Ecole Meso 2016 Matiere topologique, interactions et couplage matiere-lumiere

31 Oct-12 Nov 2016
Cargèse
France

Table of contents

A SU(3) Topological Insulator in the 2D Honeycomb Lattice

Ulrike Bornheimer * [1,2,3], Christian Miniatura [1,2,3,4,5], Benoît Grémaud [1,2,3,6]

[1] Center for Quantum Technologies, National University of Singapore (CQT, Singapore) – Singapore
[2] MajuLab, CNRS-UNS-NUS-NTU International Joint Research Unit, UMI 3654, Singapore (MajuLab) – Singapore
[3] Physics Department, Faculty of Science, National University of Singapore (NUS) – Singapore
[4] Institut Non Linéaire de Nice Sophia-Antipolis (INLN) – Université Nice Sophia Antipolis [UNS], CNRS : UMR7335, Université Nice Sophia Antipolis (UNS) – 1361 route des Lucioles Sophia Antipolis 06560 Valbonne, France
[5] Institute of Advanced Studies, Nanyang Technological University – Singapore
[6] Laboratoire Kastler Brossel (LKB (Jussieu)) – Université Pierre et Marie Curie (UPMC) - Paris VI, CNRS : UMR8552, École normale supérieure [ENS] - Paris – Case 74 - Tour 12, 4 place Jussieu, F-75252 Paris CEDEX 05, France

We investigate a particular realization of a topological insulator with spin-1 bosons propagating
in a 2D honeycomb optical lattice and subjected to a SU(3) spin-orbit coupling.

*Speaker

Quantum Hall resistance standard in graphene devices under relaxed experimental conditions

Jérémy Brun-Picard * [1]

[1] Laboratoire National de Métrologie et d'Essais - Institut National de Métrologie (LNE) – Université Paris XI - Paris Sud – 29 Rue Roger Hennequin 78197 Trappes, France

We study quantum Hall effect in graphene for resistance metrology, and in particular, the physics of the Hall plateau and the dissipation mecanism.

*Speaker

Superconducting silicon devices

Francesca Chiodi * [1]

[1] Centre de Nanosciences et de Nanotechnologies (C2N) – Université Paris Sud - Paris XI – France

We demonstrate superconducting silicon devices, such as superconducting resonators with high kinetic inductance, superconducting quantum interference devices (SQUID) and all-silicon SNS Josephson junctions, comparing their behaviour with metallic superconducting devices.

*Speaker

Statistical mechanics approach to the electric polarization and polarizability in crystalline insulators

Frédéric Combes * [1]

[1] Laboratoire de Physique des Solides (LPS) – CNRS : UMR8502, Université Paris XI - Paris Sud – Bat. 510 91405 Orsay cedex, France

We explore a statistical mechanics approach for the polarization in insulators, based on the Wannier-Stark ladder (spectrum in the presence of the field)

*Speaker

Topological collective plasmons in bipartite chains of metallic nanoparticles

Charles Downing * [1]

[1] Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS) – université de Strasbourg, CNRS : UMR7504 – 23 rue du Loess - BP 43 - 67034 Strasbourg Cedex 2 - France, France

We study a bipartite chain constituted by metallic nanoparticle dimers, where each nanoparticle supports a localized surface plasmon. We find a Dirac Hamiltonian and nontrivial topological effects.

*Speaker

Lifetime of Dirac plasmons in honeycomb arrays of interacting metallic nanoparticles

Francois Fernique * [1]

[1] Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS) – université de Strasbourg, CNRS : UMR7504 – 23 rue du Loess - BP 43 - 67034 Strasbourg Cedex 2 - France, France

We present in this poster our theoretical results about the lifetime due to radiative and non-radiative losses of the collective plasmonic excitations in a honeycomb array of metallic nanoparticles.

*Speaker

Josephson Junction Spectroscopy of Mesoscopic Systems

Joël Griesmar *† [1]

[1] Collège de France (CDF) – Collège de France, CNRS : USR3573 – 11 place Marcelin Berthelot F-75231 Paris Cedex 05, France

Josephson junctions can be used as sensitive spectrometers to detect elementary excitations in mesoscopic systems. We would like to use them to investigate multi-terminal weak link devices.

*Speaker

†Corresponding author: joel.griesmar@college-de-france.fr

Electric field-induced valley degeneracy lifting in uniaxial strained graphene: evidence from magnetophonon resonance

Sonia Haddad * [1], Mohamed Assili

[1] Laboratoire de Physique de la Matière condensée – Tunisia

We show that the magneto-phonon resonance (MPR) spectrum of graphene, under crossed electric and magnetic fields. acquires a double resonance structure originating from the two-fold valley degeneracy lifting.

*Speaker

The saturation effects in the interband Faraday rotation on doped Bi2Se3

Michael Hakl * [1], Martinez Gerard [1], Lukas Ohnoutek [2], Martin Veis [2], Marek Potemski [1], Cyril Drašar [3], Milan Orlita [1]

[1] Laboratoire national des champs magnétiques intenses - Grenoble (LNCMI) – CNRS : UPR3228 – 25 rue des Martyrs BP 166 38042 Grenoble cedex 9, France
[2] Institute of Physics (Prague, Czech) – Ke Karlovu 5, CZ-121 16 Praha 2, Czech Republic
[3] University of Pardubice – Czech Republic

N-doped Bismuth Selenide exhbits unusually large Faraday rotation induced by a circular in-
terband dichroism dependent on a Moss-Burnstein shift and Zeeman splitting of the interband excitations.

*Speaker

Shot noise of a superconductor/nanotube junction in the SU(2) and SU(4) Kondo regime

Tokuro Hata * [1], Meydi Ferrier [2], Sanghyun Lee [1], Tomonori Arakawa [1], Raphaëlle Delagrange [2], Richard Deblock [2], Rui Sakano [3], Akira Oguri [4], Kensuke Kobayashi [1]

[1] Osaka University – Japan
[2] LPS, Université Paris-Sud, CNRS – Physique mésoscopique – France
[3] University of Tokyo – Japan
[4] Osaka City University – Japan

In a CNT QD, Kondo effect presents two different symmetries: SU(2) and SU(4). We investigated the competition between Kondo effect and superconductivity in the two symmetries with shot noise measurement.

*Speaker

2D Van Der Waals Heterostructure

Hugo Henck * [1]

[1] Centre de Nanosciences et de Nanotechnologies (C2N) – CNRS : UMR9001 – Route de Nozay - 91460 Marcoussis, France

h-BN/Graphene and MoS2/Graphene structural and electronics properties are revealed with numerous of techniques including Raman spectroscopy, ARPES, TEM, photoconductive measurements.

*Speaker

Tip-induced interaction effects in STM studies of moirés on graphene on SiC(000-1)

Loïc Huder *† [1], Claude Chapelier [2], Louis Jansen , Vincent Renard [3]

[1] Institut Nanosciences et Cryogénie (ex DRFMC) (INAC) – CEA – Grenoble, France
[2] Laboratoire de Transport Electronique Quantique et Supraconductivité (LATEQS) – CEA, Université Grenoble Alpes – 17 rue des Martyrs, France
[3] Laboratoire de Transport Electronique Quantique et Supraconductivité (LATEQS) – CEA, Université Joseph Fourier - Grenoble I – France

The presence of tip-induced interaction effects lead to strong deformations of the STM images under harsh tunnelling conditions in twisted graphene layers.

*Speaker
†Corresponding author: loic.huder@cea.fr

Local density of states from scanning gate microscopy (SGM) images

Ousmane Ly * [1,2], Rodolfo Jalabert [2], Steven Tomsovic [3], Dietmar Weinmann [2]

[1] IPCMS – CNRS – France
[2] Institut de Physique et Chimie des Matériaux de Strasbourg – université de Strasbourg – France
[3] Washington State University – United States

In this poster the relationship between SGM response and local properties will be investigated in the local regime as well as in the invasive limit.

*Speaker

Engineering multiphoton dissipation in superconducting circuits for quantum error correction.

Raphaël Lescanne [1], Zaki Leghtas * [1,2]

[1] Laboratoire Pierre Aigrain (LPA) – CNRS : UMR8551, Université Pierre et Marie Curie (UPMC) - Paris VI, Université Paris VII - Paris Diderot, École normale supérieure [ENS] - Paris – Département de Physique Ecole Normale Supérieure 24, rue Lhomond F-75231 Paris Cedex 05, France
[2] École des mines de Paris (MINES ParisTech) – MINES ParisTech - École nationale supérieure des mines de Paris – 60 boulevard Saint-Michel 75272 Paris Cedex 06, France

The idea is to stabilize a subspace of states of a microwave cavity in which information can be encoded and protected from main sources of errors.

*Speaker

Inhomogeneous Josephson junction chains for superinductance optimization

Van-Duy Nguyen * [1,2], Denis Basko† [2]

[1] Institut NEEL CNRS/UJF – CNRS : UPR2940 – 25 rue des Martyrs BP 166 38042 Grenoble cedex 9, France

[2] Laboratoire de physique et modélisation des milieux condensés (LPMMC) – CNRS : UMR5493, Université Joseph Fourier - Grenoble I – Maison des Magistères/CNRS 25 Av des martyrs - BP 166 38042 GRENOBLE CEDEX 9, France

We study of the low-frequency impedance of a Josephson junction chain whose parameters vary in space. Our goal is to find the optimal spatial profile which maximizes its total inductance

*Speaker

†Corresponding author: denis.basko@lpmmc.cnrs.fr

Effet de proximité modulable dans des jonctions supraconducteurs-graphène

David Perconte * [1], Fabian Cuellar , Constance Moreau-Luchaire , Maelis Piquemal-Banci , Regina Galceran , Piran Kidambi , Marie-Blandine Martin , Stephan Hofmann , Rozenn Bernard , Bruno Dlubak , Pierre Seneor , Javier Villegas

[1] Unité mixte de physique CNRS/Thalès (UMP CNRS/THALES) – CNRS : UMR137, THALES – Domaine de Corbeville 91404 ORSAY CEDEX, France

On utilise ici de l'YBCO pour induire de la supraconductivité à haute-température dans le graphène et la moduler par un nouveau mécanisme d'interférences.

*Speaker

Waiting time distribution of a periodically driven single-electron turnstile

Elina Potanina * [1], Christian Flindt [1]

[1] Aalto University (Department of Applied Physics) – P.O. Box 15100, 00076 Aalto, Finland, Finland

Inspired by T. Brandes' study [1] on single particle transport, we present generalized waiting-time distribution theory for periodically driven systems. [1] T. Brandes, Ann Ann. Phys. **17**, 477 (2008).

*Speaker

Finite Energy Relaxation in the Integer Quantum Hall Regime

Ramiro Rodriguez [*†] [1], François Parmentier [1], Preden Roulleau [1], Ulf Gennser [2], Antonella Cavanna , Fabien Portier [3], Dominique Mailly [4], Patrice Roche[‡] [5]

[1] Service de Physique de l'Etat Condensé (SPEC, CEA, CNRS, Universié Paris-Saclay) – CEA – CEA-Saclay 91191 Gif-sur-Yvette, France, France
[2] Laboratoire de photonique et de nanostructures (LPN) – CNRS : UPR20 – Route de Nozay 91460 MARCOUSSIS, France
[3] Service de Physique de l'Etat Condensé (SPEC UMR 3680 CEA-CNRS UPSAY) – CEA, CNRS : UMR3680 – SPEC, CEA Saclay, Orme des Merisiers, 91191 Gif-sur-Yvette, France, France
[4] Laboratoire de Photonique et de Nanostructures (LPN) – Centre National de la Recherche Scientifique – France
[5] Service de Physique de l'Etat Condensé (SPEC UMR 3680 CEA-CNRS) – CEA, CNRS : UMR3680 – SPEC, CEA Saclay, Orme des Merisiers, 91191 Gif-sur-Yvette, France, France

Spectroscopy of the energy relaxation of electrons injected at a well defined energy above the Fermi sea in the edge states of the Integer Quantum Hall Effect

[*]Speaker
[†]Corresponding author: 19.rodriguez.89@gmail.com
[‡]Corresponding author: patrice.roche@cea.fr

Investigating transport in the quantum anomalous hall effect

Ilan Rosen * [1], Eli Fox [2], David Goldhaber-Gordon [2]

[1] Department of Applied Physics, Stanford University – Department of Applied Physics 348 Via Pueblo Mall Stanford University Stanford, CA 94305-4090, United States
[2] Department of Physics [Stanford] – 382 Via Pueblo, Stanford, CA 94305, United States

Conduction in quantum anomalous hall (QAH) systems is mediated by chiral edge modes, whose carriers are protected from scattering. We study transport in QAH systems, which is virtually dissipation free.

*Speaker

Majoranas in the strong-coupling limit of semiconductor-superconductor junctions

Doru Cristian Sticlet * [1]

[1] TU Delft – Netherlands

We find the topological phase diagram for semiconductor-superconductor junctions in the limit of a strong coupling.

*Speaker

Bringing exotic model Hamiltonians to reality

Athmane Tadjine * [1], Guy Allan [2], Christophe Delerue† [1]

[1] Institut d'électronique, de microélectronique et de nanotechnologie (IEMN) – CNRS : UMR8520, Université Lille I - Sciences et technologies – avenue Poincaré, Cité scientifique, BP 69, 59652 Villeneuve d'Ascq cedex, France
[2] IEMN UMR CNRS 8520 – Institut supérieur de l'électronique et du nunérique (ISEN) – Avenue poincaré CS 60069, France

We theoretically show how to design using a lithographic approach artificial electronic superlattices that mimic the behaviour of their atomic counterparts. Exotic unstable structures can thus be brought to reality.

*Speaker
†Corresponding author: Christophe.Delerue@iemn.univ-lille1.fr

Relativistic electrons in condensed matter

Sergueï Tchoumakov * [1], Marcello Civelli , Mark-Oliver Goerbig†

[1] LPS, Orsay – LPS – France

In this poster I am discussing magneto optical properties of Weyl semimetals which are a realisation of massless ultrarelativistic electrons in three-dimensionnal materials.

*Speaker
†Corresponding author:

Unusual Shubnikov-de Haas oscillations in a mixed Dirac-massive organic metal

Emilie Tisserond * [1]

[1] Laboratoire de Physique des Solides d'Orsay (LPS) – CNRS : UMR8502 – Université Paris-Sud
Bâtiment 510 91405 ORSAY Cedex, France

We report Shubnikov-de Haas oscillations measured on a Dirac-massive quasi-2D organic metal. We provide an interpretation for the unusual behaviour of these oscillations at high magnetic fields.

*Speaker

Out-of-equilibrium dephasing rate in graphene Fabry-Pérot interferometer

Louis Veyrat * [1], Anna Jordan , Katrin Zimmermann , Frederic Gay , K Watanabe , T Taniguchi , Hermann Sellier , Benjamin Sacepe

[1] Institut Néel, CNRS (Grenoble, France) – Centre National de la Recherche Scientifique - CNRS – France

We investigate out-of-equilibrium transport in a pnp junction in a high mobility graphene heterostructure equipped with a split-gate defined quantum point contact and extract a dephasing rate.

*Speaker

Hyperbolic cooling of graphene Zener-Klein transistors

Wei Yang * [1], Xiaobo Lu [2], Simon Berthou [3], Emmanuel Baudin [3], Christophe Voisin [3], Guangyu Zhang [4], Bernard Placais [3]

[1] Laboratoire Pierre Aigrain (LPA) – CNRS : UMR8551, Université Pierre et Marie Curie (UPMC) - Paris VI, Université Paris VII - Paris Diderot, École normale supérieure [ENS] - Paris – Département de Physique Ecole Normale Supérieure 24, rue Lhomond F-75231 Paris Cedex 05, France
[2] Insititute of Physics, CAS – China
[3] Laboratoire Pierre Aigrain (LPA) – CNRS : UMR8551 – France
[4] Institute of Physics, CAS – China

Using Joule heating and noise thermometry in GHz range we report on prevailing hyperbolic cooling of electrons, and we predict and observe its activation threshold, along with interband Zener-Klein tunneling.

*Speaker

List of participants

- Abbout Adel
- Albert Romain
- Alet Fabien
- Arcizet Olivier
- Armagnat Pacôme
- Badalov Sabuhi
- Bellafi Besma
- Bisognin Rémi
- Blanchet Florian
- Bonnet Pierre
- Bornheimer Ulrike
- Breunig Daniel
- Brun Christophe
- Brun-Picard Jérémy
- Bujnowski Bogusz
- Cayssol Jerome
- Chapelier Claude
- Chiodi Francesca
- Combes Frédéric
- De Moor Michiel
- Delande Dominique
- Downing Charles
- Fermin Remko
- Fernique François
- Florens Serge

- Fuchs Jean-Noël
- Goerbig Mark Oliver
- Griesmar Joël
- Guo Jingkun
- Haddad Sonia
- Hakl Michael
- Hata Tokuro
- Hazra Dibyendu
- Henck Hugo
- Huard Benjamin
- Huder Loïc
- Ilic Stefan
- Indolese David
- Istas Mathieu
- Jacques Vincent
- Jezouin Sébastien
- Leghtas Zaki
- Leriche Raphaël
- Lescanne Raphaël
- Lian Yunlong
- Ly Ousmane
- Mailly Dominique
- Mariotto Marie-France
- Mazaleyrat Estelle
- Meyer Julia
- Nguyen Van-Duy
- Pandey Preeti
- Parmentier François
- Perconte David
- Peugeot Ambroise
- Piéchon Frédéric
- Portier Fabien

- Potanina Elina
- Pothier Hugues
- Raoux Arnaud
- Rodriguez Ramiro
- Rosen Ilan
- Sacépé Benjamin
- Scarlatella Orazio
- Scola Joseph
- Splettstoesser Janine
- Sticlet Doru Cristian
- Tadjine Athmane
- Tchoumakov Sergueï
- Thomas Frederick
- Tisserond Emilie
- Upreti Lavi
- Van Miert Guido
- Veyrat Louis
- Vidal Julien
- Waintal Xavier
- Wu Shuang
- Yang Kang
- Yang Wei
- Ying Xuzhe

List of sponsors

CNRS

The National Centre for Scientific Research is a public research organization (public scientific and technological, under the Ministry of National Education, Higher Education and Research). It produces knowledge and puts this knowledge at the service of society.

GDR de physique quantique mésoscopique

The research group (GDR) 2426 brings together the CNRS national activity in "mesoscopic quantum physics." Its themes of activity relate to the coherent electron transport in ballistic conductors, diffusive and molecular and atomic transport in cold atomic gases. It gathers thirty laboratories of universities and colleges, CNRS and CEA. It organizes annual meetings and thematic plenaries and thematic schools.

Labex lanef

LANEF is a 'Laboratoire d'Excellence' that associates five fundamental research labs based in Grenoble: Institut Néel, INAC, G2ELab, LNCMI and LPMMC. It coordinates 740 scientists, engineers, technicians, and 400 PhD students and postdocs, in condensed matter, nanosciences, and electrical engineering.

Fondation Nanosciences

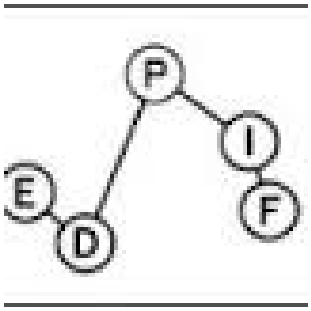
Renforcer l'excellence des recherches menées au sein du Réseau de laboratoires, Accroître les liens entre recherche et formation, Participer au développement coordonné de moyens technologiques, Développer le rayonnement international.

CEA

Le CEA intervient dans le cadre de quatre missions : la défense et la sécurité, l'énergie nucléaire (fission et fusion), la recherche technologique pour l'industrie et la recherche fondamentale (sciences de la matière et sciences de la vie).

Laboratoire de physique des solides

Le laboratoire est une unité mixte de recherche de l'Université Paris-Sud et du CNRS : l'UMR 8502. Elle dépend principalement de l'Institut de Physique du CNRS, et de la section 28 du Conseil National des Universités. Il associe enseignants-chercheurs et chercheurs, expérimentateurs et théoriciens



ED PIF

L'École Doctorale 564 Physique en Île-de-France, est portée par

Paris Sciences et Lettres (PSL Research University)

et co-accréditée par les universités :

Pierre et Marie Curie (UPMC), Sorbonne Paris Cité (USPC), Paris-Saclay (UPSaclay).

Son champ scientifique recouvre essentiellement la physique des interactions fondamentales, la physique quantique de la matière diluée ou condensée, la physique statistique, celle de la matière molle ou biologique mais également les aspects fondamentaux de l'optique, de l'acoustique et de l'hydrodynamique.

Son positionnement scientifique est celui de la physique fondamentale, théorique et expérimentale, et des applications qui en découlent naturellement.

Labex PALM

Laboratory of excellence in Physics : Atoms, Light, Matter PALM is a laboratory of excellence of the Paris-Saclay campus scientific community. It was created by the Fondation for Scientific Cooperation of the Paris-Saclay campus.

Author Index