

# **Research Networking Programmes**

## **Science Meeting – Scientific Report**

# Scientific report (one single document in WORD or PDF file) should be submitted online within two months of the event. It should not exceed seven A4 pages.

**<u>Proposal Title</u>**: The New Generation in strongly correlated electron systems, International Conference, 1-5 July 2013, Sestri Levante.

Application Reference N°: 4882

#### 1) Summary (up to one page)



The conference "The new generation in strongly correlated electron systems" (NGSCES2013) took place in Sestri Levante, July 1-5, 2013, and gathered around 100 scientist of age ~40 or less, coming from academic institutions worldwide.

A lively and friendly atmosphere, and great location and local organization have allowed for a very intense program of lectures, talks, poster sessions and discussions in a pleasant and young environment.

Invited speakers were chosen with a double criterion. Around half of them were already very visible young scientists in the international community of strongly correlated electron systems, and set a very high and attractive standard, placing the conference to the level of major events in the field (this being a unique initiative reserved to under-40 researchers).

The other half were chosen as emergent young researchers to which offering an international stage for their research, possibly still not visible enough.

Gender, geographical distribution, nationality, etc. criterions were applied among others in order to ensure the most diverse backgrounds and in order to try to represent the various communities working in the field around the world, and in Europe particularly.

The response in term of participation was great. Around 80 people from around the world applied and participated to the conference with oral contributions (27), poster (~40) or simple attendance.

The conference ended up welcoming researchers coming from more than 20 countriesfromallovertheworld:

Europe (Italy, Germany, France, Spain, Austria, UK, Portugal, Sweden, Netherlands, Poland, Czech Republic, Russia, Slovenia, Switzerland), Asia (Korea, China, Japan), America (USA, Canada), South Africa



2) Description of the scientific content of and discussions at the event (up to four pages)

The focus of the conference was on the physics of Strongly correlated electron systems, intended in a broad fashion: from bulk materials with strong electronic correlations, both in and out of thermodynamic equilibrium, to the newly atomically engineered heterostructures of such materials, to quantum simulators of the many body physics realized in these systems realized with cold atoms in optical lattices.

The first sessions were dedicated to this last topic that, if somewhat aside from the main material-oriented fields, has been playing a major role in the community, given the strong parallel and deep theoretical insight that these clean systems can provide on the manybody physics that in materials has often to be disentangled from somewhat "parasite" issues such as disorder, materials defects and impurities, lattice dynamics. Most of the researchers with main interests in this subfield remained until the end of the conference, thus showing great interest in the condensed matter part of it, and implicitly validating the connection between the various subfields.

Then we gave space to the poster presenters by allowing for a flash advertisement of each one of the posters exposed in the evening poster session.

After one session on quantum magnetism, another somewhat side-domain but still very interconnected to the main theme of the conference, the subsequent sessions were dedicated to bulk materials, ranging from the recently discovered iron superconductors (3 sessions focused on this topic) to cuprates, the historically most prominent class of superconducting materials, to heavy-fermions.

Three other sessions were dedicated to the very lively area that we have broadly named of "engineered correlations" where, by constructing meta-materials through layer-bylayer deposition or contructing "quantum dots" or similar mesoscopic systems, manybody correlation effects between electrons can be tuned and explored by variation of additional external parameters, compared to bulk materials.

One special session gathered the theorists around the last contributions to the theoretical methods for strong electronic correlations, mainly centered around development of dynamical mean-field theory.

Finally three sessions were dedicated to the more and more prominent topic of the out-of equilibrium dynamics of strongly correlated electrons. Both experimental (pump-probe) techniques and results as well as theoretical modeling have been detailed and discussed.

All the sessions introducing the main topics were preceded by short introductions and overview of the topics by the chairpersons (chosen among some of the more experienced researchers) and by lectures held by the most representative invited speakers, covering the main basic aspects of the sub-field.

3) Assessment of the results and impact of the event on the future directions of the field (up to two pages)

As a balance of the many interactions and discussions between the participants, it is fair to say that all these topics were explored thoroughly both in the basics than in the latest developments, and that new collaborations have ensued from the many professional interactions fostered by a friendly atmosphere.

As the fourth edition of the successful series of NGSCES conferences, it clearly seems that the community is on a raising trend. This 2013 edition was the largest one thus far, and the response in term of registration of participants from all over the world was also triggered by the successful brand that this conference reserved to the emergent researchers now is. We feel that, given the enthousiastic feedback that we have received both during and after the conference, and both on the scientific content and on the pleasant, interaction-fostering environment, we have contributed to the further success of the brand.

Local press coverage by the Italian newspaper "II Secolo XIX" testifies the resonance that we were able to obtain even outside the scientific community.

The contribution in terms of funds by the ESF was essential and researchers from all the European union have benefitted of this initiative.

The organization of the following edition of NGSCES (2014) has been also kicked-off in the closing of NGSCES2013, and following the tradition four new organizers have been named and are in charge of the next conference.

Future trends of the field have certainly been singled out in a broad way by the focus of the sessions (cold-atomic quantum simulators, engineered meta-materials, out-of-equilibrium probing of correlated systems) and by the strong interconnection and great attention by all the attendees to all the sessions.

# CONVEGNO IN CORSO FINO A VENERDÌ Fisica dello stato solido A Sestri 90 ricercatori

# Scienziati da tutto il mondo all'Annunziata

#### SARA OLIVIERI

SESTRI LEVANTE. Sono circa novanta, provenienti da cinque continenti, i ricercatori in fisica dello stato solido che si sono dati appuntamento a Sestri Levante per la loro conferenza annuale. Quella in corso all'ex convento dell'Annunziata, che proseguirà fino al 5 luglio, è la quarta edizione del convegno dedicato ai

più giovani scienziati del settore, tendenzialmente under 40, dedicata quest'anno ai superconduttori non convenzionali, alle proprietà di solidi artificiali costituiti da atomi freddi. «Il nostro compito principale è capire il meccanismocon cui un materiale diventa superconduttore» spiega Claudio Giannetti. ricercatore dell'università di Brescia, che ha organizzato il meeting insieme a Luca De'Medici de l' école Supérieure de Physique et de Chimie Industrielles di Parigi. Johannes Bauer dell'universi-

tà di Harvard, supportati dall'università Cattolica del sacro cuore, la European science foundation, il progetto europeo FP7- Go fast, la Foundation P-G. De Gennes pour la recherche. Tra il centinaio di ricercatori che si riuniscono la mattina nei locali pubblici di Portobello, gestiti dalla fondazione Mediaterraneo, ci sono scienziati noti nel campo della fisica. Le nazionalità di provenienza dei partecipanti sono delle più varie: Corea, Sud Africa e Nord America, Europa, Cina, India e Giappone. «Gli italiani? Quelli che lavorano in italiana sono pochi – afferma Giannetti – ma se si contano gli italiani che lavorano all'estero allora il numero sale». Dopo la Spagna e la Slovenia, la scelta sul luogo che avrebbe ospitato la quarta conferenza annuale, dal tito-

MERCOLEDI

**3 LUGLIO 2013** 

21



La Fondazione Mediaterraneo

LO STUDIO Il compito: scoprire perché un dato materiale si trasforma in superconduttore

lo "The new generation in strongly corralated electron system" è caduta su Sestri Levante. Qui, affacciati sulla baia del Silenzio, Giannetti riferisce di aver trovato la giusta combinazione tra locali attrezzati per le lezioni, la vicinanza alle spiagge e ai servizi. «In queste conferenze cerchiamo di creare un clima amichevole. privo di barriere formali, che sappia stimolare le relazionitrairicercatori al di là del momento di studio spiega -. Perciò una regola fissa è scegliere luoghi al ma-

re. Sestri è perfetta perché le spiagge, i servizi, gli alberghi dove pernottiamo e le sale per la conferenza sono concentrati in un luogo raccolto. Anche altri colleghi hanno riconosciuto le potenzialità del posto e le terranno a mente per prossimi appuntamenti».

sara.olivieri@hotmail.com © RIPRODUZIONE RISERVATA 4) Annexes 4a) and 4b): Programme of the meeting and full list of speakers and participants Annex 4a: Programme of the meeting

			(here a second			
	Sunday 30th June	Monday 1st July	Tuesday 2nd July	Wednesday 3rd July	Thursday 4th July	Friday 5th July
8.45		Welcome speech	····			
		COLD ATOMS	CORRELATED MATERIALS	ENGINEERED CORRELATIONS	CORRELATED MATERIALS	NON-EQUILIBRIUM
		Chair: Roberta Citro	Chair: Massimo Capone	Chair: Andrey Mishchenko	Chair: Alessandro Toschi	Chair: Fabrizio Carbone
09:00		Kollath (Lecture)	Eremin (Lecture)	Sangiovanni (Invited)	Gull (Invited)	Eckstein (Lecture)
09:30		Schneider (Invited)	Xu	Shen (Invited)	Eberlein	Mansart
10:00		Lev Vidmar	Brouet (Invited)	Peters	Benfatto	Cilento
10:30		Coffee Break	Coffee Break	Coffee Break	Garcia-Garcia	Coffee Break
		COLD ATOMS	CORRELATED MATERIALS	ENGINEERED CORRELATIONS	Coffee Break	NON-EQUILIBRIUM
		Chair: Roberta Citro	Chair: Massimo Capone	Chair: T Domanski		Chair: Fabrizio Carbone
11:00		Kollath (Invited)	Giovannetti (Invited)	Garcia-Barriocanal (Invited)	SPECIAL METHOD SESSION	Eckstein (Invited)
11:30		Fallani (Invited)	Mirri	Quintela	Chair: Nils Bluemer	Kaiser (Invited)
12:00		Sotnikov	Fanfarillo	Koga	Ganal Granath	Andergassen
12:30		Lunch and beach	Lunch and beach		Rohringer Taranto	CLOSING
					Rost	
					Lunch	
		POSTER PRESENTATION	CORRELATED MATERIALS		CORRELATED MATERIALS	
		Chair: Organizers	Chair: Lilia Boeri		Chair:	
15:00		Poster	Eremin (Invited)		Weng	
15:30		flash	Yamase	FREE EXCURSION	Kratichlova	
16:00		presentations	Mravlje (Invited)	TO CINQUE TERRE	Mitchell	
16:30		Coffee Break	Coffee Break		Coffee Break	
		CORRELATED MATERIALS	ENGINEERED CORRELATIONS		NON-EQUILIBRIUM	
		Chair: Luca Tocchio	Chair: Tae Won Noh		Chair: J Miller	
17:00		Comin (Invited)	Shen (Lecture)		Kaiser (Lecture)	
17:30		Orth	Bergeal (Invited)		Fausti (Invited)	
18:00	WELCOME	Ralko	Bareille		Rettig	
18:30	RECEPTION	POSTER SESSION - APERITIF				
20:00			CONFERENCE DINNER	MEETING AT VERNAZZA		

# Monday, July 1<sup>st</sup>

8:45-9	:00	Openir	ng	
9:00	<u>Sessio</u>	on 1: C	orrelation effects with Ultracold Atoms	(Chair: Roberta Citro)
	9:00 – 9	9:30	"Strong correlations in ultracold atomic gases" - I Corinna Kollath (University of Bonn, Germany)	nvited Lecture
	9:30 –	10:00	"Negative absolute temperatures for mobile partic Ulrich Schneider (Ludwig-Maximilian University,	cles" - Invited Talk Munich, Germany)
	10:00 -	- 10:30	"Sudden expansion of interacting bosons in optic integrability and dimensionality" Lev Vidmar (Ludwig-Maximilian University, Munic	al lattices: the role of ch, Germany)
10:30 -	- 11:00	COFFE	E BREAK	
11:00	<u>Sessio</u>	on 2: C	orrelation effects with Ultracold Atoms	(Chair: Roberta Citro)
Talk	11:00 -	- 11:30	"Correlation dynamics of ultracold bosons in option	cal lattices" - Invited

#### Corinna Kollath (University of Bonn, Germany)

11:30 – 12:00 "Quantum simulation with ultracold two-electron Fermi gases" - Invited

Talk

#### Leonardo Fallani (LENS, Florence, Italy)

12:00 – 12:30 "Quantum magnetism of mass-imbalanced fermionic mixtures" Andrii Sotnikov (University of Frankfurt, Germany)

12:30 - 15:00 LUNCH BREAK

#### 15:00 Session 3: Poster presentations

15:00 – 16:30 Flash presentations (about 2 min)

#### 16:30 - 17:00 COFFEE BREAK

#### 17:00 Session 4: Correlated materials

(Chair: Luca Tocchio)

- 17:00 17:30 "Novel correlated physics in iridium-based oxides: the special case of Na<sub>2</sub>IrO<sub>3</sub>" Invited talk
   Riccardo Comin (University of British Columbia, Vancouver, Canada)
- 17:30 18:00 "Emergent critical phase and Ricci flow in a 2D frustrated Heisenberg model"

Peter Philipp Orth (Karlsruhe Institute of Technology, Germany)

18:00 – 18:30 *"Statistical Transmutation in Doped Quantum Dimer Models"* Arnaud Ralko (Néel Institute, Grenoble, France)

18:30 – 20:00 POSTER SESSION WITH APERITIF

## Tuesday, July 2<sup>nd</sup>

#### **9:00** Session 5: Iron based superconductors (Chair: M. Capone) 9:10 – 9:40 "Magnetism in iron-based superconductors: interplay of magnetic

- 9:10 9:40 *"Magnetism in iron-based superconductors: interplay of magnetic, and structural transitions" Invited Lecture* Ilya Eremin (Ruhr-University, Bochum, Germany)
  - 9:40 10:10 *"Electronic Band Structure of BaCo<sub>2</sub>As<sub>2</sub>: A Fully Doped Ferropnictide Analog with Reduced Electronic Correlations"* Nan Xu (Paul Scherrer Institute)
  - 10:10 10:40 *"ARPES studies of the electronic structure of iron superconductors" Invited talk* **Veronique Brouet** (Laboratoire de Physique des Solides, Orsay, France)

10:40 - 11:00 COFFEE BREAK

#### 11:00 Session 6: Iron based superconductors

(Chair: M. Capone)

11:00 – 11:30 "Correlation effects and competing orders in iron-based superconductors" – Invited talk Gianluca Giovannetti (CNR-IOM & SISSA, Trieste, Italy)

- 11:30 12:00 "Optical investigation of Ba(Fe<sub>1-x</sub>Co<sub>x</sub>)<sub>2</sub>As<sub>2</sub> detwinned by tunable uniaxial applied pressure"
   Chiara Mirri (ETH Zurich, Switzerland)
- 12:00 12:30 "Hall Effect in pnictides" Laura Fanfarillo (ICMM-CSIC Madrid Spain)
- 12:30 15:00 LUNCH BREAK

#### 15:00 Session 7: Iron based superconductors

15:00 – 15:30 "Magnetism in iron-based superconductors: interplay of magnetic, orbital,

and structural transitions" – Invited Talk Ilya Eremin (Ruhr-University, Bochum, Germany)

15:30 – 16:00 "Superconductivity from orbital nematic fluctuations in iron pnictides " **Hiroyuki Yamase** (National Institute for Materials Science)

16:00 – 16:30 *"New insights to incoherent metals" – Invited Talk* Jernej Mravlje (Ecole Polytechnique, France)

16:30 – 17:00 COFFEE BREAK

17:00	Session 8: E	ngineered correlations	(Chair: Tae Won Noh)
	17:10 – 17:40	"Watching Correlated Electrons Move in Artificia Interfaces using Photoemission Spectroscopy" <b>Kyle Shen</b> (Cornell University, Ithaca, USA)	al Quantum Materials and – Invited Lecture
doping	17:40 – 18:10	"Two-dimensional superconductivity induced by in LaTiO <sub>3</sub> /SrTiO <sub>3</sub> heterostructures " – Inv <b>Nicolas Bergeal</b> (ESPCI ParisTech, France)	high-mobility carrier ited Talk
the	18:10 – 18:40	"A two-dimensional electron gas with hexagona (111) surface of KTaO <sub>3</sub> " <b>Cédric Bareille</b> (CSNSM - Université Paris-Suc	l electronic structure at
20:00	CONFE	ERENCE DINNER	

### Wednesday, July 3rd

#### 9:00 Session 9: Engineered correlations

(Chair: A.

Mishchenko)

- 9:10 9:40 *"Electronic correlation and geometry: what do we learn from oxide heterostructures?" Invited Talk* Giorgio Sangiovanni (Würzburg University, Germany)
- 9:40 10:10 "Watching Correlated Electrons Move in Artificial Quantum Materials and Interfaces using Photoemission Spectroscopy" – Invited Talk **Kyle Shen** (Cornell University, Ithaca, USA)
- 10:10 10:40 "Strong correlation physics in f-electron superlattices" **Robert Peters** (Kyoto University, Japan)

10:40 – 11:00 COFFEE BREAK

(Chair: Lilia Boeri)

#### 11:00 Session 10: Engineered correlations

(Chair: T. Domanski)

11:10 – 11:40 "Electronic phase diagram of electrostatically doped  $La_2CuO_{4+\delta}$ " – Invited Talk

Javier Garcia-Barriocanal (Universidad Complutense, Madrid, Spain)

- 11:40 12:10 *"Structural and Thermoelectric Properties of CrN Thin Films"* **Camilo X. G. Quintela** (University of Santiago de Compostela, Spain)
- 12:10 12:40 *"Transport properties through a quantum dot coupled to normal and superconducting leads"* Akihisa Koga (Tokyo Institute of Technology, Japan)

#### FREE EXCURSION TO "5 TERRE"

19:30 Meeting in Vernazza and dinner at "Ristorante Belforte"

## Thursday, July 4<sup>th</sup>

9:00	Session 11:	Correlated materials, superconductivity (Chair: A. Toschi)	
Model	9:00 – 9:30 ″ –	"Energetics of Superconductivity in the Two Dimensional Hubbard Invited Talk Emanuel Gull (University of Michigan, Ann Arbor, USA)	
	9:30 – 10:00	"Superconductivity and effective interactions in the Hubbard model" Andreas Eberlein (MPI for Solid State Research, Stuttgart, Germany)	
	10:00 – 10:30	"Superconductor-insulator transition at strong disorder: unconventional superfluid response and glassy physics" Lara Benfatto (Sapienza University of Rome, Italy)	
	10:30 – 11:00	"Restoring phase coherence in one dimensional superconductivity by power-law hopping" Antonio M. Garcia-Garcia (Cambridge University and University of	
Lisbon)			
11:00 – 11:30 COFFEE BREAK			
11:30	Special sess	sion: Methods for correlated materials (Chair: Nils Bluemer)	
	11:40 – 12:00	<i>"Distributional Exact Diagonalization; a real frequency quantum impurity solver."</i> <b>Mats Granath</b> (University of Gothenburg, Sweden)	
with	12:00 – 12:20	"Quasi continuous-time impurity solver for dynamical mean-field theory linear scaling in the inverse temperature" Daniel C. Rost (Johannes Gutenberg-University, Mainz, Germany)	
	12:20 – 12:40	"Efficient impurity solver using Matrix Product States" Martin Ganahl (Institute for theoretical physics, TU Graz, Austria)	
diagra	12:40 – 13:00 <i>mmatic</i>	"One-particle irreducible functional approach - a new route to extensions of DMFT" Georg Rohringer (Vienna University of Technology, Austria)	

13:00 – 13:20 *"From infinite to d dimensions: combining dynamical mean field theory functional renormalization group"* **Ciro Taranto** (TU Wien, Austria)

13:30 - 15:00 LUNCH BREAK

#### 15:00 Session 12: Correlated materials, Kondo and heavy fermion physics

15:00 – 15:30 "Correlated topological orders in Kondo insulators  $YbB_6$  and  $YbB_{12}$ " Hongming Weng (The Institute of Physics, Chinese Academy of

Sciences)

and

15:30 - 16:00 "Ambient Pressure Superconductivity in the Antiferromagnetic Compound  $Ce_2PtIn_8$ "

Marie Kratochvilova (Charles University, Prague, Czech Republik)

- 16:00 16:30 "Non-Fermi liquid physics in a two-impurity Kondo quantum box device " Andrew Mitchell (University of Oxford, UK)
- 16:30 17:00 COFFEE BREAK

#### 17:00 Session 13: Non-equilibrium physics

(Chair: John Miller)

- 17:10 17:40 "Control of Nonlinear Dynamics in Complex Matter by Ultrafast Optics" Invited Lecture Stefan Kaiser (Max Planck Hamburg, Germany)
- 17:40 18:10 "New time-domain approaches to strongly correlated electron systems" Invited Talk Daniele Fausti (University of Trieste, Italy)
- 18:10 18:40 "Time- and angle-resolved photoemission spectroscopy of the CDW material RTe<sub>3</sub>"
   Laurenz Rettig (University of Duisburg Essen, Germany)

### Friday, July 5<sup>th</sup>

9:00	0 <u>Session 14: Non-equilibrium physics</u> (Chair: F. Carbon		
	9:10 – 9:40	"Numerical methods many-particle systems ou solvers for non-equilibrium Dynamical mean fie	ıt of equilibrium: Impurity əld theory" – Invited
Lecture	Э		
		Martin Eckstein (Max Planck Hamburg)	
in a	9:40 – 10:10	"Coupling of a high-energy excitation to super- cuprate from coherent charge fluctuation spec Barbara Mansart (EPFL Lausanne, Switzerlan	conducting quasiparticles troscopy." id)
on	10:10 – 10:40	"The elusive mottness underlying the phase dia the ultrafast timescale." Federico Cilento (ELETTRA Trieste, Italy)	agram of cuprates unveiled
10:40 -	- 11:00 COFFE	E BREAK	

#### 11:00 Session 15: Non-equilibrium physics

(Chair: F. Carbone)

11:00 – 11:30 "Ultrafast melting of long-range order in the Hubbard model" – Invited

Talk	
	Martin Eckstein (Max Planck Hamburg, Germany)
	11:30 – 12:00 <i>"Transient superconductivity in optically modulated YBCO"– Invited Talk</i> Stefan Kaiser (Max Planck Hamburg, Germany
of	<ul> <li>12:00 – 12:30 "Magnetic field effects on the finite-frequency noise and AC conductance a Kondo quantum dot out of equilibrium"</li> <li>Sabine Andergassen (University of Vienna, Austria)</li> </ul>
12:30	CLOSING

NAME Aichhorn Markus Andergassen Sabine Antipov Andrey Bareille Cédric Bauer Johannes Bazzanella Matteo Benfatto Lara Sapienza University of Rome Bergeal Nicolas Biella Alberto Cuore Blümer Nils Boeri Lilia Brouet Veronique Brzezicki Wojciech Physics, Jagellonian University Capone Massimo Carbone Fabrizio Lausanne Cernák Petr Charles University, Prague, CZ Chatterjee Banhi Physics Chikina Alla Cilento Federico Citro Roberta Caianiello", Salerno Comin Riccardo Canada Cottet Mathieu Lausanne Custers Jeroen Charles University, Prague Dal Conte Stefano Politecnico di Milano de' Medici Luca Domanski Tadeusz Sklodowska University, Lublin Dorda Antonius Doyle Brian Africa Eberlein Andreas State Research Eckstein Martin Structural Dynamics, University of Hamburg Eremin Ilya Esposito Martina Fallani Leonardo Fanfarillo Laura Fausti Daniele di Trieste, Italy Galpin Martin Ganahl Martin TU Graz

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Ralko Arnaud Rettig Laurenz Rohringer Georg Rost Daniel C. Gutenberg-University, Mainz Sanchez de la Pena David Sangiovanni Giorgio Schäfer Thomas Schiro Marco Science Schneider Ulrich Schwab Holger Experimentelle Physik VII, Am Hubland, Seth Priyanka Shen Kyle Sotnikov Andrii Synoradzki Karol PAS, Pozna\_, Poland Taranto Ciro Tocchio Luca F. Toschi Alessandro Van Bay Tran University of Amsterdam Vidmar Lev Wallerberger Markus Austria Wang Jing Stuttgart Germany Weng Hongming Academy of Sciences Wentzell Nils Xu Nan Yamase Hiroyuki Science You Wen-Long State Research

Néel Institute, Grenoble, FR. Universität Duisburg-Essen Vienna University of Technology Institute of Physics, Johannes RWTH-Aachen University of Wuerzburg TU Vienna Princeton Center For Theoretical LMU & MPQ Munich Universität Würzburg, École Polytechnique Cornell University, Ithaca, USA ITP, University Frankfurt Institute of Molecular Physics, TU Wien University of Frankfurt Vienna University of Technology Van der Waals-Zeeman Institute, LMU Munich Technische Universität Wien, USTC Hefei China, MPI-FKF The institute of Physics, Chinese University of Vienna Paul Scherrer Institut National Institute for Materials Max Planck Institute for Solid