_2}$ (where $\Delta B = B_{1fj} - B_2$) is about 60% (about 25% for bilayer with identical current densities). The temperature dependence of B_{1fj} and optimal thickness of the coat are discussed.

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[1] P. Fabbricatore *et al.*, Supercond. Sci. Technol. **20** (2007) 34.
[2] J. Sutton, J. Appl. Phys. **44** (1973) 465.
[3] R.G. Mints and A.L. Rakhmanov, Rev. Mod. Phys. **53** (1981) 551.

FRACTAL-LIKE STRUCTURE OF FLUX FRONT PENETRATION INTO SUPERCONDUCTING NbTi

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The magneto-optical technique [1] was used for the experimental study of the penetration of magnetic field into superconducting NbTi disc. This method provides a measure of the normal component of the induction Bz. Such a research can become a test of the self-organized criticality of vortices in a superconductor [2]. We have observed the dynamic of the magnetic flux penetration into the superconducting NbTi disc at remagnetization in the magnetic field up to 600 G. Magneto-optical images of the vortex dynamics reveal stochastic jumps of magnetic flux forming a rough penetration front and that the surface of induction inside the superconductor has a complicated 3D-structure (the "ridge" type).
The scaling analysis of flux profiles behind the front was done. Fast Fourier transformation of flux profile data yielded the spectral function $S(k)$ of the surface. It has a power dependence on k, similar to the results in [2]. The roughness exponent α [3, 4] can be obtained from the tilt of dependence $\log(S(k))$ vs $\log(k)$. The Housdorff dimension of the rough surface D was defined using the obtained value α. Roughness exponent values are in the range $0.47 - 0.54$ for the magnetic induction $150 - 400$ G. As for Housdorff dimension, it lies in the range of $1.46 - 1.53$, respectively. According to our analysis we can conclude that the penetration front of the magnetic flux into superconducting NbTi disc has fractal-like structure [5].

Poster 13

Acknowledgments: This work was partially supported by SEP-CONACYT (Mexico) under grant CB-2012-01-183673.

[1] Ch. Jooss *et al.*, Rep. Prog. Phys. **65** (2002) 651.
[2] V.K. Vlasko-Vlasov *et al.*, Phys. Rev. B **69** (2004) 140504(R).
[3] J.M. Lopez and J. Schmittbuhl, Phys. Rev. E **57** (1998) 6405.
[4] J.J. Ramasco, J.M. Lopez and M.A. Rodriguez, Phys. Rev. Lett. **84** (2000) 2199.
[5] T. Vicsek, *Fractal Growth Phenomena* (World Scientific, Singapore, New Jersey, 1992); A.-L. Barabasi and H.E. Stanley, *Fractal Concepts in Surface Growth* (Cambridge University Press, Cambridge, 1995); P. Meakin, *Fractals, Scaling and Growth Far from Equilibrium* (Cambridge University Press, Cambridge, 1998).

MANIFESTATION OF FLUX-LINE CUTTING AND FLUX-TRANSPORT IN SEMI-REVERSIBLE TYPE-II SUPERCONDUCTORS

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Poster 14

I present a theoretical study of the behavior of semi-reversible type-II superconductor slabs under the action of an in-plane rotating magnetic field. This study is carried out within the framework of the elliptic flux-line-cutting critical-state model. The role of the surface barrier, which gives rise to the semi-reversibility of the magnetization curves, is here analyzed by using a constitutive equation relating the magnetic induction and the magnetic field as in Ref. [1]. In addition, the effects produced by varying the rotation angle, of the applied magnetic field at different values of its magnitude, $H_{\rm a}$, are studied. When $H_{\rm a}$ is smaller than the penetration field $H_{\rm P}$, the magnetization components, parallel and perpendicular to $H_{\rm a}$, oscillate with increasing the rotation angle. On the other hand, if the magnitude of the applied field, $H_{\rm a}$, is larger than $H_{\rm P}$, both magnetization components become constant functions at large rotation angles. The evolution of the magnetic induction profiles inside the superconductor are calculated in order to explain available experimental magnetization curves on a PbIn rotating disk in a fixed magnetic field $H_{\rm a}$, parallel to its flat surfaces.
Acknowledgement: This work was partially supported by SEP-CONACYT (Mexico) under grant CB-2012-01-183673.

[1] E.H. Brandt, Phys. Rev. B **59** (1999) 3369.

VOLTAGE-CURRENT CHARACTERISTIC AND TRANSPORT CURRENT AC LOSSES OF HIGH PRESSURE SYNTHESIZED MgB_2 BULK SAMPLES WITH DOPING ADDITIONS.

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We use a contactless method based on the transformer configuration and Hall-probe technique to measure the $V-I$ characteristic and AC losses in MgB_2 bulk superconductors. The samples were synthesized under quasihydrostatic high pressure conditions: 2 GPa, 1050°C during 1 hour, from the mixture of Mg and B powders with 4.0 μm average grain size taken in MgB_2 stoichiometry with additions of 10% SiC. The obtained dependence of the losses on the primary current (applied magnetic field) and frequency reveal the sufficient deviations from Bean's model. The obtained dependences of AC losses demonstrate the behavior that cannot be explained by the power-law characteristic of the MgB_2 sample. The analysis allows to suppose that the samples possess $E-J$ characteristic presented by the extended critical state model. Simulation carried out using COMSOL justifies this conclusion. The possible explanation of the observed perculiarities of the $V-I$ characteristic lies in a specific non-uniform structure of the investigated MgB_2 samples in which the non-superconducting and superconducting regions were formed during the preparation procedure. Non-superconducting regions can be additional pinning centers with the pinning force different from the force due to defects in MgB_2 itself.

Poster 15

SUPERCONDUCTING PROPERTIES OF SINGLE AND MULTIFILAMENTARY WIRES OF MgB_2/Ti PRODUCED BY POWDER IN TUBE

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Poster 16

MgB_2 has become a commercially attractive material for technological applications due to its suitable superconducting properties and other advantages such as low cost and light weight. However, due to its brittleness, in order to obtain wires it is necessary to use the Powder in Tube (PIT) method, which consists in filling a metallic sheath with the superconducting powder before drawing. In this work, to add to the light weight advantage, grade 2 Titanium has been used as sheath material and several single and multifilamentary wires have been prepared. The PIT method has been used with two variants to prepare the wires: Ex situ consisting on filling the sheath with pre-reacted MgB_2 and In situ where the sheath is filled with the precursor powders (Mg and B). Different thermal treatments have been investigated including several intermediate treatments during the drawing process as well as final ones. These last treatments are necessary to finish the synthesis and to heal the cracks generated during the cold work. The superconducting properties were determined by magnetization measurements using a SQUID magnetometer and the microstructure evolution was followed by TEM and SEM microscopy.

FROM BCS TO EXOTIC SUPERCONDUCTIVITY IN GRANULAR Al

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Unconventional superconductors such as the Cuprates, Pnictides and the Heavy Fermions are known by their magnetic properties. Although magnetism is known to be detrimental to BCS conventional superconductivity, it is well known that the T_c of these superconductors is not quenched but rather elevated, well above the BCS electron-phonon coupling limit. This coexistence of superconductivity and magnetism was recently shown in granular Al [1] where enhanced superconducting properties are observed in the presence of strong spin scattering and a Kondo-like behavior. In fact, granular Al films show several important similarities to the Heavy Fermion superconductors, a well-known Kondo lattice. The local interaction of conduction electron with localized magnetic moments by a spin-flip process in granular Al suggest that superconductivity is mediated by local spin fluctuations as was recently proposed in the Heavy Fermions. We will show several observations of this unconventional superconductivity by transport measurements and THz spectroscopy. We will discuss the coexistence of magnetism and superconductivity in granular Al in view of the experimental results.

Poster 17

[1] N. Bachar *et al.*, Phys. Rev. B **87** (2013) 214512.

INTERBAND JOSEPHSON STRINGS AND PHASE SLIPS IN WIRES OF TWO-BAND SUPERCONDUCTORS

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Poster 18

We perform numerical simulations of the time-dependent two-component Ginzburg-Landau equations for wires of two-band superconductors driven by a current. We find that the onset of dissipation involves the nucleation of composite phase slips, where the order parameters vanish periodically with the same frequency but at different times. We find that the zero of one order parameter connects in the time direction to the zero of the second order parameter through a Josephson string of the interband phase difference. The time dependence of the voltage shows a periodic two-peaked structure, with the time separation of the two peaks corresponding to the temporal length of the Josephson string. We study the dependence of these effects on the interband coupling strength.

ELECTRONIC STRUCTURE OF MULTI-BAND HUND-HUBBARD MODELS FOR STRONGLY CORRELATED MATERIALS

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Poster 19

We have developed a numerical method that combines the Dynamical Mean Field Theory (DMFT) with the Density Matrix Renormalization Group (DMRG) as the impurity-solver for the DMFT 's self-consistent equations and which allows for the efficient real-energy axis calculation of electronic and magnetic spectral functions of complex strongly correlated materials. Using this method, we study the two-orbital Hubbard model in a square lattice at half filling, taking into account the Coulomb interaction (U) as well as Hund coupling (J). We calculate the electronic density of states and obtain the phase diagram in the $U - J$ space, which characterizes the metal-insulator transition.

INTERPLAY BETWEEN CONDENSATION ENERGY, PSEUDOGAP AND THE SPECIFIC HEAT OF A HUBBARD MODEL IN A N-POLE APROXIMATION

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The specific heat and the condensation energy of a two-dimensional Hubbard model, suitable to discuss high-Tc superconductors (HTSC), is studied taking into account hopping to first (t) and second (t_2) nearest neighbors. Results for the Hubbard model show that the specific heat as a function of the temperature $C(T)$ presents a two peaks structure [1]. The low temperature peak has been associated with spin fluctuation while the high temperature peak is related to charge fluctuation. Experimental results for the specific heat of HTSC's [2], for instance, the YBCO and LSCO, indicate a close relation between the pseudogap and the specific heat. In the present work, we investigate the specific heat by the Green's function method within the n-pole approximation proposed by L. Roth [3]. The specific heat is calculated on the pseudogap and on the superconducting regions. Superconductivity with $d_{x^2-y^2}$-wave pairing is considering following the procedure proposed by Beenen and Edwards [4]. The analytical expressions for the specific heat and for the condensation energy have been obtained following the formalism presented in reference [5].
In the present scenario, the pseudogap emerges when the antiferromagnetic (AF) correlations (present in the Roth's band shift) become strongly sufficient to push down the region of the nodal point (π, π) on the renormalized quasi-particle bands. We observed that above a given total occupation n_T, the specific heat decreases signaling the pseudogap presence. The effects of the antiferromagnetic correlations on the condensation energy and on superconductivity are also investigated.

Poster 20

[1] D. Duffy and A. Moreo, Phys. Rev. B **55** (1997) 12918.
[2] J.W. Loram *et al.*, J. Phys. Chem. Solids **62** (2001) 59.
[3] L.M. Roth, Phys. Rev. **184** (1969) 451.
[4] J. Beenen and D.M. Edwards, Phys. Rev. B **52** (1995) 13636.
[5] R. Kishore and S.K. Joshi, J. Phys. C: Solid State Phys. **4** (1971) 2475.

DOPING EFFECT ON THE EVOLUTION OF THE PAIRING SYMMETRY IN n-TYPE SUPERCONDUCTOR NEAR ANTI-FERROMAGNETIC PHASE BOUNDARY

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Poster 21

Among the high-T_c superconductors n-type compounds have a unique region of coexistence between the superconductivity and antiferromagnetism. Moreover in this area the Fermi surface reconstruction takes place that leads to the formation of the holelike pokets around the ($\pi/2$,$\pi/2$) point beside the electron pokets [1]. A simple two-band model allowed us to interpret the sign change in the Hall coefficient and the upper critical field temperature dependencies in underdoped ($x = 0.14$) and optimally doped ($x = 0.15$) regions of electron-doped superconductors $Nd_{2-x}Ce_xCuO_{4+\delta}$ [2].

The results of the investigation of the in-plane $\rho(T)$ resistivity tensor at the temperature range $0.4 - 40$ K in magnetic fields up to 120 kOe ($H \parallel c$, $J \parallel ab$) for electron-doped $Nd_{2-x}Ce_xCuO_{4+\delta}$ near antiferromagnetic (AF) - superconducting (SC) phase boundary with different degree of disorder will be presented.

Using the resistivity method we have experimentally found the difference between the behaviors of the upper critical field slope $(dH_{c2}/dT)|_{T\to T_c}$ and critical temperature T_c/T_{c0} as the functions of the disorder parameter for optimally doped ($x = 0.15$) and underdoped films ($x = 0.14$): both the upper critical field slope and the critical temperature decrease with increasing of the disorder parameter in experiment for optimally doped compound while in the case of underdoped system the critical temperature remains constant with the change of the disorder parameter and $(dH_{c2}/dT)|_{T\to T_c}$ increases with increasing of the disorder.

We can assume that in underdoped region of electron-doped superconductors $Nd_{2-x}Ce_xCuO_{4+\delta}$ (x=0.14) the predominant part of the pairing simmetry is the anisotropic s-wave component (may be due to the existence of an inhomogeneous magnetic state). In optimally doped region (x=0.15) the d-wave part begins to prevail because of the SC state prevalence (Fermi surface with nodes in ($\pi/2$,$\pi/2$) directions [3]) with a presence of the residual spin fluctuations.

[1] S.R. Park *et al.*, Phys. Rev. B **75** (2007) 060501(R).
[2] T.B. Charikova *et al.*, Physica C **488** (2013) 25.
[3] J.R. Schriffer, X.G. Wen and S.C. Zhang, Phys. Rev. B **39** (1989) 11663.

MAGNETIZATION AND MAGNETOTRANSPORT IN AIII-BV SEMICONDUCTOR HETEROSTRUCTURES WITH Mn δ-LAYER

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Diluted magnetic semiconductor heterostructures are of grate interest for the research because of both the charge and the spin of carriers are used for managing information [1]. Advances in epitaxial growth technology, such as molecular beam epitaxy, have made it possible to grow a variety of semiconductor heterostructures with atomically controlled layer thicknesses and abrupt doping profiles, in which the wave function of carriers can be controlled in artificially designed potentials. Unlike the random alloy system, δ-layer of Mn in GaAs provides the doping profile along the growth direction and inherent advantages of δ-doping give locally higher dopant concentration and higher carrier concentration [2].

Poster 22

The molecular beam epitaxy GaAs/InGaAs/GaAs heterostructures with Mn δ-doped GaAs barrier and different quantum well width were grown on semi-insulating GaAs (001) substrates at the temperatures $T_S = 600 - 200$°C. The abruptness of the δ-doped Mn profiles and the extent of formation of crystal defects such as dislocations and clusters as well as the degree of localization of the Mn dopants were studied by cross-sectional transmission electron microscopy, secondary ion mass spectroscopy and X-ray standing wave studies, while the surface morphology was studied by atomic force microscopy.

The magnetization, magnetoresistivity and Hall effect in heterostructures GaAs/InGaAs/GaAs with Mn δ-layer have been investigated in temperature range $T = (1.3 - 300)$ K in magnetic field up to 9 T. We have found that over the temperature range $T = (1.3 - 300)$ K the susceptibility is diamagnetic for all the type of samples but some heterostructures have paramagnetic contribution at the temperature $T < 100$ K. The results of the field dependent resistivity tensor in semiconducting heterostructures with Mn δ doping will be presented.

[1] T.Dietl, H.Ohno and F.Matsukara, IEEE Trans. Electron Dev. **54** (2007) 945.
[2] R.V. Parfeniev *et al.*, J. Magn. Magn. Mater. **321** (2009) 712.

EXCITONIC COHERENT STATES, SYMMETRIES AND THERMALIZATION

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Poster 23

New exciton coherent state proposed previously by the authors is introduced in order to analize from the algebraic and group theoretical point of view the thermal properties of the model. In particular, if the possibility that it can be defined as a conventional thermal state certainly exists and if it can be based on an appropriate Hamiltonian. After a brief discussion about supersymmetric and information theoretical properties of the model, we check if the signal-to-noise ratio is degraded, and propose a simple model of thermalization (Kraus thermalization).

ROLE OF DEFECTS IN THE PHOTOMAGNETOCONDUCTIVITY AND PHOTOLUMINESCENCE PROPERTIES OF ZnO MICROWIRES

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We present experiments to systematically study the characteristic times involved in the spin dependent recombination processes in ZnO doped semiconductors. Undoped and Li-doped (3, 5 and 7%) ZnO microwires were prepared by carbothermal reduction process and then co-doped with H using two different times of H+ implantation. The results of photoluminescence showed that the Li concentration is directly linked to the emission intensity of the samples at 3.14 eV, reaching its maximum for 5% of Li. The characterizations were performed using the techniques of X-ray diffraction, photoluminescence (PL), photoresistance (PR), and photomagnetotransport (PMT). The samples showed high resistivity and persistent photoconductivity. In order to prevent inconsistencies and/or lack of reproducibility, product of the history of the samples, a novel methodology to measure the photoresistance(PR) transient relaxation is proposed. Besides, the PR excitation spectra as a function of the wavelength of light showed that the change in PR in the blue region is more marked for 7% of Li. Different models were used to fit the significant effect of the applied magnetic field on photocurrent decay. Our results suggest that a spin-dependent, non-radiative recombination process is responsible for photoresistivity changes in Li and H co-doped ZnO microwires.

Poster 24

EFFECT OF V DOPING ON THE MAGNETIC PROPERTIES OF ZnO BULK SAMPLES

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Poster 25

The integrated control of charge and spin degrees of freedom in semiconductors is required to realize new functionalities in semiconductor devices. To achieve this goal, diluted magnetic semiconductors (DMS) as transition metals doped ZnO, have been considered as good candidates not only in terms of its room temperature ferromagnetism but also as a transparent ferromagnetic material.

Bulk materials with nominal composition $Zn_{1-x}V_xO$ ($x = 0.075$ and 0.125) were prepared by the solid state reaction method. X-ray diffraction (XRD) studies indicate the formation of wurtzite crystal structure in addition to secondary phases associated with vanadium oxides and zinc vanadates. Magnetization (M) vs. magnetic field (H) curves obtained for both samples, show a strong ferromagnetic behavior at 77 K which decreases at room temperature, nevertheless at 7.5 mol% the overlapping of diamagnetic and ferromagnetic signals is evident. Magnetization measurements as a function of temperature, in the range of $5 - 320$ K, show no evidence of phase transitions from ferromagnetic to paramagnetic state.

Mn-DOPING EFFECT ON STRUCTURE AND MAGNETIC PROPERTIES OF ZnO NANOPARTICLES

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Poster 26

Zinc oxide - based diluted magnetic semiconductors (DMSs) have been predicted to show ferromagnetic order above room temperature and a large saturation magnetization which makes them promising candidates for the next generation of spintronic devices. In this work, we present the study of Mn-doped ZnO nanoparticles synthesized by the co-precipitation method. The analysis of X-ray diffraction data indicates the formation of the wurtzite phase. For ZnO nanoparticles doped with $10 mol\% Mn$, the rising of additional Bragg reflections with weak intensities suggests the formation of the $ZnMnO_3$ phase. Raman spectroscopy measurements show the presence of vibrational modes consistent with the wurtzite phase of ZnO and an additional peak centered at $\sim 647\,\mathrm{cm}^{-1}$ which was assigned to a local vibrational mode of Mn-O bonds. The temperature dependence of the magnetization carried out from 5 K to 300 K shows a Curie-Weiss behavior and the study of the Curie-Weiss temperatures (θ) indicates the presence of antiferromagnetic interactions between magnetic ions. Magnetization (M) vs. magnetic field (H) curves obtained at 5 K show non-zero coercive fields whose values increase as the Mn content increases. At 300 K, no coercive fields are observed in the M vs. H curves for all Mn-doped ZnO nanoparticles.

CURRENT AND STATES DENSITY IN DILUTED MAGNETIC SEMICONDUCTOR NANOSTRUCTURES

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In this article we have studied the spin-polarized current components in diluted magnetic semi-conductor tunneling diodes with different sample geometries. The charge build up and its fluctuation on the resonant levels of given geometry can help to project efficient low voltage spin filter devices working with small barrier offset and small magnetic field. These theoretical studies on the spin polarization effects on the resonant current are studied within the Green's function formalism following the diagrammatic technique for non-equilibrium processes as proposed by Keldysh, using the one-band tight-binding modeling. The magnetic impurities can be located inside the well or the barrier layers of a diode sample. The resonant $I-V$, density of sates (DOS) and differential conductance curves are analyzed as a function of the applied voltage and the magnetic potential strength induced by the magnetic ions.

Poster 27

IN-PLANE/OUT-OF-PLANE TRANSPORT MEASUREMENTS ON SYMMETRIC EPITAXIAL FERROMAGNET/SUPERCONDUCTOR/FERROMAGNET (F/S/F) JUNCTIONS

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Poster 28

The anisotropic magnetoelectric behavior of all oxide symmetric Ferromagnet/Superconductor/Ferromagnet (F/S/F) junctions is reported. $La_{2/3}Ca_{1/3}MnO_3$(F)/$YBa_2Cu_3O_{7-\delta}$(S)/$La_{2/3}Ca_{1/3}MnO_3$(F) junctions have chosen as test system to study the effect of the geometry of the applied magnetic field on the magnetoelectric response of the F/S/F hybrid systems. The thickness of the superconducting layers has been varied in order to modulate the strength of the interaction between superconductivity and ferromagnetism in the junction. The external magnetic field has been applied both parallel (in-plane, $H||a-b$-plane) and perpendicular (out-of-plane, $H||c$-axis) to the plane of the trilayer. The magnetization hysteresis loops, recorded at 5 K features a clear central peak around of zero field when the magnetic field is applied perpendicular to the plane of the trilayer. The form of this curve reflects the dominant diamagnetic character of the S layer in this measuring geometry. In turn, by measuring the in-plane $M-H$ dependence, the central peak disappeared. This finding and the form of the recorded curve suggested a strong contribution of the ferromagnetic layer to the magnetization of the junction. In turn, measurements of the resistance of the junctions as a function of the external magnetic field also show strong dependence on the measuring geometry. Thus, when the field is applied in in-plane configuration a typical butterfly-like $R(H)$ curve emerges, which is associated with the magnetoresistence of the ferromagnetic layer. Contrarily, when the field is applied in out-of-plane configuration, the $R(H)$ dependence is exclusively determined by the penetration of the magnetic field into the superconductor. The results achieved can contribute to broaden the current knowledge of the complex interaction between superconductivity and ferromagnetism.

CORRELATED MAGNETIC SOLITONS IN DILUTED MAGNETIC SEMICONDUCTORS

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Diluted magnetic semiconductors have attracted much attention because of the conbination of magnetic and semiconducting properties. In addition, interesting phenomena such as the photo-induced magnetic polaron in diluted magnetic semiconductors have been discovered [1]. In order to evolute the quantum theory of solitons, the path-integral formula, which is based on the gauge-invariant Lagrangian densty with the spontaneously broken symmetry, is a powerful one. Recently, the present author has discussed the localization mechanism, using the gauge-invariant Lagrangian density for the hole-induced magnetic solitons [2,3]. In this study, we will discuss the localization efferct, taking into account the long-range interactions among magnetic solitons, by using the effective Lagrangian of dffusion modes.

Poster 29

[1] S. Koshihara *et al.*, Phys. Rev. Lett. **78** (1997) 4617.
[2] I. Kanazawa, Physica E **29** (2005) 647.
[3] I. Kanazawa, Phys. Lett. A **355** (2006) 460.

QUANTIZED MASSIVE COLLECTIVE MODES, THE PSEUDOGAP, AND FERMI ARC IN HIGH-TC CUPRATES

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The present author[1] proposed that the temperature-evolution of the Fermi arc is strongly related to the restoration of spontaneous symmetry breaking in underdoped cuprates. Furthermore, he [2] proposed the evolution mechanism of the Fermi arc with increasing of hole-doping in high-Tc cuprates, from the standpoint of the effect of the quantized massive gauge fields around the hole [3]. Recently Yazdani [4] has suggested that the high-energy (up to 400 meV) hole-like excitations of the normal state are a direct predictor of the strength of Cooper pairing. In this study, we discuss the characteristic properties of quantized massive gauge fields in high-Tc cuprates.

Poster 30

[1] I. Kanazawa, J. Phys. Chem. Solids **66** (2005) 1388.
[2] I. Kanazawa, Physica C **470** (2010) S183.
[3] I. Kanazawa, J. Phys. A **36** (2003) 9371.
[4] A. Yazdani, J. Phys.: Condens. Matter **21** (2009) 164214.

A PECULIAR SOLITARY RE-ENTRANT SUPERCONDUCTIVITY INDUCED BY AN EXTERNAL MAGNETIC FIELD IN FERROMAGNET-SUPERCONDUCTOR HETEROSTRUCTURES

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Poster 31

Interplay between of the superconductivity and ferromagnetism in the artificial layered ferromagnet-superconductor (FS) systems leads to many interesting effects, such as re-entrant and periodically re-entrant superconductivity. The phase diagrams of these systems can be controlled by an external magnetic field. This does these systems promising for potential spin switch applications. We consider the boundary value problem for the Usadel-like equations in the case of so-called "dirty" limit for thin-film three layered heterostructures FSF and FFS in the presence of parallel external magnetic field. Our theoretical approach taking into account of the asymmetry and triplet superconducting correlations is valid in the external magnetic field presence as in real experimental setup for the FS spin valve explorations. We discuss recent experimental data obtained for symmetrical (FSF) trilayer in an external magnetic field and expand the theoretical description to asymmetrical FSF and FFS trilayers. We also predict and discuss the peculiar re-entrant superconductivity and solitary re-entrant superconductivity induced by external magnetic field for the FFS trilayer. The possibility of solitary superconductivity in clean and dirty asymmetrical FS systems without magnetic field is also discussed.

THERMAL EXPANSION OF ANTIFERROMAGNETIC SUPERCONDUCTORS

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Poster 32

We investigated the temperature dependence of thermal expansion of antiferromagnetic superconductors below the superconducting transition temperature. The Néel temperature was much higher than the superconducting transition temperature. Therefore, the staggered magnetization was approximately constant. The isotropic singlet superconducting gap was used. This theory was based on the single band model [1] of antiferromagnetic superconductors to which theory of ferromagnetic superconductors [2] was extended. We derived a free energy and thermal expansion from this single band model. We find that thermal expansion increases exponentially at low temperatures. On the other hand, it has the power-law behavior near the superconducting transition temperature.

[1] H.-J. Lee and T. Takimoto, J. Phys. Soc. Jpn. **81** (2012) 104704.
[2] J. Linder and A. Sudbo, Phys. Rev. B **76** (2007) 054511.

MAGNETIC AND SUPERCONDUCTING PHASE DIAGRAM OF THE NOVEL ANTIFERROMAGNETIC COMPOUND Ce_3PdIn_{11}

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The family of $Ce_nT_mIn_{3n+2m}$ ($n = 1, 2$; $m = 1$; T=transition metal) heavy fermion compounds are known to be on the verge of a magnetic to non-magnetic quantum critical point (QCP) [1]. In the vicinity of the materials‘ QCP an unconventional superconducting state has been reported which attracted much of the attention in the past decades. However, this family of compounds is interesting for an other reason. The compounds crystallize in the tetragonal $Ho_nCo_mGa_{3n+2m}$ structures which provide the possibility to tune the structural dimensionality from more 2D to 3D (stoichiometries: $127 \rightarrow 115 \rightarrow 218 \rightarrow 103$ [1]. This makes them ideal candidates to investigate the influence of the parameter “dimensionality” with respect to quantum criticality [2]. Recently, two new phases within this family, $Ce_5Pd_2In_{19}$ and Ce_3PdIn_{11}, have been discovered [3]. These materials are located between the purely cubic $CeIn_3$ and their less 3D Ce_2PdIn_8 counterpart.

Poster 33

We prepared the Ce_3PdIn_{11} compound in a single-crystalline form for the first time. The detailed resistivity and magnetization studies reveal very low anisotropy of Ce_3PdIn_{11}. At low temperatures, the compound orders antiferromagnetically below $T_1 = 1.7\,\mathrm{K}$ and further cooling reveals another, order-to-order transition at $T_{mN} = 1.5\,\mathrm{K}$. Applying the magnetic field within the basal plane gradually suppresses both transitions. In contrast, when the field is along the tetragonal c-axis, both transitions slightly decrease, merge at $4\,\mathrm{T}$ and then split again in higher fields. At even lower temperatures, superconductivity emerges at $T_\mathrm{c} = 0.39\,\mathrm{K}$. Application of hydrostatic pressure leads to formation of a superconducting dome with $T_\mathrm{c}^{max} = 0.7\,\mathrm{K}$ at $1\,\mathrm{GPa}$. The unusual magnetic field-pressure-temperature phase diagram will be discussed in the context of superconductivity and magnetism evolution in related compounds.

[1] J.D. Thompson *et al.*, J. Magn. Magn. Mater. **226-230** (2001) 5.
[2] J. Custers *et al.*, Nature Mat. **11** (2012) 189.
[3] A. Tursina *et al.*, J. Sol. State Chem. **200** (2013) 7.

X-RAY ABSORPTION STUDIES AND *f*-LEVEL OCCUPANCY IN $Ce_2Rh_{1-X}Ir_XIn_8$

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Poster 34

Within the series of heavy fermions $Ce_2Rh_{1-x}Ir_xIn_8$ intermetallic compounds it has been recently observed the occurrence of two low-temperature superconducting (SC) phases as a function of temperature both at ambient pressure and under applied pressure for intermediate Ir-content ($x \sim 0.25 - 0.7$) with remarkable different behaviour of both states as a function of pressure and Iridium content (x) [1]. The observed results seem to be reminiscent of the two SC phases found in the monolayer $CeRh_{1-x}Ir_xIn_5$ system [2] but the former appear for smaller x ranges which has been associated to its higher dimensionality and structural disorder. In this work, we have performed EXAFS (X-ray Absorption Fine Structure) and XANES (X-ray Absorption Near Edge Structure) measurements in the series $Ce_2Rh_{1-x}Ir_xIn_8$ ($x = 0.00, 0.25, 0.50, 0.75$), in order to shed light into the complex phase diagram obtained [1] as well as into the relationship between the local atomic order and the interesting ground states observed as a function of temperature and Ir concentration. The experimental data were obtained at the Brazilian Synchrotron Light Source (LNLS) in the Ir (L3), Rh (K) and Ce (L3) absorption edges. Our results have been analysed by using FEFF and IFEFFIT codes and they suggest that there is no evidence for the presence of local structural disorder down to the lowest temperature measured (10 K), contrary to what has been suggested, however sample inhomogeneities (Rh clustering) and changes in the Rh/Ir stoichiometry could be responsible for the smaller doping range where SC were observed. XANES data reveals that Ce valence is 3+ over the entire studied T interval. Preliminary results of EXAFS data under pressure of up to 20 kbar will be presented and compared to the ambient pressure EXAFS data.

[1] E.N. Hering *et al.*, Phys. Rev. B **82** (2010) 184517.
[2] M. Nicklas *et al.*, Phys. Rev. B **70** (2004) 020505.

SUPERCONDUCTING AND MAGNETIC PROPERTIES OF YFe_2Ge_2: A CHEMICAL PRESSURE STUDY

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Interest in the new branch of Fe-containing superconductors of nominal stoichiometry $R\mathrm{Fe_2As_2}$ where R is an alkali earth metal such as Ba or Sr, and in the doped quartenary iron arsenides have stimulated the search for superconducting phases in other iron containing materials, in pursuit of higher superconducting ordering temperatures. Moreover, this topic has brought renewed interest to studies of overlapping superconducting and long-range magnetic ordering phases and the conditions that either favour or impede their coexistence. Here we focus on the tetragonal compounds $\mathrm{YFe_2}X_2$ (X =Si or Ge). $\mathrm{YFe_2Si_2}$ has been reported [1] as an example of a nearly ferromagnetic Fermi liquid, wheras Fe in $\mathrm{YFe_2Ge_2}$ is in the paramagnetic state. Surprisingly, a recent low-temperature study [2] found superconductivity in $\mathrm{YFe_2Ge_2}$ below 1.8 K. The additional attribute of an enhanced electronic specific heat (Sommerfeld) coefficient may classify this compound as a strongly correlated electron system. Here we report on the findings of low-temperature studies of specific heat, electrical resistivity, and magnetic measurements on doped compounds of the form $\mathrm{YFe_2(Ge_{1-x}Si}_x)_2$. Controlled Ge replacement by Si is expected to produce an effective positive chemical pressure. Following the indication of Hase and Yanagisawa [3] and later by Felner, Lv, and Chu [1] of the relation between electronic density of states (DOS, which is related to the Sommerfeld coefficient) and concommittant distortion of the $\mathrm{Fe}X_4$ tetrahedra in this crystal structure, our objective is to investigate how the superconducting critical temperature as well as the heavy electron masses would respond to pressure effects induced by Si doping.

Poster 35

[1] I. Felner, B. Lv, and C.W. Chu, arXiv:1311.1984v1 (2013).
[2] Y. Zou *et al.*, arXiv:1311.0247 (2013).
[3] I. Hase and T. Yanagisawa, Physica C **471** (2011) 656.

EFFECT OF THE ADDITION OF FERROMAGNETIC $La_{0.67}Sr_{0.33}MnO_3$ ON THE SUPERCONDUCTING PROPERTIES OF $La_{1.85}Sr_{0.15}CuO_4$

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Poster 36

The structural and magnetic properties of the composite-like hybrid system $(La_{1.85}Sr_{0.15}CuO_4)_{1-x}(La_{0.67}Sr_{0.33}MnO_3)_x$ (x=0, 0.02) are carefully studied. The superconductor $La_{1.85}Sr_{0.15}CuO_4$ and the ferromagnet $La_{0.67}Sr_{0.33}MnO_3$ have been synthesized separately by means of standard solid state reaction using high-purity precursors. The X-ray diffraction patterns of $La_{1.85}Sr_{0.15}CuO_4$ recorded at room temperature show a tetragonal structure with lattice parameters $a = 3.7784$ Å and $c = 13.2344$ Å. In turn, $La_{0.67}Sr_{0.33}MnO_3$ shows an orthorhombic structure with lattice parameters $a = 5.469$ Å, $b = 5.560$ Å and $c = 7.736$ Å. For samples with x= 0.02, the observed diffraction peaks stem exclusively from the constituent elements. Moreover, no shifting of the X-ray pattern, as compared with that of the sample with $x = 0$, is verified. Magnetic hysteresis loops have been recorded different temperatures (below and above of the superconducting critical temperature, T_c) and in fields up to 6.5 T. An asymmetric superconducting behavior is observed for samples with $x = 0$. In turn, for samples with $x = 0.02$, hysteresis loops, recorded a $T > T_c$, display a clear ferromagnetic behavior although with low values for the coercive field. The hysteresis loops recorded at 5 K show coexistence between superconductivity and ferromagnetism with pronounced peaks at low values of the magnetic field, which is related to the onset of the H_{c2} of the superconductor. A similar trend is observed for the samples with $x = 0.02$ although with lower values for the magnetization.

THE SOUTHERNMOST VIEW OF THE FASCINATING PHYSICS OF CERIUM

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In 1978, Koskenmaki and Gschneidner wrote "In its elemental form Ce is the most fascinating member of the Periodic Table". Since that time it became evident that this statement also applies to Ce intermetallic alloys and compounds. This characteristic arises from the empathy of its $4f^1$ electron to kindly adapt to the electronic environment.
In this poster, an historical overview of the contributions performed from the far south of the world to the study of the thermodynamical properties of Ce and some related systems is presented. Nearly free from trendy pressures, the research work allowed to explore alternative aspects of the low temperature properties of this element, with the conviction that "If it is Cerium it will behave in an original way". This work was continuously supported by the friendship of colleagues and students.

Poster 37

OBSERVATION OF A CHARGE DENSITY WAVE QUANTUM CRITICAL POINT IN $Lu(Pt_{1-X}Pd_X)_2In$

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Puzzling out cause and effect of novel phase transitions is one of the most appealing tasks in modern solid state physics. We recently studied the two compounds $LuPt_2In$ and $LuPd_2In$. Thereby, we discovered an exceptional opportunity for studying a charge density wave (CDW) quantum critical point (QCP). Up to now QCPs have been intensively studied in magnetic systems, while CDW QCPs are rather scarce.
We synthesized both alloys in polycrystalline form to analyse their structural and electronic properties. We found that at high temperatures both compounds crystallise in the simple cubic Heusler structure ($Fm\bar{3}m$). While $LuPd_2In$ retains this structure down to lowest temperature, in $LuPt_2In$ susceptibility $\chi(T)$, resistivity $\rho(T)$ and temperature dependent powder X-ray diffraction evidence a CDW type phase transition at about 480 K to a yet undetermined low T structure. The temperature dependence of the anomalies in $\chi(T)$ and $\rho(T)$ indicate a 2^{nd} order type transition. Substituting Pd for Pt in $Lu(Pt_{1-x}Pd_x)_2In$ results in a continuous decrease of the transition temperature, indicating a structural CDW QCP at $x_c \approx 0.58$. Most interestingly, we observed bulk superconductivity (SC) in the whole alloy series, with a pronounced SC dome at x_c. Furthermore, we found that the phonon contribution to the specific heat at low T also presents a clear maximum at x_c, suggesting critical phonon softening. These results provide new insight into CDW QCPs.

Poster 38

$Ce_NPd_MIn_{3N+2M}$: A NOVEL LAYERED HEAVY FERMION SYSTEM

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Poster 39

After the discovery of the Pt- and Pd- based $Ce_nT_mIn_{3n+2m}$ ($n = 1, 2$; $m = 1$; T=transition metal) heavy fermion compounds $CePt_2In_7$ and Ce_2PdIn_8, more attention has been paid to synthesize of new materials from these series. Only recently Ce_2PtIn_8, Ce_3PtIn_{11}, Ce_3PdIn_{11}, and $Ce_5Pd_2In_{19}$ have been reported [1,2,3]. Here we will also present first results on hitherto missing 115-compound $CePdIn_5$. The most interesting compounds are Ce_3PtIn_{11} and Ce_3PdIn_{11} [4] where a coexistence of long range magnetic order and superconducting state was observed at ambient pressure. Presently the Pd-base compounds occupy a unique position within the materials class. Together with their unique physical properties they cover the broadest range of stoichiometries and a smooth line of compounds which evolves from more 2D to 3D-like structure can be created: $CePdIn_5$ – Ce_2PdIn_8 – $Ce_5Pd_2In_{19}$ – Ce_3PdIn_{11}– $CeIn_3$. This provides a great possibility to investigate the influence of the $CeIn_3$-layer spacing (dimensionality) with respect to quantum criticality [5]. Single crystal growth, detail sample characterization and low temperature properties of $Ce_nT_mIn_{3n+2m}$ single crystals will be presented. The results will be discussed in context of the global phase diagram of quantum critical behavior for heavy fermion systems [5,6].

[1] Z.M. Kurenbaeva *et al.*, Intermetallics 16 (2008) 979.
[2] A. Tursina *et al.*, J. Sol. State Chem. **200** (2013) 7.
[3] M. Kratochvilova *et al.*, J. Cryst. Growth, accepted (2014).
[4] M. Kratochvilova *et al.*, J. Cryst. Growth **397** (2014) 47; arXiv:1403.4363 (2014).
[5] Q. Si, Physica B **378** (2008) 23.
[6] J. Custers *et al.*, Phys. Rev. Lett. **104** (2010) 186402.

ORBITAL KONDO EFFECT IN V DOPED $1T$-$CrSe_2$

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We have studied the electrical resistance of $1T$-$Cr_{1-x}M_xSe_2$, M = V or Ti. The V replacement leads to a logarithmic increase in the resistance at low temperatures, that is proportional to the V concentration. While this behavior is consistent with a Kondo effect, the weak dependence of the resistance with magnetic field and the fact that the system has antiferromagnetic order, rule out a Kondo effect due to spin degeneracy. In contrast to the case of V, that has one d electron left, Ti substitution, with no d electron, does not increase the logarithmic term. Application of pressure destroys the logarithmic term, which is compatible with an orbital Kondo effect, as pressure probably produces distortions of the lattice that split the orbital degeneracy. Calculations of the electronic structure within the framework of density functional theory, maximally localized Wannier functions, and many-body calculations in a cluster containing a Cr or V atom and its six nearest-neighbor Se atoms, helped to reveal the existence of an orbital Kondo effect due to orbital degeneracy in the V substitutional impurities.

Poster 40

[1] M. Núñez *et al.*, Phys. Rev. B **88** (2013) 245129

LOW TEMPERATURE ELECTRICAL RESISTIVITY AND THERMOPOWER IN $CeSc_{1-Y}Ti_YGe$

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CeScGe shows antiferromagnetic order at $T_{\mathrm{MO}} = 47\,\mathrm{K}$, the second highest ordering temperatures among Ce-based intermetallic systems. CeTiGe, on the other hand, is a non-magnetic heavy fermion compound in which low temperature magnetism can be induced through a metamagnetic transition occuring roughly at 120 kOe. These compounds crystallize in two related tetragonal structures, CeScSi and CeFeSi-type respectively. The study of the resulting alloy, $CeSc_{1-y}Ti_yGe$, could shed light on the conditions that lead to such anomalous magnetic ground states.

In this contribution we will present electrical resistivity, $\rho(T)$, and thermopower (Seebeck effect, $S(T)$) measurements on a series of alloys covering the whole substitution range. These measurements complement the information available on thermal properties measured in this system [1]. On the Sc-rich side (CeScSi-type structure) we use the resistivity data to trace the suppression of $T_{\mathrm{MO}}(y)$ as Ti-content increases. The $\rho(T)$ anomaly at $T_{\mathrm{MO}}(y)$ changes from a kink at $y = 0$, to a superzone or SDW-like resistivity increase for $0.05 \leq y \leq 0.35$ and back to a kink for $y > 0.4$. This kink is observed up to $y \sim 0.23$, i.e. close to the stability limit of the CeScSi-structure. We use this information, together with low-field magnetization data, to infer that a change in the nature of the $T_{\mathrm{MO}}(y)$ transition occurs. The proposed scheme is consistent with high-field resistivity measurements on selected samples (up to 160 kOe). The thermopower $S(y,T)$ increases with Ti-doping, displaying a double-maxima or single-maximum structure depending on y. This evolution is typical of Ce-compounds and alloys that progressively loose their magnetism. Contrary to what is observed in the $\rho(T)$ data, the magnetic anomaly at $T_{\mathrm{MO}}(y)$ manifests in $S(T)$ as a very small kink. To understand this apparent inconsistency we propose that more than one band contributes to the electronic transport.

The proper detection of small features in $S(T)$ is only possible with a newly implemented ac-detection technique for the thermopower. This technique relies on low noise preamplification of two thermocouple signals measured with a lock-in technique.

Poster 41

[1] J.G. Sereni *et al.*, arXiv:1403.4490 (2014).

THERMOELECTRIC POWER OF $Ce(Pd_{1-X}Cu_X)_2Si_2$

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The ground state of the $Ce(Pd_{1-x}Cu_x)_2Si_2$ alloy evolves from ordered antiferromagnetism for $x \sim 0$ to heavy fermion superconductivity for $x = 1$. We present low temperature thermoelectric power $S(T)$ of this alloy, showing three characteristic anomalies across the whole composition range: a positive maximum at high temperatures, a negative minimum and a low temperature maximum. We associate the high temperature maximum, also seen in electrical resistivity, to the Kondo effect and crystal field excitation. We argue that in this alloy the low temperature maximum, displaying a non-monotonous evolution, cannot be simply associated to the Kondo scale and that disorder may be at the origin of the very low $S(T)$ measured in the $0.2 < x < 0.8$ concentration range.
A recently acquired dilution refrigerator allowed us to extend electrical resistivity measurements on this system down to 30 mK.

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CHARGE DENSITY WAVE INDUCED BY DOPING IN LAYERED $La_{1-X}Ce_XSb_2$

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Poster 43

$CeSb_2$ is a well-known layered compound showing several magnetic transitions below 16 K. $LaSb_2$, on the other hand, shares the same layered structure and is a two-dimensional metal with a linear magnetoresistance which has been associated to some sort of charge ordering. We have synthesized the family of compounds $La_{1-x}Ce_xSb_2$ with $0 < x < 1$ and present here resistivity, specific heat and x-ray scattering experiments. We find a kink in the resistivity above $x = 0.2$, which remains until the establishment of the series of magnetic transitions of $CeSb_2$. We conclude that substitutional disorder stabilizes a charge density wave, and that the charge order competes with magnetic order.

MAGNETIC FIELD PHASE DIAGRAM OF THE NON-CUBIC ANTIFERROMAGNETIC Mn_5Si_3

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Poster 44

Transition metal magnets are characterized by having moments strongly linked to their local environment. This leads to a rich interplay between *d*-electron magnetism and nearest-neighbor interactions [1]. MnSi and MnGe crystallize in a cubic structure without center of inversion, leading to spiral magnetic order. The compound Mn_5Si_3 is antiferromagnetically ordered at low temperatures. Previous neutron scattering in polycrystalline or powder samples show several magnetic phases, with two magnetic transitions $T_N^1 = 60\,K$ and $T_N^2 = 90\,K$. Below T_N^1, spins are arranged in a non-collinear structure, showing local chirality. This phase is destroyed by a magnetic field of several Tesla, favoring the high temperature antiferromagnetic arrangement [2]. Here we have synthesized crystals of Mn_5Si_3 out of Cu flux. We obtain needles with typically 6 mm in length and cross section of about $1\,mm^2$ with a non-regular octagonal section. We find, from magnetization measurements up to 7 T and down to 2 K performed on individual needles along their main axis, that there are actually three magnetic phases, with an additional transition at $T_N^{1*} = 45\,K$. Contrary to results in other polycrystalline samples, we find that T_N^1 is magnetic field independent, whereas T_N^{1*} strongly decreases with the magnetic field, and presents transitions when increasing field at a fixed temperature. Our measurements suggest that the low temperature magnetic non-collinear structure unwinds with the magnetic field through metamagnetic transitions. There is an additional intermediate magnetic phase between 45 K and 60 K, which is probably also non-collinear. The role of sample synthesis on the magnetic structure is briefly discussed.

[1] N. Nagaosa and Y Tokura, Nat. Nanotechnol. **8** (2013) 899.
[2] C. Sürgers *et al.*, Nat. Commun. **5** (2014) 3400.

THE QUANTUM PHENOMENA IN NATURE: SUPERCONDUCTIVITY AND NOVEL MAGNETISM IN MINERALS

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The brief overview is given on the quantum cooperative phenomena, i.e. superconductivity and frustrated or/and low-dimensional magnetism, observed in the natural objects, ores or minerals. An important source of helium is the mineral cleveite UO_2. Prior to the discovery of high-Tc superconductivity numerous observations at low temperatures are due to the wide use of this liquefied noble gas. An extremely rare case of the mineral which experiences transition into superconducting state under pressure is calaverite $AuTe_2$ [1,2]. Of interest are the observations of anomalously strong diamagnetism in widely spread covellite CuS and klockmannite CuSe [3]. The minerals are seemingly endless source of exotic magnetic topologies as is observed e.g. in the kagome-type herbertsmithite $ZnCu_3(OH)_6Cl_2$ where either topological spin liquid which feature a spin gap [4] or algebraic spin liquids with gapless excitations [5] is realized. Various new objects to be discussed include the litidionite $Na_2Cu_2Si_4O_11\times2H_2O$ where the variation of the water content allows alternations in the spin gap value [6]; the dugganite $Pb_3TeCo_3V_2O_14$ which exhibits succession of phase transitions to reach its quantum ground state [7]; the synthetic analogue of kunzite, $NaTiSi_2O_6$, which exhibits orbitally-driven spin-Peierls type transition into dimerized state [8].

Poster 45

CRYSTAL STRUCTURE, PHYSICAL PROPERTIES, ELECTRONICS AND MAGNETIC STRUCTURE OF $S = 5/2$ CHAIN COMPOUND $Bi_2Fe(SeO_3)_2OCl_3$

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Poster 46

We present synthesis and characterization of a compound $Bi_2Fe(SeO_3)_2OCl_3$. The main feature of its crystal structure is the presence of isolated $S = 5/2$ zigzag chains of corner sharing FeO_6 octahedra decorated with BiO_4Cl_3, BiO_3Cl_3 and SeO_3 groups. At cooling, the magnetization passes through the broad maximum at $T_{max} \sim 130\,\mathrm{K}$ which indicates the formation of the magnetic short-range correlations regime. The same behavior is demonstrated by the integral electron spin resonance intensity. The absorption is characterized by isotropic effective g-factor $g \approx 2$ typical for high-spin Fe^{3+} ions. At $T_N = 13\,\mathrm{K}$, $Bi_2Fe(SeO_3)_2OCl_3$ exhibits transition into antiferromagnetically ordered state evidenced in magnetization, specific heat and Mössbauer spectra. At $T < T_N$, the ^{57}Fe Mössbauer spectra reveal low saturated value of the hyperfine field $H_{hf} \approx 44\,\mathrm{T}$ which indicates a quantum spin reduction of spin-only magnetic moment $\Delta S/S \sim 20\%$. The determination of exchange interaction parameters using first principles calculations validate the quasi-one-dimensional nature of magnetism in this compound.

MAGNETICAL AND ELECTRICAL STUDY OF $GdCoIn_5$

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$GdCoIn_5$ single crystals were grown by the In-flux method. The compound crystallizes in tetragonal structure and it orders antiferromagnetically at $T_N \approx 30\,K$. The structural, magnetic and electronic properties were investigated by XRD, magnetic susceptibility, magnetoresistivity, specific heat, and magnetostriction. The magnetic susceptibility shows a significant anisotropy below T_N indicating that the magnetic moments order perpendicularly to the c-axis. The anisotropy, however, disappears in a moderate applied magnetic field $B \geq 2\,T$. Magnetostriction experiments suggest that this anisotropy is associated with a lattice distortion. Electronic, phonon and magnetic contributions to the thermodynamic quantities were calculated using ab-initio and Quantum Monte Carlo techniques. The theoretical results show very good agreement with the experimental data.

Poster 47

FIRST PRINCIPLES STUDY OF $GdCoIn_5$, $GdRhIn_5$, AND $GdIrIn_5$: SPECIFIC HEAT AND MAGNETIC PROPERTIES

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Poster 48

We present a first principles study of the structural and magnetic properties of tetragonal $GdXIn_5$ (X = Co, Rh, Ir). Through density functional theory-based total energy calculations we obtain the equilibrium structure, the phonon spectrum and the parameters for the Gd-Gd exchange coupling interactions. The ground state of the three compounds is a *C*-type antiferromagnet which is determined by the competition between the first- and second-neighbor exchange couplings inside the $GdIn_3$ planes and stabilized by the interplane couplings. The interplane exchange coupling in the Co-based material is much smaller than in Rh and Ir which explains its observed lower transition temperature. We use the obtained parameters in a quantum Monte-Carlo calculation to obtain the magnetic contribution to the specific heat and the magnetic susceptibility as a function of the temperature across the magnetic transition. We obtain an excellent agreement of the calculated specific heat including the lattice, magnetic and electronic contributions, and the magnetic susceptibility with our experimental results on $GdCoIn_5$. We finally discuss the electronic structure, analyze the phonon spectrum and compare with the non-magnetic $YRhIn_5$, $YCoIn_5$ and $LaRhIn_5$ which are usually used experimentally to cancel the phonon contributions to the specific heat.

Y-SUBTITUTION EFFECTS IN $Tb_{1-X}Y_XRhIn_5$

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In this work we discuss the evolution of the magnetic susceptibility and specific heat data as a function of temperature of the series of intermetallic compounds $Tb_{1-x}Y_xRhIn_5$ ($x = 0.00, 0.15, 0.30, 0.40, 0.50$ and 0.70). The thermodynamic properties have been measured on single crystals for the nominal compositions above. $TbRhIn_5$ is antiferromagnetic (AFM) below $T_N \sim 46\,K$, the highest value of T_N within the $RRhIn_5$ series (R = Rare Earth). We use a mean field model to simulate the crystalline electric field (CEF) effects affecting the Tb^{3+} ions as a function of Y content and discuss the magnetic exchange weakening (T_N suppression) between Tb^{3+} ions as a result of the combined effects of CEF perturbations and dilution. The above AFM ground state suppression does not follow a linear behaviour with Y content. These results are compared to the La-substituted $(Tb,Gd)_{1-x}La_xRhIn_5$ series. For the particular case of the $Gd_{1-x}La_xRhIn_5$ antiferromagnets, the perturbation of the Gd^{3+}-Gd^{3+} exchange cannot be affected by first order CEF effects since Gd^{3+} is a magnetic S-ion (half filled $4f$ shell with null orbital angular momentum).

Poster 49

STRUCTURAL AND MAGNETIC PROPERTIES OF $YNi_{4-X}Co_XB$ INTERMETALIC ALLOYS AND MAGNETIC ANISOTROPIC STUDY

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Poster 50

Since the 70s, intermetallic alloys with boron have been mainly studied due to its properties as permanent magnets [1], and more recently for its large magnetocrystalline anisotropy [2]. The compounds RM_4B, where M = Fe, Co and Ni and R = Y, La and Lu are excellent candidates for the study of the magnetic propierties of the transition metals (M) in these structures, due to non-magnetic nature of R. YCo_4B is a ferromagnetic material with a critical temperature $T_C = 380\,K$ without magnetic hysteresis and exhibit spin reorientation to 150 K [3]. On the other hand, YNi_4B is a paramagnetic material, except under 12 K where it has a superconducting transition [4]. Therefore, the purpose of this work is to study the variations in the structural and magnetic properties of $YNi_{4-x}Co_xB$ intermetallic alloys ($x = 0, 1, 2, 3$ and 4). The samples were prepared by arc furnace under argon atmosphere, with appropriate amounts of cobalt, boron and yttrium, with a subsequent annealing for 10 days at 1323 K. The X-ray difraction result exhibit a single phase $CeCo_4B$ type (space group $P6/mmm$ 191) in all samples. The behavior of the magnetization with the temperature (4 K up to 350 K) and magnetic field (at 4 K) show spin reorientation in the samples with $x = 1, 2, 3$ and 4 below the room temperature. The Curie temperature of these samples exhibit a monotonic behavior. Furthermore, it shows evidences of texture in the samples, verified with SEM measurements. For future work, we will deeper on the magnetocaloric properties of these compounds.

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[1] Yu.B. Kuz'ma *et al.*, J. Less-Common Met. **67** (1979) 51.
[2] C. Chacón and O. Isnard, J. Appl. Phys. **89** (2001) 71.
[3] Z.-G. Zhao *et al.*, J. Magn. Magn. Matter. **104-107** (1992) 1289.
[4] R. Nagarajan *et al.*, J. Alloys-Compounds. **225** (1995) 571.

LOW TEMPERATURE ANOMALIES OF THE HEAT CAPACITY OF $Ho_XLu_{1-X}B_{12}$

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Heat capacity measurments on high quality single crystals of $Ho_xLu_{1-x}B_{12}$ ($x \leq 1$) have been carried out in a wide range of temperatures ($0.07 - 300\,K$) and in external magnetic field up to 90 kOe. For concentrations with $x \geq 0.2$ antiferromagnetic phase transitions with T_N in the range of $1 - 7.7\,K$ have been detected. Magnetic order disappears at critical Ho-concentration of $x_{cr} \approx 0.1$, below which the system is in regime of isolated magnetic impurities and broad maxima in heat capacity at 150 mK and 360 mK for $Ho_{0.1}Lu_{0.9}B_{12}$ and $Ho_{0.01}Lu_{0.99}B_{12}$, respectively are observed.

Poster 51

Detailed investigations of received heat capacity dependencies within the framework of approach developed in [1] allowed us to separate the contributions to heat capacity. From this analysis it follows that in $Ho_xLu_{1-x}B_{12}$ compounds there are two magnetic contributions to heat capacity. The first one may be described as a magnetic three-level Schottky anomaly attributed to Γ_5 triplet ground state of holmium Ho^{3+} ions [2] splitted by external magnetic field. The second component appears due to hyperfine splitting of holmium nuclear levels, and it can be approximated by a nuclear multi-level Schottky anomaly. The performed analysis allowed us to estimate the hyperfine field on holmium sites and the effective $g-$factor for all investigated Ho-concentrations.

[1] N.E. Sluchanko *et al.*, J. Exp. Theor. Phys. (JETP) **140** (2011) 536.
[2] K. Siemensmeyer *et al.*, J. Low Temp. Phys. **146** (2007) 581.

NATURE OF LARGE NEGATIVE MAGNETORESISTANCE IN METALS WITH MAGNETIC IONS: $Ho_XLu_{1-X}B_{12}$

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The magnetoresistance (MR) as a property of material to change the value of its resistivity in external magnetic field was first discovered by Lord Kelvin in 1856, but the mechanisms which are responsible for both the negative and positive MR effects in various types of materials are still a subject of debate [1,2]. During the last two decades special attention was paid to compounds with magnetic $d(f)$-ions having a "colossal" negative magnetoresistance (CMR), where MR reaches its largest value near ferro- or antiferromagnetic phase transitions [3]. Various types of imperfections (substitutional disorder, vacancies and other lattice defects, electronic, magnetic and structural inhomogeneities, non-stochiometry, phase separation, etc.) dominate the MR in compounds with rare earth (RE) and transition metal (TM) ions, and are discussed as possible common features responsible for the CMR effect.

To shed more light on the origin of large negative MR observed in RE and TM systems in vicinity of Neel T_N and Curie T_C temperatures, it is promising to investigate model compounds with simple crystalline and magnetic structures in which both the different type of disorder and the dispersion of size and concentration of magnetic clusters can be controlled.

Poster 52

In this report we show that it is very effective to perform a study of negative MR effect in fcc metallic solid solutions $Ho_xLu_{1-x}B_{12}$ with Ho^{3+} magnetic ions embedded in a rigid covalent boron cage. Recently, comprehensive measurements of LuB_{12} crystals enabled us to find a new disordered "cage-glass" phase at nitrogen temperatures [4]. It was shown [4] that the combination of loosely bound states of RE ions in the rigid boron sub-lattice of RB_{12} together with randomly arranged boron vacancies ($\sim 1-3\%$) initiate the development of a lattice instability at intermediate temperatures. As a results, below $T^* \sim 60$ K the RE-ions become frozen in randomly distributed of-center positions inside truncated B_{24} octahedrons. In $Ho_xLu_{1-x}B_{12}$ with magnetic Ho^{3+}-ions there is in addition substitutional disorder which interferes with random displacements (static disorder) of RE-sites in the metallic cage glass phase.

Dealing with dilute ($x \leq 0.1$) paramagnetic and concentrated ($0.3 \leq x \leq 0.5$) antiferromagnetic $Ho_xLu_{1-x}B_{12}$ borides we have observed both the appearance of negative MR simultaneously with the emergence of Ho^{3+} nanosize clusters in the RB_{12} matrix, and an enhancement of this effect in the vicinity of T_N. The analysis developed here, allowed us: (i) to estimate from MR results the salient characteristics of magnetic clusters below (dimers, trimers, etc) and above (short range order AF domains) the percolation threshold x_C, and (ii) to conclude in favor of an interference between localized ($4f$) and itinerant ($5d$) components in the complex magnetic structure of these antiferromagnets.

[1] J. Hu, M.M. Parish and T.F. Rosenbaum, Phys. Rev. B **75** (2007) 214203.
[2] N.J. Harmon and M.E. Flatte, Phys. Rev. Lett. **108** (2012) 186602.
[3] E. Dagotto, T. Hotta and A. Moreo, Phys. Rep. **344** (2001) 1.
[4] N.E. Sluchanko *et al.*, J. Exp. Theor. Phys. (JETP) **113** (2011) 468.

INFLUENCE OF SAMPLE QUALITY ON THE PHYSICAL PROPERTIES OF THE $S = 1$ ANTIFERROMAGNETIC SPIN-LADDER CaV_2O_4

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In this work we study the magnetic and transport properties of different CaV_2O_4 samples. This compound presents one-dimensional (1D) V chains, with an antiferromagnetic (AFM) $S = 1$ spin-ladder ground state. Due to this 1D characteristic, it is expected that the physical properties of CaV_2O_4 are very sensitive to impurities, defects, and disorder in general. Indeed, different previous works show dissimilar results about the magnetic response of this vanadium-oxide. Here, we present results on samples prepared by different methods and conditions (solid-state and wet-chemical routes), showing the influence of the sample quality and preparation protocole on the physical properties of this material. One of the important findings is that the nitrate decomposition route produces samples with a larger order temperature.

Poster 53

COMPETING EXCHANGE INTERACTIONS IN NiFe/IrMn/Co TRILAYER

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Magnetometry measurements in NiFe/IrMn/Co trilayers reveal that the exchange bias field (H_{EB}) at the NiFe/IrMn and IrMn/Co, bottom and top interface, respectively; decreases with increasing NiFe layer thickness. This behavior was interpreted as a spring coupling exchange type between the NiFe and Co ferromagnetic layers mediated by IrMn antiferromagnetic layer. To further examine this phenomenon were prepared NiFe/IrMn and IrMn/Co bilayers samples and analyzed by X-ray reflectivity and magnetometry techniques to study the morphology and magnetism interfacial. Comparative analysis, between bilayers and trilayers, shows unexpected results. From X-ray reflectivity results, roughness values show little difference in both bilayers when compared with the bottom and top interfaces in trilayers systems. From the magnetic analysis, the H_{EB} in both bilayers show the $1/t_{FM}$ behavior, were t_{FM} is the ferromagnetic layer thickness. The H_{EB} values in NiFe/IrMn bilayer shown greater intensity when compared with the bottom interface in trilayers. In IrMn/Co samples, the H_{EB} values increases when compared with the top interface in trilayers. These results are discussed in terms of exchange bias phenomena and bilinear coupling.

Poster 54

EPITAXIALITY EFFECTS ON THE MAGNETIC ORDER OF SINGLE CRYSTALLINE FeRh THIN FILMS

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Poster 55

It is well known that bulk bcc FeRh alloys undergo a very unusual transition from an antiferromagnetic (AFM) to a ferromagnetic (FM) state upon heating from room temperature (RT) to above $T_{\mathrm{AF-F}} \approx 370\,\mathrm{K}$. This is a first order transition that exhibits a thermal hysteresis of about 10 K between heating and cooling. Though FeRh is not the only compound that develops this behavior, it is unique in that the $T_{\mathrm{AF-F}}$ is significantly above RT. Beyond the basic interest in the underlying physics, this feature makes of FeRh a very interesting material for technological applications such as thermally assisted magnetic recording. Although the bulk binary system (Fe, Rh) has been extensively studied since the 1940's and very complete phase diagrams were obtained, very little work is reported on FeRh thin films. In this work we report experimental results obtained on a set of 100 nm FeRh films deposited on MgO (100) and MgO (111) substrates. The x-ray diffraction data indicate that the films grow epitaxially. The magnetic characterization was achieved by performing magnetization curves and ferromagnetic resonance (FMR) experiments. FMR is a powerful technique to investigate the magnetic properties of thin films as it provides a measure of the collective response of the spin system in the FM state. It is particularly sensible to specific properties of the films such as shape, magnetocrystalline, and tension-induced anisotropies, becoming a unique tool to trace structural and magnetic transitions. By varying the temperature from RT to above 450 K we compare the properties of the AFM-FM transition among FeRh films of same thickness but exposed to different post-growth annealings, and deposited on MgO substrates of different crystalline orientation.

EVIDENCE OF FERROMAGNETIC RESPONSE OF $TbMnO_3$ THIN FILMS AT HIGH-TEMPERATURES

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Poster 56

Magnetometry measurements performed on $TbMnO_3$ films grown onto single-crystal [001] $SrTiO_3$ substrates using magnetron sputtering technique exhibit series of anomalies related to the magnetic ordering of the Tb^{3+} and Mn^{3+} sublattices. Despite bulk $TbMnO_3$ is a low temperature antiferromagnet, the measurements indicate the presence of high-temperature ferromagnetism. Well-defined hysteresis loops are observed as temperatures as high as 70 K. Analysis of the X-ray diffraction patterns of the target and films shows no evidence of affectation (within the resolution limit of the technique) by external impurities, such as Mn_3O_4, that might give rise to an artificial magnetic signal. Thus, it is probable that the ferromagnetism observed in the films to be an intrinsic property of $TbMnO_3$. Concretely, it is possible that the strain imposed by the substrate, resulting in the tetragonally distorted orthorhombic phase of the $TbMnO_3$ films is behind the mechanism governing the anomalous ferromagnetism observed in the films.

HIGHLY TEXTURED $Pr_XY_{1-X}Ba_2Cu_3O_{7-\delta}$ POLYCRYSTALLINE CERAMICS SINTERED IN Ar ATMOSPHERE

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Poster 57

The detrimental effect of Pr substitution into the $YBa_2Cu_3O_{7-\delta}$ high temperature superconductor is still a matter of controversy, even after the finding of pure superconducting $PrBa_2Cu_3O_{7-\delta}$ materials. The issue of the conditions the material has to be prepared in order to preserve its superconducting properties is widely addressed in literature. In this contribution, we focus on the structural effects of the gas atmosphere (O_2 or Ar) during the conventional solid-state reaction method. Among our findings, we observed Ar-grown samples to be formed of large (5 μm in-plane size) highly c-axis textured domains, in contrast with their isotropic O_2-grown analogous that are formed of small sub-micron size randomly oriented isotropic crystallites. The high texture observed in Ar-grown samples is presumably due to the oxygen deficient atmosphere causing the drop of the peritectic temperature below the temperature used during the preparation. By cooling down from the peritectic temperature, solid and liquid reacts to produce PBCO, which is further characterized for a crystal growth in a radial way fashion. This final plate like domains, can be easily ordered when pellets are prepared by uniaxial pressure, allowing to generate textured samples. The highly textured domains are affected by stacking disorder and, in some cases, shows small amounts of random intercalation.

TWO COMPONENTS FOR ONE RESISTIVITY IN $LaVO_3/SrTiO_3$ HETEROSTRUCTURE

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Poster 58

A serie of $LaVO_3$ thin films have been prepared on (001)-oriented $SrTiO_3$ substrates using the Pulsed Laser Deposition (PLD) technique. Such heterostructure has been previously shown to be a potential 2DEG system due to electronic reconstruction at the interface. We analyse transport properties and report indeed large sheet carrier density and large electronic mobility, with non linear Hall effect characteristic of a two carriers material. In addition, a cross-over from a semiconducting state at high-temperature to a metallic state at low-temperature is observed, with a clear enhancement of the metallic character as the growth temperature. We show however that activated diffusion of oxygen vacancies in the $SrTiO_3$ substrate is the major process which causes the metallicity, and the film-substrate assembly behaves accordingly as an original semiconducting-metallic parallel resistor.

EFFECT OF COBALT DOPING ON THE MAGNETIC AND ELECTRICAL PROPERTIES OF $KNbO_3$

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Polycrystalline $KNb_{1-x}Co_xO_3$ ($x = 0, 0.05, 0.1$) samples have been synthesized by standard solid-state reaction and their electrical and magnetic properties carefully studied. Special attention is paid to the thermal treatments in order to obtain a single-phase compound. Thus, the $KNb_{1-x}Co_xO_3$ pellets have been preheated at 850°C for 12 hours, and then sintered at 900°C for 12 hours in air atmosphere. The X-ray diffraction patterns of the Co-doped samples show a systematic shift of their peaks to the right side as compared to those of the pristine compound ($x = 0$). Morphological analysis of the compounds evidences that the crystallite size increases by increasing Co content. The magnetic response of the pellets is detected by sensible measurements of the magnetization as a function of the temperature and external magnetic field. An increased ferromagnetism by Co-doping is observed at temperatures as high as room temperature. In turn, measurements of the resistivity as a function of the magnetic field show high values of the magnetoresistance. Finally, measurements of the electric polarization as a function of the electric field indicate the presence of ferroelectricity in the analyzed samples.

Poster 59

MAGNETIC EXCITATIONS OF PEROVSKITE RARE-EARTH NICKELATES: $RNiO_3$

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The perovskite nickelates $RNiO_3$ (R= rare-earth) have been studied as potential multiferroic compounds [1]. A certain degree of charge disproportionation in the Ni ions has been confirmed by high resolution synchrotron power diffraction [2]: instead of the nominal Ni^{3+} valence, they can have the mixed-valence state $Ni^{(3-\delta)+}$ and $Ni^{(3+\delta)+}$, though agreement has not been reached on the precise value of δ (e.g. $\delta = 0.28$ [2] while $\delta = 0.35$ [3]). Also, the magnetic ground state is not yet clear: collinear and non-collinear Ni-O magnetic structures have been proposed to explain neutron diffraction results in these compounds [3,4,5], and more recently a canted antiferromagnetic spin arrangement was proposed with magnetic susceptibility measurements [6]. This is reminiscent of the situation in the half-doped manganites.

Poster 60

In order to gain insight into the ground state of these compounds, we studied the magnetic excitations of some of the different phases proposed, using a localized spin model. With the purpose of describe the charge disproportionation, we include two kinds of Ni-spins with different magnitude. As for the magnetic couplings, we include: nearest-neighbor (NN) Heisenberg-like interactions, respectively for the ferromagnetic and antiferromagnetic couplings present in the collinear phases. To describe the non-collinear phases, we also consider NN Dzyaloshinskii-Moriya couplings and magnetic sublattices, with the possibility of a relative angle θ, between NN spins in different sublattices. Using the Holstein-Primakoff transformation and the linear spin-wave approximation, we evaluate the spin excitations corresponding to the collinear and orthogonal ($\theta = \pi/2$) phases, and predict differences that should allow to distinguish them in inelastic neutron scattering experiments.

[1] G. Giovannetti *et al.*, Phys. Rev. Lett. **103** (2009) 156401.
[2] J.L. García *et al.*, Phys. Rev. B **79** (2009) 134432.
[3] J.A. Alonso *et al.*, Phys. Rev. Lett. **82** (1999) 3871.
[4] M.T. Fernández-Díaz *et al.*, Phys. Rev. B **64** (2001) 144477.
[5] A. Muñoz *et al.*, J. Solid State Chem. **182** (2009) 1982.
[6] D. Kumar *et al.*, Phys. Rev. B **88** (2013) 014410.

CONFINEMENT EFFECTS IN Cr THIN FILMS

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The recent realization of antiferromagnetic domains in Cr thin films drew back the attention once again to this metal being the only simple element with a spin density wave (SDW) ground state. Anti-ferro domains are hard to obtain and even harder to measure. A big amount of effort is being done to account for these systems. In Cr thin films they appear in a very natural way and we think they may be thought as a test bed for new experiments in this direction. In bulk Cr samples, the SDW forms below the Néel temperature $T_{\mathrm{N}} = 311\,\mathrm{K}$ with a wavelength $\Lambda(T)$ that is temperature dependent, varying from 8 nm at 311 K to 6 nm at 150 K. The confinement of the SDW in thin films leads to the emergence of very interesting features in transport properties: hysteresis in resistivity and Hall coefficient in cooling-warming cycles, multiple first order phase transitions as temperature is swept and a characteristic noise that has been recognized as a Barkhausen-type, among others. These features are due mainly to the effect of confinement of the SDW within the film thickness L: the boundary conditions imposed by the surface force the quatization of the wavelength in λ_n (n is chosen to satisfy conmensurability $\lambda_n = 2L/n$) and thus to an energy competition between something that tends to keep n fixed and the cost of deformating the SDW with respect to bulk wavelength. In this work we present our results on transport measurements in Cr thin films with thicknesses ranging from 10 to 100 nm and we discuss the variety of observed phenomena. We also present measurements on nanostructured Cr films and discuss the sample size effect and the possibility of an enhancement of the domains contribution.

Poster 61

AB-INITIO SPIN-POLARIZED CALCULATIONS IN SMALL FLUORINE CLUSTERS IN GRAPHENE

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We studied the different magnetic states of small fluorine clusters on graphene by using spin-polarized density functional calculations [1]. We consider the absorption of fluorine atoms on one side of the graphene sheet (cis-clusters) and on both sides (trans-clusters) [2]. For each cluster size dimers, trimmers, etc.), we considered several possible positions of the fluorine atoms to find the most energetically favorable configuration and its different metaestable magnetic states.

Poster 62

[1] J.P. Perdew, K. Burke and M. Ernzerhof, Phys. Rev. B **77** (1996) 3865.
[2] Z. Sljivancanin *et al.*, Phys. Rev. B, **83** (2011) 205426.

MAGNETIC EFFECTS ON THE TRANSPORT PROPERTIES OF GRAPHENE NANORIBBONS

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Poster 63

In this work we analyzed the transport properties of zigzag graphene nanoribbons (ZGNR). Firstly, we calculated the electronic structure of an infinite long ZGNR that presents a magnetic order which depends on the doping level and the width of ribbon. This was done using a Hubbard model treated in the mean field approximation. We then constructed the magnetic phase diagram for two systems of different sizes, 8-ZGNR and 32-ZGNR. Later on, we considered transport through those systems in the presence of a potential barrier that locally controls the doping and therefore the magnetic ordering. We solved this problem self-consistently and calculated transport using the Landauer-Büttiker approach in linear response.

ABOUT THE METALLIC BEHAVIOR OF PICENE COMPOUNDS DOPED BY POTASSIUM.

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Poster 64

We perform electronic structure calculations of picene clusters doped by potassium. Our results suggest that in crystalline K_3picene structure two electrons are completely transferred from potassium atoms to the LUMO orbitals of pristine picene. Meanwhile a third electron remains bounded to both materials. Based on these calculations we propose a quarter filled two orbitals model with strong local Coulomb repulsion as the most simple model capable to describe the normal sate of these compounds. Correlations functions for this model showing the excitation spectrum of a finite cluster with a fixed number of particles are evaluated using Lanczos method. It shows low lying energy excitations, and consequently, metallic transport is possible in spite of the clear dominance of Coulomb interaction over kinetic energy.

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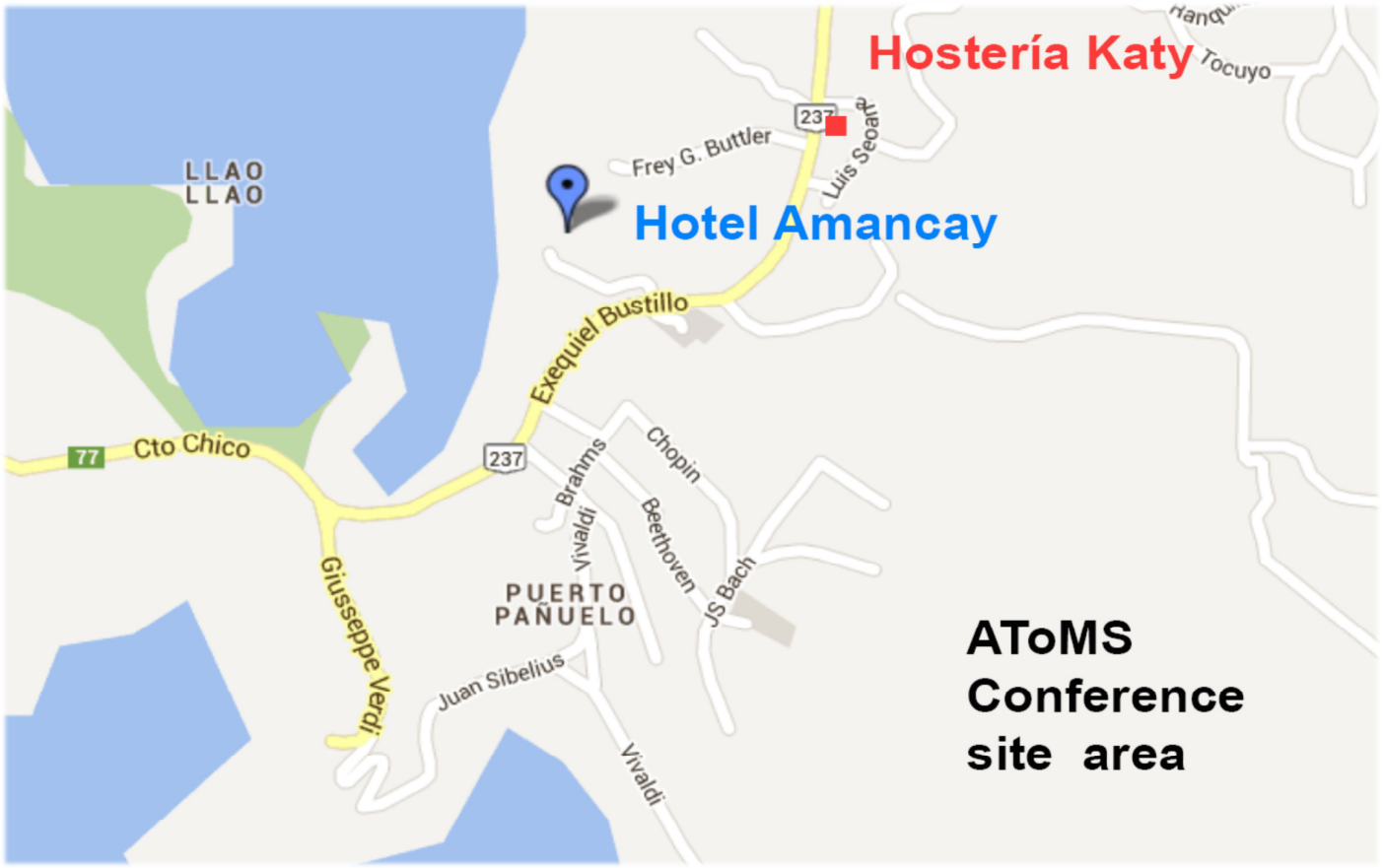
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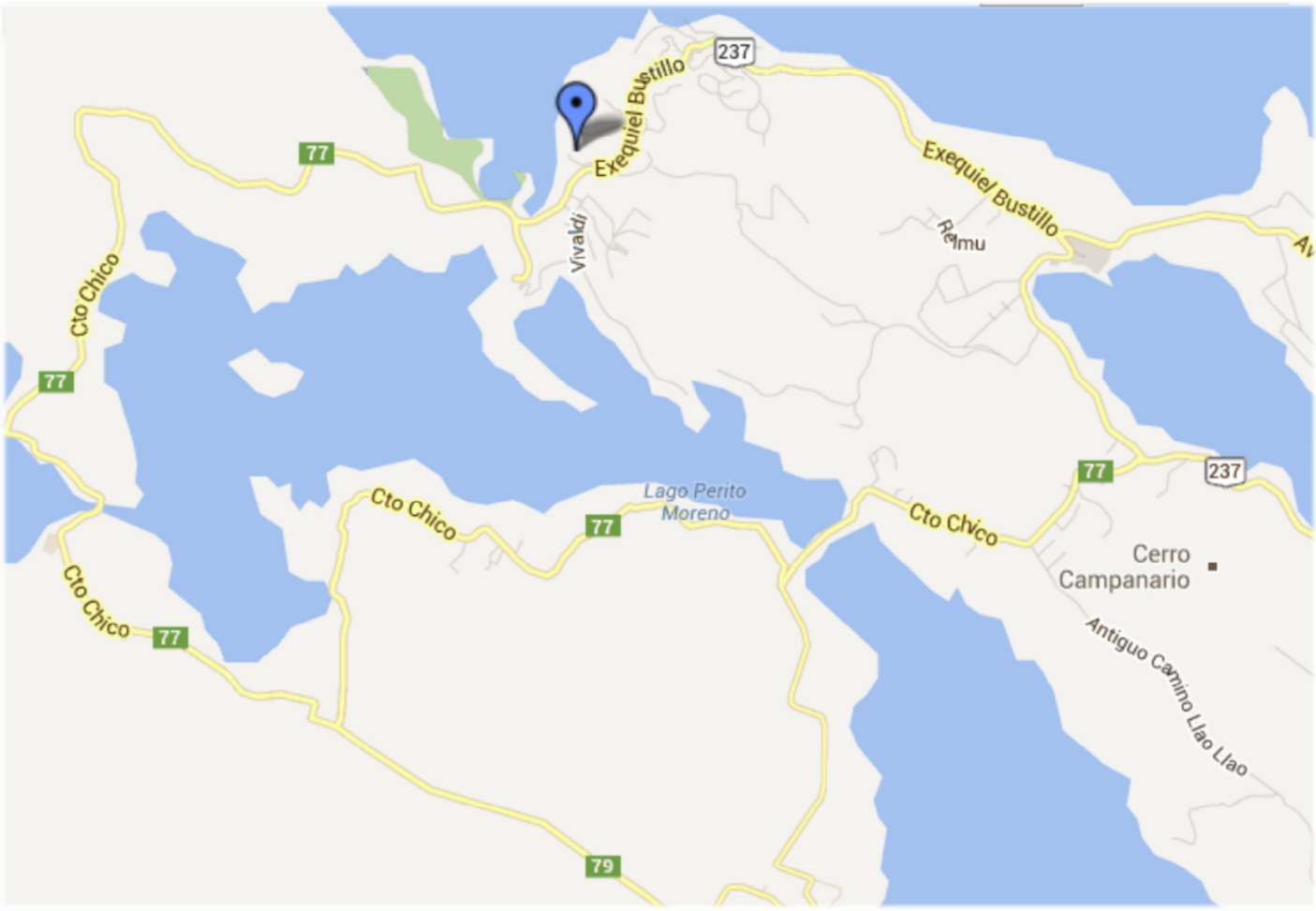
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