The Abdus Salam
International Centre for Theoretical Physics

Conference on "Quantum Phenomena in Confined Dimensions"

(Trieste, 4 - 8 June 2007)

Co-sponsored by: NEC Laboratories America, In

CONFERENCE BOOKLET

PRELIMINARY PROGRAMME

ABSTRACTS OF INVITED TALKS

ABSTRACTS OF SHORT TALKS

ABSTRACTS OF POSTERS

PRELIMINARY LIST OF PARTICIPANTS

DIRECTORS:

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(Lancaster University, UK)

Julia MEYER
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The Abdus Salam
International Centre for Theoretical Physics

United Nations Educational, Scientific and Cultural Organization

IAEA
International Atomic Energy Agency

Conference on
"QUANTUM PHENOMENA IN CONFINED DIMENSIONS"
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PRELIMINARY PROGRAMME
Venue: Adriatico Guest House, Kastler Lecture Hall

MONDAY, 4 June 2007

08.30 – 10.00 ***Registration and Administrative Formalities***

10.00 – 10.30 Coffee break

10.30 – 10.40 ***OPENING REMARKS***
V. KRAVTSOV
(Head, ICTP Condensed Matter and Statistical Physics Section)

SESSION: Quantum Dots and Wires – I
Chairperson: J. MEYER (The Ohio State Univ.)

10.40 – 11.40 **S. TARUCHA** (Univ. of Tokyo)
Kondo effect and spin correlation in single InAs self-assembled quantum dots with nanogap electrodes of normal, superconducting and ferromagnetic metal

11.40 – 12.40 **M. SKOLNICK** (Univ. of Sheffield)
The macroscopically occupied polariton state in semiconductor microcavities

12.40 – 13.00 **A. RUSSELL** (Univ. of Lancaster)
Bistability of optically-induced nuclear orientation in quantum dots

13.00 – 15.00 *Lunch break*

SESSION: Graphene - I
Chairperson: F. GUINEA (CSIC, ICM de Madrid)

15.00 – 16.00 **P. KIM** (Columbia Univ.)
Electric transport in graphitic carbon materials

16.00 – 16.30 **K. KECHEDZHI** (Univ. of Lancaster)
Weak localization magnetoresistance in graphene

16.30 – 17.00 *Coffee break*

17.00 – 17.30	**A. SAVCHENKO** (Univ. of Exeter) Weak localization in graphene layers
17.30 – 18.30	**B. ALTSHULER** (Columbia Univ. New York/ NEC Res.Inst.) PN junction in graphene: optics of electronic flows
19.00	***Welcome Reception - Adriatico Guest House Terrace***

<u>TUESDAY, 5 June 2007</u>

	<u>SESSION: Graphene - II</u> **Chairperson: P. KIM** (Univ. of Columbia)
09.00 – 10.00	**A. MORPURGO** (Univ. Delft Technology) Phase coherent transport in graphene
10.00 – 10.20	**F. MOLITOR** (ETH Zürich) Mesoscopic transport in graphene
10.20 – 11.00	**V. CHEIANOV** (Univ. of Lancaster) Electron transport in inhomogeneous graphene structures
11.00 – 11.30	*Coffee break*
	<u>SESSION: Graphene - III</u> **Chairperson: K. FLENSBERG** (Univ. of Copenhagen)
11.30 – 12.30	**K. ENSSLIN** (ETHH – Festkorperphysik, Zürich) Raman imaging and transport properties of graphene
12.30 – 12.50	**J. PEREIRA** (Univ.Fed. do Ceara / Univ. of Antwerpen) Quantum dots in doped bilayer graphene
12.50 – 15.00	*Lunch break*
	<u>SESSION: Quantum Dots and Wires - II</u> **Chairperson: R. HAUG** (Univ. of Hannover)
15.00 – 15.40	**K. FLENSBERG** (Univ. of Copenhagen) In-elastic electron-electron scattering in quantum wires
15.40 -16.00	**A. ROMITO** (The Weizmann Inst. of Science) Charge fluctuations as dephaser of a spin qubit
16.00 – 16.20	**A. CHUDNOVSKIY** (Univ. of Hamburg) Tunneling into strongly biased Tomonaga-Lüttinger liquid
16.20 – 16.40	**F. ROMEO** (Univ. di Salerno) Phase rigidity breaking in open Aharonov-Bohm ring coupled to a cantilever

16.40 – 17.00 *Coffee break*

SESSION: Quantum Dots and Wires - III
Chairperson: S. TARUCHA (Univ. Tokyo)

17.00 – 18.00 **R. HAUG** (Univ. Hannover)
Transport through single and coupled quantum dots: Noise and statistics

18.00 – 18.20 **M. LAVAGNA** (CEA, SPSMS/DRFMC, Grenoble)
Theoretical study of the phase evolution in a Kondo quantum dot

18.20 – 18.40 **A. TAGLIACOZZO** (Univ. di Napoli "Federico II')
Tuning spin transport and magnetoconductance in a semiconductor quantum ring with Rahsba spin-orbit interaction

WEDNESDAY, 6 June 2007

SESSION: Quantum Dots and Wires - IV
Chairperson: V. CHEIANOV (Univ. of Lancaster)

09.00 – 10.00 **N. MASON** (Univ. of Illnois at Urbana-Champaign)
Electron interactions in carbon nanotube quantum wires

10.00 – 10.40 **Y. GEFEN** (The Weizmann Inst. of Science)
Phase lapses and population switching in quantum dots:
A quantum phase transition?

10.40 -11.00 **A. CREPIEUX** (CNRS, Centre Physique Theorique, Marseille)
Finite size effects, super- and sub-poissonian noise in a nanotube connected to leads

11.00 – 11.30 *Coffee break*

SESSION: Graphene - IV
Chairperson: E. ROTENBERG (Lawrence Berkeley Nat. Lab.)

11.30 – 12.30 **E. ANDREI** (Rutgers Univ.)
Observation of Dirac fermions in graphene and graphite

12.30 – 13.00 **D. KHVESHCHENKO** (Univ. of North Carolina)
Composite Dirac fermions in graphene

13.00 – 15.00 *Lunch break*

15.30 – 17.00 **Session of Short Talks and Introduction of Posters**
Chairperson: B. NAROZHNY (ICTP, Trieste)

17.00 -19.00 ***Poster Session and Coffee break***

THURSDAY, 7 June 2007

SESSION: Quantum Dynamics and Correlations - I
Chairperson: L.M. BALENTS (Univ. California at Santa Barbara)

09.00 – 10.00	**D. LOSS** (Univ. of Basel) Nuclear spins in quantum dots and interacting 2DEGs
10.00 – 10.30	**C. HONERKAMP** (Univ. of Wurzburg) Long range ordered phases of electrons on the honeycomb lattice
10.30 – 11.00	*Coffee break*

SESSION: Quantum Dynamics and Correlations - II
Chairperson: M.S. SKOLNICK (Univ. of Sheffield)

11.00 – 11.40	**R. YOUNG** (Toshiba Research Europe Ltd., Cambridge) Quantum light generation and imaging using quantum dots
11.40 – 12.10	**A. GREILICH** (Univ. of Dortmund) Electron spin coherence in singly charged InGaAs/GaAs quantum dots
12.10 – 12.30	**B. GUMHALTER** (Institute of Physics, Zagreb) Ultrafast electron dynamics and decoherence in quasi-two dimensional surface bands
12.30 – 13.00	**S. VISHVESHWARA** (Univ. Illinois at Urbana-Champaign) Proximity-induced effects in carbon nanotubes
13.00 – 15.00	*Lunch break*

SESSION: Graphene - V
Chairperson: K. NOVOSELOV (The Univ. of Manchester)

15.00 – 16.00	**A. PINCZUK** (Univ. of Columbia) Spectroscopy of electrons and phonons in graphene structures
16.00 – 16.30	**D. BASKO** (Univ. of Columbia) Effect of inelastic collisions on multiphonon Raman scattering in graphene
16.30 – 17.00	*Coffee break*
17.00 – 18.00	**E. ROTENBERG** (Lawrence Berkeley National Lab.) Many-body interactions in clean and alkali-adsorbed graphene
18.00 – 18.20	**J. CSERTI** (Eotvos Lorand Univ.) Role of the trigonal warping on the minimal conductivity of bilayer graphene

19:00	***Bus Departure for Conference Dinner to "Rural Trattoria Mezzaluna"***

FRIDAY, 8 June 2007

	SESSION: Quantum Dynamics and Correlations – III **Chairperson: Y. GEFEN** (The Weizmann Inst. of Science)
09.00 – 10.00	**E. YUZBASHYAN** (Rutgers, The State Univ. of New Jersey) Signatures of non-stationary Cooper pairing in ultra-cold atomic gases
10.00 – 11.00	**L. BALENTS** (Univ. of California at Santa Barbara) Semiclassical dynamics and long time asymptotics of the central spin problem
11.00 – 11.30	*Coffee break*
	SESSION: Quantum Dots and Wires - V **Chairperson: A.J. MILLIS** (Univ. of Columbia)
11.30 – 12.30	**K. LE HUR** (Yale Univ.) Charge fractionalization and transport in low dimensions
12.30 – 12.50	**S. TEBER** (CNRS, Lab. Louis Neel, Grenoble) Attenuation of one-dimensional plasmons
12.50 – 13.10	**R.S. WHITNEY** (Inst. Max Von Laue-Paul Langevin, Grenoble) Towards a dephasing diode: asymmetric and geometric dephasing
13.10 – 15.00	*Lunch break*
	SESSION: Graphene – VI **Chairperson: V. FALKO** (Univ. of Lancaster)
15.00 – 16.00	**F. GUINEA** (CSIC, ICM de Madrid) Graphene quantum dots
16.00 – 16.40	**A. LICHTENSTEIN** (Univ. Hamburg) Molecular doping and impurity states of graphene
16.40 – 17.00	*Coffee break*
17.00 – 18.00	**K. NOVOSELOV** (Univ. of Manchester) QED in a pencil trace
18.00 – 18.10	**CLOSING REMARKS**

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ABSTRACTS

of

INVITED TALKS

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Eva Y. ANDREI
Rutgers University, Piscataway, U.S.A.

Title:
Observation of Dirac Fermions in Graphene and Graphite.

Abstract:

The recent synthesis of graphene (a single layer of graphite) has uncovered a fountainhead of remarkable electronic properties that are linked to the emergence of a new class of quasiparticles, Dirac-fermions, whose properties are governed by quantum-relativistic dynamics. I will describe scanning tunneling spectroscopy and transport experiments that provide access to these quasiparticles. Our findings include the direct observation of Landau levels of massless Dirac-fermions in graphene, evidence of the coexistence of massless and massive Dirac-fermions on the surface of graphite and the observation of induced superconductivity in single layer graphene.

* In collaboration with Guohong Li, Xu Du and Ivan Skachko

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Leon BALENTS
UCSB, Physics, Santa Barbara, USA

Title:
Semiclassical dynamics and long time asymptotics of the central spin problem

Abstract:

The spin of an electron trapped in a quantum dot is a promising candidate implementation of a qubit for quantum information processing. We study the central spin problem of the effect of the hyperfine interaction between such an electron and a large number of nuclear moments. Using a spin coherent path integral, we show that in this limit the electron spin evolution is well described by classical dynamics of both the nuclear and electron spins. We then introduce approximate yet systematic methods to analyze aspects of the classical dynamics, and discuss the importance of the exact integrability of the central spin Hamiltonian. This is compared with numerical simulation. Finally, we obtain the asymptotic long time decay of the electron spin polarization. We show that this is insensitive to integrability, and determined instead by the transfer of angular momentum to very weakly coupled spins far from the center of the quantum dot. The specific form of the decay is shown to depend sensitively on the form of the electronic wave function.

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Klaus ENSSLIN
ETHH - Lab. fuer Festkorperphysik, Zurich, Switzerland
and
F. Molitor, D. Graf, C. Stampfer, T. Ihn and K. Ensslin

Title:
Raman imaging and transport properties of graphene

Abstract:

Raman spectroscopy can be used to unambiguously identify single-layer graphene. We employ a scanning Raman set up to map out few-layer graphene flakes with various thicknesses. Using a disorder sensitive Raman line we show that structural disorder is minimal within a given flake and maximal at the edge of a flake as well as at the crossover between flake areas of different thickness. For a 7 monolayer thick graphene flake which is several microns long and 300 nm wide we investigate weak localization as well as universal conductance fluctuations. The data can be analyzed using the theory for one-dimensional diffusive metals. We obtain a phase coherence length of 2 microns at a temperature of 2 K. The carrier density can be tuned by the usual back gate (doped Si substrate) as well as by metallic side gates patterned by electron beam lithography next to the graphene wire. Single layer graphene flakes are investigated by transport experiments around the charge neutrality point and for various temperature treatments.

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Karsten FLENSBERG
Univ. of Copenhagen, Denmark

Title:
In-elastic electron-electron scattering in quantum wires

I discuss the role of electron-electron interactions in one-dimensional quantum wires in the clean limit on condutance and thermopower. For single subband long wires, where momentum is conserved, two-particle scattering has no effect and the dominant contribution comes from three-particle scattering. With more subbands e-e scattering can take place at specific values of the Fermi energy, which results in features in the transport properties. I also discuss the case of short wires where non-momentum conserving scattering leads to a reduced conductance with increasing temperature and relate this to the experimental observations.

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Yuval GEFEN
Department of Condensed Matter Physics, The Weizmann Institute of Science, Rehovot 76199 Israel

Title:
Phase Lapses and Population Switching in Quantum Dots: A Quantum Phase Transition?

Abstract:

A set of experiments at Weizmann Institute a decade ago revealed unexpected features of the behavior of the transmission phase, θ, in transport through a quantum dot. Most surprisingly was the observation that as the gate voltage, V_g, is varied continuously, the evolution of θ involves an increase by π as V_g sweeps through a resonance (a Coulomb peak), and a sharp decrease by π (a phase lapse) between consecutive peaks. This systematic behavior was left unaccounted for till recently.

I will review the major theoretical steps that recently led to an understanding of the effect, emphasizing the role of (i) dot-lead asymmetries and (ii) non-monotonous occupation of the dot's levels known as "population switching" [1,2].

Recent studies of the population switching provide conflicting evidence as to whether this effect is smooth or abrupt [3]. The latter would suggest a zero-temperature phase transition.

References:

1. D. Golosov and Y.Gefen, Phys. Rev. B vol. 74, 205316 (2006).
2. D. Golosov and Y. Gefen, New J. Phys. vol. 9 (2007), in press [preprint cond-mat/0612494].
3. R. Berkovitz, Y. Gefen, M. Goldstein, and D. Golosov, unpublished.

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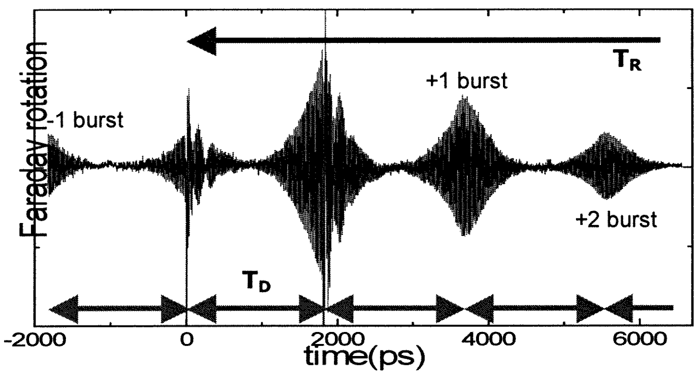
Alex Greilich[1], D. R. Yakovlev[1], A. Shabaev[2], Al. L. Efros[2], I. A. Yugova[1], R. Oulton[1], D. Reuter[3], A. Wieck[3], and M. Bayer[1]
[1]Experimentelle Physik II, Universität Dortmund, D-44221 Dortmund, Germany
[2]Naval Research Laboratory, Washington, DC 20375, USA
[3]Angewandte Festkörperphysik, Ruhr-Universität Bochum, D-44780 Bochum, Germany

Title:
Electron spin coherence in singly charged InGaAs/GaAs quantum dots

Abstract:
Electron spins in ensembles of quantum dots (QDs) offer one possible pathway to implement quantum information technologies in a solid-state environment. Unfortunately, inhomogeneities within an ensemble lead to the rapid loss of coherence among the phases of the spins, typically on the scale of nanoseconds.

We report an optical technique based on time-resolved Faraday rotation measurements of the electron spin dynamics in an ensemble of QDs to recover the coherence time of a single QD. The measured spin coherence time T_2 is 3 microseconds, which is three orders of magnitude longer than the ensemble dephasing time of about 2 nanoseconds. A periodic train of circularly polarized light pulses from a mode-locked laser synchronizes the precession of the spins to the laser repetition rate T_R, transferring the mode-locking into the spin system. This synchronization leads to constructive interference of the electron spin polarization in time. The interference gives also the possibility for all-optical coherent manipulation of spin ensembles: the electron spins can be clocked by two trains of pump pulses with a fixed temporal delay T_D. After this pulse sequence, the QD ensemble shows multiple echo-like Faraday rotation signals with a period equal to the pump pulse separation.



[1] A. Greilich, R. Oulton, E. A. Zhukov, I. A. Yugova, D. R. Yakovlev, M. Bayer, A. Shabaev, Al. L. Efros, I. A. Merkulov, V. Stavarache, D. Reuter, and A. Wieck, Phys. Rev. Lett. **96**, 227401 (2006).
[2] A. Greilich, D. R. Yakovlev, A. Shabaev, Al. L. Efros, I. A. Yugova, R. Oulton, V. Stavarache, D. Reuter, A. Wieck, and M. Bayer, Science **313**, 341 (2006).

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Francisco GUINEA
CSIC – Instituto de Ciencias de Materiales de Madrid, Spain

Title:
Graphene quantum dots

Abstract:

We analyze simple models of graphene quantum dots, and study their transport properties. It is shown that charging effects are significantly influenced by localized states at zero energy, between the valence and conduction bands. The presence of these states also lead to non equilibrium effects. The role of disorder and magnetic fields are also analyzed. We finally show how charging effects can reduce the electron coherence and modify the transport properties of graphene nanoribbons.

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Philip KIM
Columbia University, Physics, New York, U.S.A.

Title:
Electric Transport in Graphitic Carbon Materials

Abstract:

The massless Dirac particle moving at the speed of light has been a fascinating subject in relativistic quantum physics. Graphene, an isolated single atomic layer of graphite, now provides us an opportunity to investigate such exotic effect in low-energy condensed matter systems. The unique electronic band structure of graphene lattice provides a linear dispersion relation where the Fermi velocity replaces the role of the speed of light in usual Dirac Fermion spectrum. In this presentation I will discuss experimental consequence of charged Dirac Fermion spectrum in two representative low dimensional graphitic carbon systems: 1-dimensional carbon nanotubes and 2-dimensional graphene. Combined with semiconductor device fabrication techniques and the development of new methods of nanoscaled material synthesis/manipulation enables us to investigate mesoscopic transport phenomena in these materials. The exotic quantum transport behavior discovered in these materials, such as room temperature ballistic transport and unusual half-integer quantum Hall effect. In addition, the promise of these materials for novel electronic device applications will be discussed.

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Karyn LE HUR
Yale University, Physics, New Haven, CT, USA

Title:
Charge Fractionalization and Transport in low dimensions

Abstract:

Quantum one-dimensional systems such as quantum wires or carbon nanotubes can carry charge in units smaller than a single electron charge. According to Lüttinger theory which describes low-energy excitations of such systems, the resulting charge and spin waves are predicted to carry fractional charge and spin that propagate at different velocities. Observing fractionalization physics in an experiment is a considerable challenge in those low-dimensional systems which are adiabatically coupled to metallic (measuring) leads. We theoretically discuss the possibility of observing charge fractionalization as well as the associated electron lifetime which varies as $1/T$ (with T being the temperature) in coupled wire geometries. We also present recent experimental data from Amir Yacoby et al. which confirms the charge fractionalization in quantum wires. This work has been done in collaboration with Amir Yacoby and Bertrand I. Halperin.

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Alexander LICHTENSTEIN
University of Hamburg, Institute of Theoretical Physics, Hamburg, Germany

Title:
Molecular Doping and Impurity States of Graphene

Abstract:

Graphene has been attracting an increasing interest due to its remarkable physical properties ranging from the Dirac electron spectrum to ballistic transport under ambient conditions. The latter makes graphene a promising material for future electronics and the recently demonstrated possibility of chemical doping without significant change in mobility has improved graphene's prospects further. We address the question of impurity formation in graphene [1]. Results of tight-binding calculations as well as DFT studies will be presented to explain the peculiar nature of impurity states in this material, the consequences for STM experiments as well as the possibility of strong exchange interactions between magnetic impurities. Furthermore, recent results on graphene's chemical sensor properties [2], in particular, the possibility to detect a single NO2 molecule, will be discussed from a theoretical point of view.

[1] T. O. Wehling, K. S. Novoselov, S. V. Morozov, E. E. Vdovin, M. I. Katsnelson, A. K. Geim, A. I. Lichtenstein, cond-mat/0703390
[2] F. Schedin, K.S. Novoselov, S.V. Morozov, D. Jiang, E.H. Hill, P. Blake, A.K. Geim, cond-mat/0610809

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Nadya MASON
Univ. Illinois at Urbana-Champaign, Dept. Physics, Urbana, U.S.A.

Title:
Electron Interactions in Carbon Nanotube Quantum Wires

Abstract:

Carbon nanotubes are tubes of rolled-up graphite, with diameters as small as a nanometer and lengths up to a millimeter. This amazing aspect ratio allows nanotubes to be studied as one-dimensional wires, with quantum effects that can be seen for a wide range of length and energy scales. In this talk, I will discuss several transport experiments on carbon nanotubes, which demonstrate one-dimensional, interacting physics in these systems. I will first show how point contacts fabricated over nanotubes create the quantized conductance steps expected for one-dimensional systems. However, the steps in nanotubes have an anomalous spacing, perhaps indicative of broken band and spin degeneracies. I will then discuss tunneling measurements designed to measure interacting electron states—particularly Luttinger liquid effects – in nanotubes of varying length scales. We find an unusual length-dependence of the Luttinger exponent, particularly for very short (<<1 micron) and very long (>> 1 micron) nanotubes.

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Kostya NOVOSELOV
The University of Manchester, School of Physics & Astronomy
Manchester, U.K.

Title:
QED in a Pencil Trace

Abstract:

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

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Aron PINCZUK
Department of Physics and of Applied Physics
Columbia University, New York, 10027 NY, USA

Title:
Spectroscopy of electrons and phonons in graphene structures (*†)

Abstract:

Single layers of graphene were probed by Raman scattering measurements of the long wavelength optical phonon (the G-band). Gate-modulated low-temperature Raman spectra reveal that the electric-field-effect (EFE), that has pervasive presence in contemporary electronics, has marked impacts on the G-band optical phonons of graphene. The EFE in the two dimensional honeycomb lattice of carbon atoms creates large density modulations of carriers with linear dispersion (known as Dirac fermions). The EFE Raman spectra display the interactions of lattice vibrations with these unusual carriers. The changes of phonon frequency and line-width demonstrate optically the particle-hole symmetry about the charge-neutral Dirac-point. The linear dependence of the phonon frequency on the EFE-modulated Fermi energy is explained as the electron-phonon coupling of mass-less Dirac fermions.

(*) Collaboration with J. Yan, Y. Zhang, and P. Kim
(†) Supported by ONR, NSF and DOE

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Eli Rotenberg, A. Bostwick[1], T. Ohta[1,2], J. McChesney[1], K. V. Emtsev[3], Th. Seyller[3], and K. Horn[2]

[1] E. O. Lawrence Berkeley Natl. Lab. 6-2100, Berkeley, CA 94720 USA
[2] Fritz-Haber-Institut der MPG, Faradayweg 4-6, 14195 Berlin, Germany
[3] Lehrstuhl f¨ur Techn. Physik, U. Erlangen-N¨urnberg, Erwin-Rommel-Straße 1, D-91058 Erlangen, Germany

Title:
Many-body interactions in clean and alkali-adsorbed Graphene

Abstract

The study of many-body interactions among the charge carriers in graphene is of interest owing to their contribution to superconductivity in carbon nanotubes and graphite intercalation compounds (GICs). I will report the characterization of graphene thin films using angle-resolved photoemission spectroscopy (ARPES). We determined the spectral function for monolayer graphene, which encodes the many-body interactions in the system–namely the charge and vibrational excitations. The bands around the Dirac crossing point E_D are heavily renormalized by electron-electron, electron-plasmon, and electron-phonon couplings, which must be considered on an equal footing to understand the quasiparticle dynamics in graphene and related systems.

At alkali coverages comparable to graphite intercalation compounds (GICs), renormalization of the carrier mass near E_F becomes significant. The electron-phonon coupling has an overall strength and anisotropy which cannot be explained by conventional models. We propose a significant enhancement of the coupling strength by the presence of a van Hove Singularity (VHS) at or just above E_F, which can account for the enhanced coupling in both doped graphene and potentially for the similar situation encountered in the high T_c cuprate superconductors.

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M.S. SKOLNICK
Department of Physics & Astronomy, University of Sheffield
Sheffield S3 7RH, U.K.

Title:
The Macroscopically Occupied Polariton State in Semiconductor Microcavities

Abstract:

Recent work on the high density macroscopically occupied polariton state which can be excited in planar semiconductor microcavities will be reviewed.

Following a general introduction, attention will be focused principally on the driven optical parametric oscillator system, where high density states are formed at zero and finite wavevector are formed. There will be discussion of the important effects of interactions in such systems, both polariton-polariton and polariton-exciton/electron, which are shown to limit the temporal coherence of the condensed phase which is formed, in strong contrast to the case of non-interacting photons in a laser. Evidence for phase transitions as the threshold is crossed from the spontaneous to coherent regimes will be presented. Finally comparison will be made with the high density polariton state which condenses from an exciton reservoir excited non-resonantly.

I would like to acknowledge the contributions of D N Krizhanovskii, D Sanvitto, D M Whittaker and A P D Love to this work.

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S. TARUCHA[1] and A. Oiwa [1,2]
[1] Department of Applied Physics, The University of Tokyo
Tokyo, 113-8656, Japan
[2]ICORP, JST, Quantum Spin Project, c/o The University of Tokyo, Tokyo 113-8656, Japan

Title:
Kondo effect and spin correlation in single InAs self-assembled quantum dots with nanogap electrodes of normal, superconducting and ferromagnetic metal

Abstract:

Quantum dots are tiny solid-state system suffering from strong effects of quantum confinement and interaction. The electron transport through a pair of electrodes with a quantum dot in between is thoroughly influenced by the feature of the quantum dot. This has been used to study the electronic properties of quantum dot itself and also manipulate the charge and spin degrees of freedom in the conduction. Particularly, associated with the latter, there has been growing interest in controlling the spin-related phenomena, such as Pauli effect and the Kondo effect. Use of superconductor or ferromagnet instead of normal metal for making contacts to quantum dots can further expand the freedom of spin correlation in the transport property. In this work we use an InAs self-assembled quantum dot coupled to contact electrodes made from different types of metal, i.e. normal, superconducting, and ferromagnetic metal, to explore the Kondo effect depending on the interplay with superconductivity and ferromagnetic order.

We initially observe the spin-half Kondo effect for an InAs quantum dot coupled to normal metal (Ti-Au) electrodes. The Kondo effect arises from an anti-ferromagnetic coupling of a local electron spin in a quantum dot to Fermi sea in the electrodes. When the electrode metal is replaced by Al-Ti (Ni-Ti), competition between two different types of ordering, i.e. the Kondo singlet and Cooper-pair states (ferromagnetic states) can appear. For the Al-contact device we observe coexistence of first order Andreev reflection and the Kondo effect. The Andreev process is enhanced by the Kondo effect in such a way that the zero-bias peak develop side-peaks the superconducting gap energy D. We find that the zero-bias conductance measured for various D's and Kondo temperature T_K's falls on a single curve with D/T_K as the only relevant energy scale. This can represent a new type of Kondo universality. On the other hand, for the Ni-contact device, we study tunneling magneto-resistance (TMR) as a function of gate voltage, and observe different types of TMR in the Kondo and non-Kondo valley. The TMR is always positive in the non-Kondo valley, and changes the sign at the Coulomb peaks. In contrast, the TMR sign change occurs at the center of the Kondo valley. We argue that the observed TMR feature can be influenced by the phase shift of electrons tunneling though the dot, although the underlying physics is not yet clear.

The Abdus Salam
International Centre for Theoretical Physics

United Nations Educational, Scientific and Cultural Organization

IAEA
International Atomic Energy Agency

Conference on "Quantum Phenomena in Confined Dimensions"
(4 – 8 June 2007)

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Title:
Quantum light generation and imaging using quantum dots

Abstract:

Semiconductor Quantum dots are potentially an attractive source of non-classical light. They can confine bound electron-hole pairs, excitons, in all three spatial dimensions giving them discrete optical emission energies, much like the electronic states in atomic systems. The semiconductor nature of the system allows quantum dots to be integrated into complicated device structures including optical cavities [1] and electrical injection [2].

The radiative exciton emission from a semiconductor quantum dot can provide the simplest form of quantum light, a single photon source [2]. The finite re-excitation time following the radiative decay of an exciton in a quantum dot prevents the dot from emitting more than one photon if excited with a short optical or electronic pulse. In a similar fashion excitation of the biexciton state, consisting of two electrons and holes, in the quantum dot results in the emission of a pair of photons at the energy of the biexciton and exciton transitions. The biexciton state was, in fact, proposed as a possible source of polarisation-entangled photons in 2000 by Benson et al. [3] as it consists of two polarisation-correlated decay paths which could potentially be indistinguishable. The condition of indistinguishability is fundamental to the generation of entangled photons and is, in general, not true of the two decay paths from the biexciton state in a quantum dot; physical anisotropy causes the intermediate exciton states to hybridise and separate in energy providing 'which-path' information about the route taken through the biexciton decay.

We demonstrate how the splitting between the intermediate exciton states in a single InAs quantum dot can be controlled by growth [4], rapid thermal annealing [5] and the application of an external magnetic field [6]. Each of these three techniques can be used to make the intermediate exciton states degenerate allowing the biexciton decay to produce singe pairs of entangled photons triggered by short laser pulses [7,8]. Entangled photon pair sources are essential for applications such as entanglement based quantum key distribution, and optical quantum computing. For these applications it is important that no more than one entangled photon pair is generated in a cycle, a requirement met by our quantum dot source which is not possible with traditional methods for generating entangled pairs of photons.

Entanglement also enables quantum interferometry and metrology, the basis of image resolution beyond that possible with equivalent classical light. Biphoton interferometry using entangled emission from the biexciton decay reveals fringes with half the period of classical light [9], and less that that of the laser. In addition, interferometry suggests that this type of entangled light source is not limited by decoherence, we fine the biphoton is surprising robust against dephasing, in stark contrast to the devastating effect of decoherence upon single photons emitted by similar structures.

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Conference on

"Quantum Phenomena in Confined Dimensions"

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ABSTRACTS

of

SHORT TALKS

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Effect of inelastic collisions on multiphonon Raman scattering in graphene

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The Raman spectrum of graphene consists of distinct narrow peaks corresponding to different optical phonon branches as well as their overtones. Raman scattering measurements represent a powerful experimental tool for studying phonon modes, as well as their interaction with electrons. Indeed, electron-phonon interaction and Raman scattering in graphene has attracted a great deal of interest, both experimental [1, 2, 3, 4] and theoretical [5, 6].

We argue that information about electron-electron interaction can be extracted from Raman spectra as well. Namely, we calculate the probabilities of two- and four-phonon Raman scattering in graphene and show how the relative intensities of the overtone peaks encode information about relative rates of different inelastic processes electrons are subject to. In particular, assuming that the most important processes are phonon emission and electron-electron collisions, one can deduce the rate of the latter from the Raman spectra. This fact is especially interesting as the question about electron-electron collisions for the Dirac spectrum is not a trivial one [7, 8].

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Tunneling into strongly biased Tomonaga-Luttinger liquid

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We consider tunneling from the Fermi-liquid reservoir into the nonequilibrium TLL through a point tunnel contact (see Fig. 1). The nonequilibrium conditions are created by a strong transport voltage applied to a TLL channel. Finite source-drain voltage V_{sd} applied to the channel results in the shift of the chemical potentials for the right and left movers to the quasi-Fermi energies $E_F + eV_{sd}/2$ and $E_F - eV_{sd}/2$ respectively. At strong enough voltages, the nonlinearity of the electronic dispersion leads to different Fermi velocities of the right- and left-movers $v_{R/L} = \sqrt{(2E_F \pm eV_{sd})/m^*}$, as depicted in Fig. 1. (Here, m^* is the effective electron mass.) In turn, the tunneling densities of states (TDoS) for the left- and right-moving spectral branches differ. Furthermore, since the direction of partial tunneling currents into the left branch and out of the right branch are opposite, these two tunnel currents do not compensate any more even at zero voltage V_{pc} at the point contact (see Fig. 1). Therefore, a finite tunnel current flows between the nonequilibrium TLL and a point contact. We calculate the dependence $I_{pc}(V_{pc}, V_{sd})$ analytically. To this end, we propose a method of diagonalization of TLL Hamiltonian with different Fermi velocities for the right- and left-movers. The method can be usefull for a number of problems which involve chiral asymmetry of the density of states such as a TLL wire in an external magnetic field or wires with spin-orbit interactions. The nonequilibrium TDoS ν can be best seen in the measurements of the differential conductances $\partial I_{pc}/\partial V_{pc,sd}$ at small voltages V_{pc} on the point contact (see Fig. 2). There are two power-low singularities at $V_{pc} = \pm V_{sd}/2$, separately for the tunneling into the right- and the left-moving spectral branch of TLL. At these voltages, the Fermi level in the Fermi liquid reservoir coincides with the quasi Fermi energy for the left- or the right-moving fermions in TLL, and the tunneling density of states in the corresponding channel is suppressed.

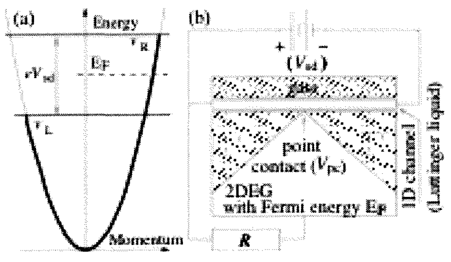

FIG. 1: (a) Occupation of the dispersional parabola in 1D channel in presence of the source–drain voltage V_{sd} at negligible V_{pc} when the Fermi energy of the 2DEG lies exactly in the middle between quasi Fermi levels of the biased TLL. (b) Schematics of the device proposed.

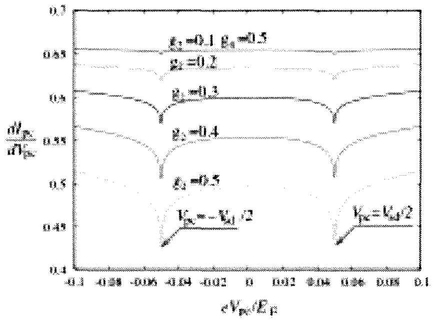

FIG. 2: Differential conductance $\partial I_{pc}/\partial V_{pc}$ as a function of voltage at the point contact V_{pc} for different values of the Luttinger liquid interaction parameter g_2 at a given g_4. The bias voltage V_{sd} is taken equal to $0.1E_F$, and the other parameters are relevant for typical GaAs-based electron gases. The conductance dependencies $\partial I_{pc}/\partial V_{pc,sd}(V_{pc})$ exhibit singularities at $V_{pc} = \pm V_{sd}/2$.

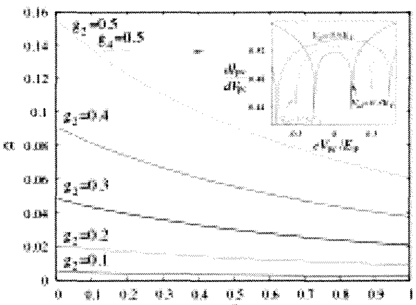

FIG. 3: The dependence of the tunneling exponent α ($\nu(\omega) \propto |\omega|^\alpha$) on the asymmetry of the Fermi velocities v_R and v_L expressed through the parameter $g = v_L/v_R$. The unbiased TLL corresponds to $g = 1$. The asymmetry increases (g diminishes) increasing the bias voltage V_{sd}. The suppression of the tunneling density of states grows with bias voltage. Inset: Differential conductance $\partial I_{pc}/\partial V_{pc}$ as a function of voltage at the point contact for different values of V_{sd} at a given $g_2 = g_4 = 0.5$.

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Finite size effects, super- and sub-poissonian noise in a nanotube connected to leads

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The injection of electrons in the bulk of carbon nanotube which is connected to ideal Fermi liquid leads is considered. While the presence of the leads gives a cancellation of the noise cross-correlations, the auto-correlation noise has a Fano factor which deviates strongly from the Schottky behavior at voltages where finite size effects are expected. Indeed, as the voltage is increased from zero, the noise is first super-poissonian, then sub-poissonian, and eventually it reaches the Schottky limit.
These finite size effects are also tested using a diagnosis of photo-assisted transport, where a small AC modulation is superposed to the DC bias voltage between the injection tip and the nanotube. When finite size effects are at play, we obtain a stepwise behavior for the noise derivative, as expected for normal metal systems [1], whereas in the absence of finite size effects, due to the presence of Coulomb interactions, a smoothed staircase is observed. The present work [2] shows that it is possible to explore finite size effects in nanotube transport via a zero frequency noise measurement.

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Role of the trigonal warping on the minimal conductivity of bilayer graphene

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Using a reformulated Kubo formula we calculate the zero-energy minimal conductivity of bilayer graphene taking into account the small but finite trigonal warping. We find that the conductivity is independent of the strength of the trigonal warping and it is three times as large as that without trigonal warping, and six times larger than that in single layer graphene. Although the trigonal warping of the dispersion relation around the valleys in the Brillouin zone is effective only for low energy excitations, our result shows that its role cannot be neglected in the zero-energy minimal conductivity.

Reference: József Cserti, András Csordás, and Gyula Dávid, cond-mat/0703810.

Ultrafast electron dynamics and decoherence in quasi-twodimensional surface bands

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Abstract

We develop a many-body description of nonadiabatic dynamics of quasiparticles in surface bands appropriate to the studies of ultrafast electronic relaxation in the processes of one- and two-photon photoemission and inverse photoemission from surfaces. The approach is based on the combination of the formalisms for calculation of quasiparticle survival probabilities and selfconsistent treatment of the linear electronic response of the system. We demonstrate that the calculation of survival probabilities that carry information on the quasiparticle decoherence and decay can be conveniently mapped onto the problem of renormalization of quasiparticle propagators by the interactions with bosonized excitations constituting the system heatbath. Applying this approach to the benchmark Cu(111) surface we are able to assess the regimes of preasymptotic non-Markovian electron and hole dynamics in surface bands and locate transitions to the regime of exponential quasiparticle decay characterized by the corrected Fermi golden rule-type of transition rates. The general validity of these findings enables to establish borderlines between the various regimes of ultrafast electronic relaxation that affect the energy and time resolved measurements of surface electronic properties.

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Title:
Long range ordered phases of electrons on the honeycomb lattice

Abstract:

Motivated by the experimental realization of graphene, we investigate instabilities of electrons on the honeycomb lattice, interacting by local Hubbard and longer-ranged interactions. Using a temperature-flow functional renormalization group scheme which takes into account the wave vector-dependence of the interactions throughout the Brillouin zone, we detect the leading ordering tendencies at low temperatures. Near half band filling and for dominant onsite repulsion, critical minimal interaction strengths are required for a instabilities toward anti-ferromagnetic or charge density wave order, in support of a previous large-N work of Herbut [Phys. Rev. Lett. 97, 146401 (2006)]. Away from half filling, a triplet pairing superconducting instability occurs. Phononic coupling to the substrate can further enhance this instability.

Weak localisation magnetoresistance in graphene

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We describe the weak localization correction to conductivity in ultra-thin graphene films, taking into account disorder scattering and the influence of trigonal warping of the Fermi surface. A possible manifestation of the chiral nature of electrons in the localization properties is hampered by trigonal warping, resulting in a suppression of the weak anti-localization effect in monolayer graphene and of weak localization in bilayer graphene. Intervalley scattering due to atomically sharp scatterers in a realistic graphene sheet or by edges in a narrow wire tends to restore weak localization resulting in negative magnetoresistance in both materials.

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Title:
Composite Dirac fermions in graphene

Abstract

Generalizing the notion of composite fermions to the case of "relativistic" Quantum Hall phenomena in graphene, we discuss a possible emergence of compressible states at the filling factors 1/2 and 3/2.
This analysis is further extended to the nearby incompressible states viewed as Integer Quantum Hall Effect of composite Dirac fermions, as well as those that can result from (pseudo)spin-singlet pairing between them.

Theoretical study of the phase evolution in a Kondo quantum dot

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We study the effects of Kondo correlations on the transmission phase shift of a quantum dot (QD) in the Kondo regime. This work is motivated by the quantum interferometry experiments [1] carried out these last years at the Weizmann Institute which allow one to access the phase shift experienced by an electron passing through a quantum dot. We present our results [2] obtained for the Anderson model with 2 reservoirs using 2 types of methods: (i) Bethe ansatz and (ii) noncrossing approximation for the infinite-U Anderson model. We follow the evolution of the phase shift with the gate voltage and find quantitative agreement with experimental results in two different regimes of the coupling to the leads. Finally we extend our NCA study to the out-of-equilibrium situation and discuss how the phase shift evolves in the presence of a finite bias voltage.

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Mesoscopic transport in graphene

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We report on transport measurements on a few-layer graphene wire with a phase coherence length at low temperatures T≈2 K larger than the wire width (ca 300 nm), but comparable to the wire length (ca. 2 μm)[1]. By analyzing the weak localization peak in the one-dimensional dirty-metal regime, we find a density dependence of the quantum corrections to the conductivity. Reproducible conductance fluctuations are also analyzed as a function of density and a similar value for the phase coherence length is found. Side gates allow us to tune the Fermi energy locally and to change the disorder configuration for a fixed Fermi level.
Single layer graphene flakes are investigated by transport experiments around the charge neutrality point and for various temperature treatments.

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Title:
"Quantum dots in doped bilayer graphene"

Abstract

In this work we demonstrate the possibility of confinement of electrons and holes in ,quantum dots in bilayers of graphene. A position-dependent doping breaks the equivalence between the upper and lower layer and lifts the degeneracy of the positive and negative momentum states of the dot. We present numerical results that show the simultaneous presence of electron and hole confined states for certain doping profiles and a remarkable angular momentum dependence of the quantum dot spectrum which is in sharp contrast with that for conventional semiconductor quantum dots. We predict that the optical spectrum will consist of a series of non-equidistant peaks.

Phase rigidity breaking in open Aharonov-Bohm ring coupled to a cantilever

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(Dated: May 15, 2007)

ABSTRACT

Nanoelectromechanical systems (NEMS) have been a subject of extensive research in recent years due to the possibility of combining electrical and mechanical degrees of freedom on the nanoscale. From a technological point of view the interest is largely related to the many applications that may be realized using NEMS. Among the many NEMS phenomena of considerable physical interest, we focus in this talk on the effect of quantum-coherent displacements of a molecular cantilever coupled to a one-dimensional Aharonov-Bohm (AB) ring symmetrically connected to two external leads. In such a system phase coherent charge transport through the closed loop (which can be regarded as a non-simply connected quantum dot) is perturbed as a consequence of inelastic scattering induced by electron-phonon interaction. The effect of the perturbation can be detected as a violation of the Onsager symmetry rule in the linear conductance curves as a function of the applied magnetic flux (i.e. the linear conductance is not symmetric in the AB phase). The observed asymmetry can be tuned continuously by changing the electron-phonon coupling, showing that the phase shift of the linear conductance in a two-terminal AB interferometer is not rigid when tunnelling is assisted by phonons. We will provide a characterization of such interaction effects, referred to phase-rigidity breaking in recent literature, by studying the Fourier series of the linear conductance obtained by means of a suitable scattering approach. In particular, the phase shift of the first term in Fourier expansion (which under Onsager symmetry is seen to be a dichotomic variable assuming value 0 or π) can vary continuously as a function of the electron-phonon coupling. This continuous phase variation as a function of the incident electron energy can be exploited in experiments to obtain the value of the electron-phonon coupling. The relevant structural and experimental parameters will be briefly discussed. The phase rigidity breaking can be regarded a common feature of two-terminal nanomechanical systems and thus we propose measurements of phase shifts as a way to characterize the electron-phonon coupling in NEMS.

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Title:
Charge fluctuations as dephaser of a spin qubit

Abstract:

We study the role of charge fluctuations in the decoherence of Rabi oscillations between spin states $|\uparrow\downarrow>$, $|\downarrow\uparrow>$ of two electrons in a double dot structure. We consider the effects of fluctuations in energy and in the quantum state of the system, both in the classical and quantum limit. The role of state fluctuations is shown to be of leading order at sufficiently high temperature, applicable to actual experiments. At low temperature the low frequency energy fluctuations are the only dominant contribution.

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Title:
"Bistability of optically-induced nuclear orientation in quantum dots"

Abstract

We demonstrate that bistability of the nuclear spin polarization in optically pumped semiconductor quantum dots is a general phenomenon possible in dots with a wide range of parameters. In experiment, this bistability manifests itself via the hysteresis behavior of the electron Zeeman splitting as a function of either pump power or external magnetic field. In addition, our theory predicts that the nuclear polarization can strongly influence the charge dynamics in the dot leading to bistability in the average dot charge."

Weak localisation in graphene layers

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We present results of the first experimental investigation of weak localisation (WL) in bilayer graphene [1]. Although the spectrum of charge carriers in bilayer graphene has a usual, parabolic character, the manifestation of WL in this system is very different from that in conventional 2D structures with such spectrum. The chiral character of charge carriers makes WL dependent not only on inelastic scattering which controls the dephasing rate, but also on different elastic scattering mechanisms.

The carrier density in the samples, fabricated by the method of mechanical exfoliation, is controlled by a gate voltage in the range up to 1.5×10^{12} cm^{-2}. The temperature dependent magnetoresistance is detected at all densities including the electroneutrality region where the type of carrier changes from electrons to holes. The analysis of the magnetoresistance using theory [2] allows us to determine the phase-breaking time, as well as the time of intervalley scattering. This scattering is essential in the manifestation of WL as it is due to this scattering that WL in graphene is not totally suppressed by topological defects or energy spectrum warping.

The results on WL in bilayer graphene are compared with those on single-layer graphene, which we analyse at different carrier densities (including the Dirac point) using the approaches developed in [3,4]. We study several samples of different geometry and quality, with the aim to control the characteristic times responsible for the manifestation of WL. The intensity of intervalley scattering and the scattering due to topological defects and spectrum warping are compared for different samples.

The study of WL is complemented by the analysis of the universal conductance fluctuations which are observed at all studied densities, both as a function of magnetic field and carrier density.

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TUNING SPIN TRANSPORT AND MAGNETOCONDUCTANCE IN A SEMICONDUCTOR QUANTUM RING WITH RAHSBA SPIN-ORBIT INTERACTION

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Aharonov Bohm oscillations of the magnetoconductance in a ballistic quantum ring is a beautiful demonstration of the quantum interference of electrons and a probe for weak localization corrections in presence of diffusive contacts. Spin effects due to the Zeeman spin splitting and to the spin-orbit (SO) interaction can be monitored as well, together with antilocalization corrections. It has been pointed out that the transport of the electron spin around the ring affects the interference by adding an extra Berry phase. For appropriately designed heterostructures the SO is also tuned with electric gates, which is a practical realization of the Aharonov-Casher effect. Recently such effects have also been observed in a 2D GaAs hole ring structure [1]. We have analyzed in detail the interplay of the phenomena quoted above within a real time path integral approach and studied the spin polarization of the transported electron. At zero magnetic field strong SO coupling provides the flipping of the spin polarization. We will present our results which also include WL corrections and dephasing induced by non fully transparent, ideal contacts[2,3].

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Title: **"Attenuation of one-dimensional plasmons"**

Abstract:

This poster will focus on recent theoretical developments in the field of one-dimensional (1D)
plasmons in ballistic conductors. In the physics of the solid-state, plasmons correspond to quantas of the oscillation of the electronic density. Much experimental and theoretical work has been devoted to 3D (since the 50s) and 2D (in semiconductor heterostructures) plasmons.
In 1D, recent theories have motivated the need to go beyond the standard model of interacting 1D fermions, the Tomonaga-Luttinger model, in order to access the attenuation (or inverse life-time) of 1D plasmons due to electron-electron interactions. I will summarize these theoretical developments [1,2,3] and the main techniques used to tackle this problem. I will also propose the use of
electronic Raman spectroscopy, e.g. on metallic wires, in order to measure the plasmon peak and test the theoretical predictions (non-lorentzian profile [1,2] and interaction-dependent width of the peak
[2,3]).

[1] Pustilnik et al. PRL (2006)
[2] Pereira et al. PRL (2006)
[3] Teber, PRB (2007)

Proposed 15 minute talk, smr.1844, Trieste

Title: Proximity-induced effects in carbon nanotubes
Author: Smitha Vishveshwara
(in collobaration with Karyn Le Hur and Cristina Bena)

The properties of a single-walled metallic carbon nanotube placed on a superconducting substrate are discussed. Given that the nanotube possesses two bands in its excitation spectrum, a novel proximity effect is manifest which allows the existence of a ``double superconducting gap." It is shown that there is a critical experimentally-accessible interaction strength in the nanotube at which this proximity effect transitions from being suppressed to being enhanced.

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Co-authors: A. Shnirman, Y. Gefen

Title:
Towards a dephasing diode: asymmetric and geometric dephasing

Abstract

We study the effect of noise on spin and charge transport in ballistic quantum wires with strong spin-orbit coupling (Rashba coupling). We find that the wire then acts as a ``dephasing diode", inducing very different dephasing of the spins of right and left movers. We also show how geometric dephasing emerges in curved wires and find that the curvature can induce a left-right asymmetry in dephasing. We propose ways to measure these effects through spin detectors, spin-echo techniques, and Aharanov-Bohm interferometry.

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Conference on

"Quantum Phenomena in Confined Dimensions"

(4 – 8 June 2007)

ABSTRACTS

of

POSTERS

The Abdus Salam
International Centre for Theoretical Physics

Conference on "Quantum Phenomena in Confined Dimensions" (4 – 8 June 2007)

POSTER TITLES

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CHEN, Xiao-yu	Conversion of entanglement between continuous variable and qubit systems
HERNANDEZ, A.	Nonlinear transport in ballistic mesoscopic systems: B field symmetry
KASHUBA, O.	O-π transition in SFS junctions with strongly spin-dependent scattering
LIANG, Shi-Dong	Quantum phenomena in carbon-nanotube field emission
MATHEW, V.	Surface plasmon guidance and control in semiconductor structures
RUFEIL FIORI, E.	One dimensional many-body dynamics in spin chains detected through multiple quantum coherence NMR experiments
SHOKRI, Ali A.	The effect of angular dependence of magnetization on electrical transport in GaMnAs/GaAs/GaMnAs heterostructures
STAMPFER, C.	Spatially resolved Raman spectroscopy of single- and few-layer graphene

METAL -INSULATOR TRANSITION IN A QUANTUM WELL SYSTEM

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Abstract

Metal-Insulator transition is investigated for a shallow donor in an isolated well of $GaAs/Ga_{1-x}Al_xAs$ superlattice system within the effective mass approximation using Thomas-Fermi screening function. Within the one-electron approximation the occurrence of Mott transition is seen when the binding energy of a donor vanishes is observed. The effects of Anderson localization and exchange & correlation in the Hubbard model are included in the model. The critical concentration is enhanced when a random distribution of impurities is considered. The relationship between the present model and the Mott criterion in terms of Hubbard model is also brought out. Hartree-Fock function yields values of critical concentration which are one order higher than when TF screening function is involved. The scaling theory of Abrahams et al., [1,2] is critically examined. The combined effects of magnetic and electric fields on MIT are studied. While the magnetic field enhances the critical concentration where MIT occurs whereas the electric field pushes down. Some of the excited states of a hydrogenic donor in a quasi quantum also discussed. The transition from the ground state to the pure $2p_z$ state which is associated with the second subband is observed. The results show that the transition line is observed near the metal-insulator transition as shown in other Ref.[3,4]. All the calculations have been carried out with finite barriers and the results are compared with the available data in the literature [5].

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Pure dephasing of two charge qubits in vertically coupled quantum dots

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Semiconductor quantum dots (QDs) are often considered as candidate devices for a solid-state implementation of quantum information processing [1,2,3]. The implementation of charge states in quantum dot (QD) systems, recently supported by an experimental demonstration [4], has driven a lot of investigations on coherence properties of these systems. Coherent oscillations in double quantum –dot qubit are observed [5].

We analyze the pure dephasing of two electrons in vertically coupled quantum dots due to the interaction with phonons. We numerically evaluated the dephasing rates due to electron coupling to both acoustic and optical phonons. Our results show that the pure dephasing rates depend on the separation between dots and the strength of electron confinement.

Keywords: decoherence, entanglement, double quantum dot

Conversion of entanglement between continuous variable and qubit systems

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Quantum information processing (QIP) has been extensively studied for a qubit system which is a quantum extension of a bit, spanning two-dimensional Hilbert space. A qubit is realized by an electronic spin, a two-level atom, the polarization of a photon and a superconductor among others. In parallel, much attentions have been paid to the QIP of quantum continuous variable (CV) system which is a quantum extension of analog information in classical information theory. CV physical systems such as a harmonic oscillator, a rotator and a light field are defined in infinitive-dimensional Hilbert space. While conversions of analog to digital (A/D) and digital to analog (D/A) are quite usual in information processing, qubit and CV systems are nearly always treated separately. Few schemes have been suggested to transfer entanglement between qubits and radiation field. The critical point in these entanglement conversions is that the usual Jaynes-Cummings interaction Hamiltonian of qubit and CV field is assumed. This usual Jaynes-Cummings interaction Hamiltonian accounts for the imperfect of the entanglement conversion.

We propose a mathematically traceable scheme of perfect entanglement transfer. The cost to realize this sheche is that a serial of non-linear interaction Hamiltonians should be used. The first Hamiltonian takes the form of $H_1 = \hbar\Omega(\sqrt{n}a^+\sigma_- + a\sqrt{n}\sigma_+)$,The $k-th$ Hamiltonian will be $H_k = \hbar\Omega[n(\frac{1}{\sqrt{n}}a^+)^{2^{k-1}}\sigma_- + (a\frac{1}{\sqrt{n}})^{2^{k-1}}n\sigma_+]$. The entanglement transfer of the two-mode squeezed vacuum state is shown in Fig.1for different value of receiving qubit pair number K. The entanglement transfer of CV Werner state is also discussed.

It is difficult to find a real physical system to realize the the nonlinear Hamiltonians. We would like to ask if it can be realized with confined dimensional quantum system?

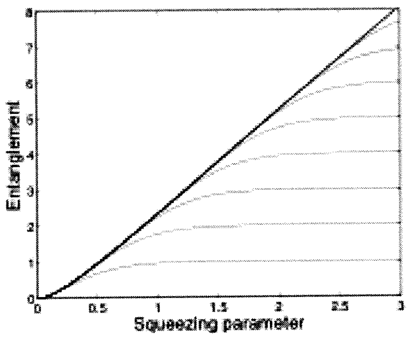

Figure 1: The thick line is for CV state, The thin lines from bottom to top are for the entanglement transferred of K=1,2,...,8 respectively.

Nonlinear transport in ballistic mesoscopic systems: B field Symmetry.

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We study the conductance through ballistic mesoscopic devices beyond the linear response regime. By using non-equilibrium Green's functions we obtain a general expression for the current. This expression is manifestly gauge invariant and depends in a self-consistent way on the charge distribution in the device. To compare our findings with recent non-linear transport experimental results[1,2], our calculations are specialized to two terminal devices. The current is expanded in powers of the applied bias, which allows us to identify the nonlinear conductance terms. We study their symmetry with respect to the magnetic field and observe that they violate the Onsager relations. We identify the first correction to the linear conductance with the nonlinear conductance obtained by Büttiker and collaborators using the S-matrix formulation[3,4]. One of the advantages of our approach is that it can easily be extended beyond the first order correction. To quantitatively study the non-linear conductance we consider a simple model[5,6], namely, a single-channel quantum ring attached to two leads. In the S-matrix theory, this model allows us to compute the characteristic potentials, injectivity, and the first non-linear conductance term in a Thomas-Fermi approximation.

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0-π transition in SFS junctions with strongly spin-dependent scattering

Oleksiy Kashuba, Yaroslav Blanter, Vladimir I. Falko

Abstract

A theory of the critical current and 0-π transition in a superconductor – ferromagnetic alloy – superconductor trilayers (SFS) was developed. To take strong spin dependence of electron scattering of compositional disorder in a diluted ferromagnetic alloy into account a model of ferromagnet doped by random delta-functional impurities which were implied to be both potential and magnetic was used. Employing semiclassical approximation with corresponding self-energy and applying boundary conditions at S/F interfaces we can find order parameter in ferromagnet and obtain in result the total current through the junction. We show that in such a system the critical current oscillations as the function of the thickness of the ferromagnetic layer, with the period of $v_F/2I$, v_F and I being the Fermi velocity and exchange splitting, respectively, decay exponentially with the characteristic length of the order of the mean free path.

Quantum phenomena in carbon-nanotube field emission

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The carbon nanotubes (CN) as a new kind of quasi-one-dimensional materials promise a potential application in nanotechnology. Particularly, the experimental investigations of CN field emission exhibits some excellent and novel properties, including the low turn-on field, high current density, the current-voltage characteristic deviating Fowler-Nordheim (FN) type in the high current, and the multi-peak energy distribution. These novel phenomena stimulate us a lot of theoretical thought. Is there any new field emission mechanism in CN field emission? What is the nanoscale effect in CN field emission? Using the tight-binding approach, we consider the effect of the energy band structure of CN in field emission beyond the FN theory to investigate the current-voltage characteristic and the energy distribution of CN field emission.[1] We find that the metallic and semiconducting single-wall carbon nanotubes (SWCN) exhibit different field-emission behaviors, such as the current-voltage characteristic, quantum size effect and the multi-peak energy distribution.[1,2] For the multi-wall carbon nanotubes (MWCN), the interlayer coupling induces the semiconductor-metal phase transition, which makes the quantum size effect vanish. [3] Particularly, when a magnetic field is applied along the tube axis, it modifies the energy band structures of the metallic and semiconducting SWCNs, which leads to the universal current density at the ratio of magnetic flux and flux quanta equaling to 0.21. The emission currents of the metallic and semiconducting SWCNs exhibit different responding behaviors to the magnetic field. These properties give possibilities to observe the Aharonov-Bohm phase and to generate a spin polarized electron source from the CN field emission.[4,5] These studies reveal some novel properties in the CN field emission.

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Surface plasmon guidance and control in semiconductor structures

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Abstract

This paper discusses the possible applications of semiconductor heterostructures in the propagation and control of surface plasmon polaritons (SPP). Usually, SPP are guided in the interfaces of metal and dielectric slabs. The long range surface plasmon polaritons (LRSPP) are realized in structures with a thin metal film placed in between dielectric media, where the SPP modes at the two interfaces couple to give modes with longer propagation distance [1].

The metallic character of doped semiconductor at low frequencies make it possible to excite SPPs at midinfrared, terahertz and microwave frequencies [2]. An important property of semiconductor is that their carrier density and mobility and hence the dispersion of SPP can be controlled by thermal excitation of free carriers.

We have derived dispersion relations for various SPP modes, and in the present paper, these relations are used to explore theoretically the propagation in semiconductor SPP waveguides. First the usual LRSPP modes are explored with metal film replaced by a semiconductor film. This situation may also be realized in the electron gas formed at the interface between GaAs and AlGaAs. Another important situation is the metal-oxide-semiconductor structure where the coupled SPP modes at the two interfaces will give rise to long-range effects. An advantage of this structure is the possibility of controlling electron concentration by changing the gate voltage.

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One dimensional many-body dynamics in spin chains detected through multiple quantum coherence NMR experiments.

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In this work, we test the dimensionality of the quantum dynamics in a network of coupled spins using solid state nuclear magnetic resonance.
In particular, one can generate an effective double quantum Hamiltonian (flip-flip + flop-flop) that mixes subspaces with different spin projection creating many-body superposition states: the multiple quantum coherences. These states can be probed through a bidimensional technique that allows one to follow the superposition weights as they are created.
Multiple-quantum coherence intensities [1] are measured under a double-quantum Hamiltonian [2] in hydroxyapatite. This system is a quasi-one-dimensional spin chain, as the distance between hydrogen spin chains is about three times larger than the distance between adjacent protons within the chain. As a consequence of the distance dependence of the dipolar interaction and the quantum Zeno effect [3], this should lead to a separation in about three orders of magnitude between the intra and inter-chain time scales.
Analytical and numerical methods give exact expressions for the intensities of the multiple-quantum coherences in homogeneous one-dimensional linear chains of nuclear spins 1/2 coupled by nearest neighbor interactions [4]. As occurs with the XY (flip-flop) dynamics [5], the double-quantum dynamics has a simple mapping to non-interacting fermions under a Tight-Binding Hamiltonian [4]. As a consequence, only zero and second order coherences are expected in the case of a homogeneous chain. As predicted by theory, we find that all the coherences orders above two cancel out. In contrast, the dynamics of the same system under a different effective Hamiltonian shows higher orders of coherence, revealing that this is not a limitation of signal to noise ratio. Decoherence is tested through a form of Loschmidt echo experiment which reveals that in this quasi-1-d system, the double-quantum dynamics presents an exponential decay, in contrast with results in 3-d systems.

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4 - 8 June 2007 (smr.1844)

Title:

The effect of angular dependence of magnetization on electrical transport in GaMnAs/GaAs/GaMnAs heterostructures

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Abstract: Theoretical studies on spin-dependent transport in magnetic tunnel heterostructures consisting of two diluted magnetic semiconductors (DMS) separated by a nonmagnetic semiconductor (NMS) barrier, are carried in the limit of coherent regime by including the effect of angular dependence of the magnetizations in DMS. Based on parabolic valence band effective mass approximation and spontaneous magnetization of DMS electrodes, we obtain an analytical expression of angular dependence of transmission for DMS/NMS/DMS junctions. We also examine the dependence of spin polarization and tunneling magnetoresistance (TMR) on barrier thickness, temperature, applied voltage and the relative angle between the magnetizations of two DMS layers in GaMnAs/GaAs/GaMnAs heterostructures. We discuss the theoretical interpretation of this variation. Our results show that TMR of more than 65% are obtained at zero temperature, when one GaAs monolayer is used as a tunnel barrier. It is also shown that the TMR decreases rapidly with increasing barrier width and applied voltage; however at high voltages and low thicknesses, the TMR first increases and then decreases. Our calculations explain the main features of the recent experimental observations and the application of the predicted results may prove useful in designing nano spin-valve devices.

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Spatially resolved Raman spectroscopy of Single- and Few-Layer Graphene

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We present Raman spectroscopy measurements on single- and few-layer graphene flakes. Using a scanning confocal approach we collect spectral data with spatial resolution, which allows us to directly compare Raman images with scanning force micrographs [1,2]. Single-layer graphene can be distinguished from double- and few-layer graphene by the intensity of the G-line and by the width of the 2D line. The single peak of the 2D line for single-layer graphene splits into different peaks for the double-layer. The splitting increases with increasing number of layers. These findings are explained using the double-resonant Raman model based on ab-initio calculations of the electronic structure and of the phonon dispersion. The double-resonant model explains qualitatively well the splitting of the 2D line but fails to quantitatively predict the splitting. This indicates possible limitations of the model due to the neglect of electron-electron and electron-hole interaction (excitonic effects). Moreover, we investigate the D line intensity and find no defects within the flake. A finite D line response originates only from the edges of the flakes and can be attributed to the breakdown of translational symmetry.

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Activity SMR: **1844**

Conference on Quantum Phenomena in Confined Dimensions

4 June 2007 - 8 June 2007
Trieste - ITALY

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(with dates)

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Permanent Institute e mail haug@nano.uni-hannover.de

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
15.	**KIM Philip**	REPUBLIC OF KOREA	CONFERENCE SPEAKER	2-Jun-2007	6-Jun-2007

Permanent Institute:

Columbia University
Department of Physics
538 West 120th Street
New York NY 10027
UNITED STATES OF AMERICA

Permanent Institute e mail pk2015@columbia.edu, pkim@phys.columbia.edu

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
16.	**LE HUR Karyn**	FRANCE	CONFERENCE SPEAKER	2-Jun-2007	10-Jun-2007

Permanent Institute:

Yale University
Department of Physics
P.O.Box 208120
CT 06520-8120 New Haven
UNITED STATES OF AMERICA

Permanent Institute e mail karyn.lehur@yale.edu

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
17.	**LICHTENSTEIN Alexander**	GERMANY	CONFERENCE SPEAKER	2-Jun-2007	9-Jun-2007

Permanent Institute:

Universitat Hamburg
I. Institut fuer Theoretische Physik
Jungiusstr. 9
D-20355 Hamburg
GERMANY

Permanent Institute e mail alichten@physnet.uni-hamburg.de

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
18.	**LOSS Daniel**	SWITZERLAND	CONFERENCE SPEAKER	6-Jun-2007	9-Jun-2007

Permanent Institute:

University of Basel
Department of Physics & Astronomy
Klingelbergstrasse 82
CH-4056 Basel
SWITZERLAND

Permanent Institute e mail Daniel.Loss@unibas.ch

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
19.	**MASON Nadya**	UNITED STATES OF AMERICA	CONFERENCE SPEAKER	4-Jun-2007	8-Jun-2007

Permanent Institute:

University of Illinois at Urbana Champaign
Department of Physics
1110 West Green Street
Urbana IL 61801-3080
UNITED STATES OF AMERICA

Permanent Institute e mail masonn@uiuc.edu, mason@mrl.uiuc.edu

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
20.	**MORPURGO Alberto**	ITALY	CONFERENCE SPEAKER	3-Jun-2007	6-Jun-2007

Permanent Institute:

Delft University of Technology
Kavli Institute of Nanoscience
Molecular Electronics and Devices
Lorentzweg 1
2628 CJ Delft
NETHERLANDS

Permanent Institute e mail A.Morpurgo@tnw.tudelft.nl

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
21.	**NOVOSELOV Kostya**	RUSSIAN FEDERATION	CONFERENCE SPEAKER	5-Jun-2007	9-Jun-2007
	Permanent Institute: The University of Manchester School of Physics and Astronomy Oxford Road Manchester M13 9PL UNITED KINGDOM Permanent Institute e mail kostya@manchester.ac.uk				
22.	**PINCZUK Aron**	ARGENTINA	CONFERENCE SPEAKER	3-Jun-2007	8-Jun-2007
	Permanent Institute: Columbia University Department of Physics 538 West 120th Street New York NY 10027 UNITED STATES OF AMERICA Permanent Institute e mail aron@phys.columbia.edu				
23.	**ROTENBERG Eli**	UNITED STATES OF AMERICA	CONFERENCE SPEAKER	3-Jun-2007	9-Jun-2007
	Permanent Institute: Lawrence Berkeley National Laboratory Advanced Light Sources 1 Cyclotron Rd. CA 94720 Berkeley UNITED STATES OF AMERICA Permanent Institute e mail erotenberg@lbl.gov				
24.	**SKOLNICK Maurice S.**	UNITED KINGDOM	CONFERENCE SPEAKER	3-Jun-2007	8-Jun-2007
	Permanent Institute: Sheffield University Department of Physics and Astronomy Hicks Building Hounsfield Road S3 7RH Sheffield UNITED KINGDOM Permanent Institute e mail m.skolnick@sheffield.ac.uk				
25.	**TARUCHA Seigo**	JAPAN	CONFERENCE SPEAKER	3-Jun-2007	6-Jun-2007
	Permanent Institute: University of Tokyo Faculty of Science Department of Physics Bunkyo-Ku 7-3-1 Hongo 113-0033 Tokyo JAPAN Permanent Institute e mail tarucha@ap.t.u-tokyo.ac.jp				

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
26.	**YOUNG Robert James**	UNITED KINGDOM	**CONFERENCE SPEAKER**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Toshiba Research Europe Ltd.
260 Cambridge Science Park
Milton Road
CB4 0W Cambridge
UNITED KINGDOM

Permanent Institute e mail Robert.young@crl.toshiba.co.uk

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
27.	**YUZBASHYAN Emil**	RUSSIAN FEDERATION	**CONFERENCE SPEAKER**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Rutgers, the State University of New Jersey
Department of Physics and Astronomy
136 Frelinghuysen Road
Piscataway NJ 08854-8019
UNITED STATES OF AMERICA

Permanent Institute e mail eyuzbash@physics.rutgers.edu

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure

PARTICIPANT Total number in this function: 58

28. **ADAMYAN Arsen** ARMENIA **AFFILIATE** 21-May-2007 - 8-Jun-2007

Permanent Institute:
Yerevan State University
Dep.Physics of Semiconductors
Manoogian St. 1
375049 Yerevan
ARMENIA

Permanent Institute e mail arsadam@yahoo.com

29. **AHMED Mesbahuddin** BANGLADESH **SENIOR ASSOCIATE** 3-Jun-2007 - 13-Jul-2007

Permanent Institute:
University of Dhaka
Department of Physics
Ramna
1000 Dhaka
BANGLADESH

Permanent Institute e mail netproj@bdcom.com,mahmed@udhaka.net

30. **AMALORPAVAM John Peter** INDIA **PARTICIPANT** 3-Jun-2007 - 9-Jun-2007

Permanent Institute:
K.L.N. (KLN) College of Information Technology
Sivagangai District,
Tamilnadu
630611 Pottapalayam
INDIA

Permanent Institute e mail a.john.peter@gmail.com

31. **BALSEIRO Carlos Antonio** ARGENTINA **PARTICIPANT** 3-Jun-2007 - 8-Jun-2007

Permanent Institute:
Centro Atomico Bariloche
Comision Nacional de Energia Atomica
Avda Bustillo Km. 9500 (9,6)
Rio Negro
8400 San Carlos de Bariloche
ARGENTINA

Permanent Institute e mail balseiro@cab.cnea.gov.ar

32. **BARTHOLD Patrick** GERMANY **PARTICIPANT** 3-Jun-2007 - 9-Jun-2007

Permanent Institute:
University of Hannover
Institute of Solid State Physics
Appelstr. 2
D-30167 Hannover
GERMANY

Permanent Institute e mail barthold@nano.uni-hannover.de

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival Departure
33.	**BASKO Denis Mikhailovich**	RUSSIAN FEDERATION	PARTICIPANT	1-Jun-2007 - 20-Jun-2007

Present institute:
Columbia University
Department of Physics
538 West 120th Street
New York NY 10027
United States of America
Present Institute e mail basko@phys.columbia.edu
Until when: **27 SEPTEMBER 2007**

No.	NAME and INSTITUTE	Nationality	Function	Dates
34.	**BEGUM Narjis**	PAKISTAN	PARTICIPANT	6-Feb-2007 - 5-Aug-2007

Permanent Institute:
COMSATS (Commission On Science & Tech. for Sustainable Development in the South)
Institute of Information Technology
Department of Physics
Plot no. 30 Sector H-8/1
park Road
Chak Shahzad
Islamabad
PAKISTAN

Present institute:
Laboratorio TASC
INFM
Palazzina MM
S.S. 14 Km. 163.5 Basovizza
34012 Trieste
Italy
Until when: **5 AUGUST 2007**

No.	NAME and INSTITUTE	Nationality	Function	Dates
35.	**BEN CHOUIKHA Wiem**	TUNISIA	PARTICIPANT	3-Jun-2007 - 9-Jun-2007

Permanent Institute:
Universite de Tunis
Faculte Des Sciences
D. de Physique
Campus Universitaire
Le Belvedere
1060 Tunis
TUNISIA
Permanent Institute e mail wiem.benchouikha@fst.rnu.tn

No.	NAME and INSTITUTE	Nationality	Function	Dates
36.	**BHATTACHARJEE Aranya Bhuti**	INDIA	PARTICIPANT	31-May-2007 - 9-Jun-2007

Permanent Institute:
University of Delhi
Atma Ram Sanatan Dharma College
Department of Physics
Dhaula Khan
110021 New Delhi
INDIA
Permanent Institute e mail bhattach@df.unipi.it

Present institute:
Max-Planck-Institut fur Physik Komplexer Systeme
Noethnitzer Strasse 38
D-01187 Dresden
Germany
Present Institute e mail bhattach@df.unipi.it
Until when: **26 DECEMBER 2007**

No.	NAME and INSTITUTE	Nationality	Function	Dates
37.	**CHEN Xiaoyu**	PEOPLE'S REPUBLIC OF CHINA	PARTICIPANT	3-Jun-2007 - 9-Jun-2007

Permanent Institute:
Zhejiang Gongshang University
College of Information & Electronic Engineering
Xuezheng Street
Xiasha Higher Education Zone
Hangzhou
PEOPLE'S REPUBLIC OF CHINA
Permanent Institute e mail drxychen@yahoo.com.cn

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
38.	**CHUDNOVSKIY Alexander Lvovich**	GERMANY	**PARTICIPANT**	3-Jun-2007	8-Jun-2007

Permanent Institute:

Universitat Hamburg
I. Institut fuer Theoretische Physik
Jungiusstr. 9
D-20355 Hamburg
GERMANY

Permanent Institute e mail achudnov@physik.uni-hamburg.de

39.	**CREPIEUX Adeline Claire**	FRANCE	**PARTICIPANT**	3-Jun-2007	8-Jun-2007

Permanent Institute:

Centre National de la Recherche Scientifique
Centre de Physique Theorique
Faculte des Sciences
163 Avenue de Luminy
Case 907
13009 Marseille Cedex 09
FRANCE

Permanent Institute e mail crepieux@cpt.univ-mrs.fr

40.	**CSERTI Jozsef**	HUNGARY	**PARTICIPANT**	3-Jun-2007	9-Jun-2007

Permanent Institute:

Eotvos Lorand University
Department of Physics of Complex Systems
Pazmany P. Setany 1/A
H-1117 Budapest
HUNGARY

Permanent Institute e mail cserti@complex.elte.hu

41.	**CUANSING Eduardo Chaves**	PHILIPPINES	**PARTICIPANT**	2-Jun-2007	8-Jun-2007

Permanent Institute:

De La Salle University
Department of Physics
2401 Taft Avenue
1004 Malate Manila
PHILIPPINES

Permanent Institute e mail cuansinge@dlsu.edu.ph

42.	**DELGADO GRAN Alain**	CUBA	**JUNIOR ASSOCIATE**	21-May-2007	19-Aug-2007

Permanent Institute:

Center of Technology Applications and Nuclear Development
(CEADEN)
Calle 30, No. 502 e/ 5ta y 7ma
Apartado Postal 6122
Miramar
11300 Havana
CUBA

Permanent Institute e mail GRAN@CEADEN.EDU.CU

Present institute:

Center of Mathematics and Theoretical Physics - ICIMAF
Calle e #309
Vedado
Ciudad Habana
10400 Havana
Cuba

Until when: **31 JANUARY 2008**

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
43.	**DESPOJA Vito**	CROATIA	**PARTICIPANT**	3-Jun-2007	9-Jun-2007

Permanent Institute:

University of Zagreb
Faculty of Science
Department of Physics
Bijenicka Cesta 32
P.O. Box 162
10000 Zagreb
CROATIA

Permanent Institute e mail vito@phy.hr

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
44.	**EGBLEWOGBE Martin Nana Yaw Hama**	GHANA	**PARTICIPANT**	3-Jun-2007	9-Jun-2007

Permanent Institute:

University of Ghana
Department of Physics
P.O. Box 63
Legon
Accra
GHANA

Permanent Institute e mail nanayaw@ug.edu.gh

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
45.	**FAUZI Mohammad Hamzah**	INDONESIA	**PARTICIPANT**	3-Jun-2007	10-Jun-2007

Permanent Institute:

Bandung Institute of Technology
Fac. of Science & Mathematics
Department of Physics
Jl. Ganesha 10
P.O. Box 273
40132 Bandung
INDONESIA

Permanent Institute e mail hamzah_f@students.itb.ac.id

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
46.	**FOTSA NGAFFO Fernande**	REPUBLIC OF CAMEROON	**JUNIOR ASSOCIATE**	9-Apr-2007	22-Jun-2007

Permanent Institute:

University of the Witwatersrand
School of Physics
Material Physics Institute
Advanced Nano Material and Nanoscale
Physics Laboratory
Private Bag 3
Wits 2050
Johannesburg
SOUTH AFRICA

fernande.fotsa@le.infn.it

Permanent Institute e mail fotsaf@science.pg.wits.ac.za

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
47.	**FRANCHINI Fabio**	ITALY	**PARTICIPANT**	12-Oct-2006	11-Oct-2008

Permanent Institute:

State University of New York at Stony Brook
Department of Physics and Astronomy
Stony Brook NY 11794-3800
UNITED STATES OF AMERICA

Permanent Institute e mail fabio.franchini@stonybrook.edu

Present institute:

The Abdus Salam International Centre for Theoretical Physics
Condensed Matter Section
Strada Costiera 11
34014 Trieste
Italy

Until when: **11 OCTOBER 2008**

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
48.	**GUMHALTER Branko**	CROATIA	**PARTICIPANT**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Institute of Physics
P.O. Box 304
Bijenicka Cesta 46
10001 Zagreb
CROATIA

Permanent Institute e mail branko@ifs.hr

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
49.	**HERNANDEZ NUNEZ Alexis Ricardo**	VENEZUELA	**PARTICIPANT**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Centro Brasileiro de Pesquisas Fisicas - CBPF
Brazilian Centre for Research in Physics
Rua Dr. Xavier Sigaud 150
Urca
22290-180 Rio de Janeiro
BRAZIL

Permanent Institute e mail chechi@cbpf.br

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
50.	**HO Trung Dung**	VIET NAM	**REGULAR ASSOCIATE**	1-Apr-2007 -	30-Jun-2007

Permanent Institute:

National Centre For Natural Science and Technology
Institute of Physics
1 Mac Dinh Chi St.
1St District
Ho Chi Minh
VIET NAM

THEORPHYS@HCM.VNN.VN

Permanent Institute e mail thdung@ioph.ncst-south.ac.vn

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
51.	**HONERKAMP Carsten**	GERMANY	**PARTICIPANT**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Institute for Theoretical Physics & Astrophysics
University of Wurzburg
Am Hubland
D-97074 Wurzburg
GERMANY

Permanent Institute e mail honerkamp@physik.uni-wuerzburg.de

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
52.	**KASHUBA Oleksiy Mykolayovych**	UKRAINE	**PARTICIPANT**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

University of Lancaster
Department of Physics
LA1 4YB Lancaster
UNITED KINGDOM

Permanent Institute e mail o.kashuba@lancaster.ac.uk

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
53.	**KECHEDZHI Kostyantyn**	UKRAINE	**PARTICIPANT**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

University of Lancaster
Department of Physics
LA1 4YB Lancaster
UNITED KINGDOM

Permanent Institute e mail k.kechedzhi@lancaster.ac.uk

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
54.	**KHVESHCHENKO Dmitry**	RUSSIAN FEDERATION	**PARTICIPANT**	5-Jun-2007 -	8-Jun-2007

Permanent Institute:

University of North Carolina
College of Arts and Sciences
Dept. Physics and Astronomy
CB 3255 Phillips Hall
Chapel Hill NC 27599-3255
UNITED STATES OF AMERICA

Permanent Institute e mail khvesh@physics.unc.edu

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
55.	**LAVAGNA Mireille**	FRANCE	**PARTICIPANT**	2-Jun-2007 -	8-Jun-2007

Permanent Institute:

CEA - Centre D'Etudes Nucleaires de Grenoble
SPSMS/DRFMC
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17 Rue Des Martyrs
38054 Grenoble Cedex 9
FRANCE

Permanent Institute e mail mireille.lavagna@cea.fr

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
56.	**LIANG Shidong**	PEOPLE'S REPUBLIC OF CHINA	**PARTICIPANT**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

School of Physics & Engineering
Zhongshan (Sun Yat-Sen) University
Guangzhou 510275
PEOPLE'S REPUBLIC OF CHINA

Permanent Institute e mail stslsd@mail.sysu.edu.cn

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
57.	**LUEDTKE Thomas**	GERMANY	**PARTICIPANT**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

University of Hannover
Institute of Solid State Physics
Appelstr. 2
D-30167 Hannover
GERMANY

Permanent Institute e mail luedtke@nano.uni-hannover.de

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
58.	**MATHEW Vincent**	INDIA	**PARTICIPANT**	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Saint Thomas College
Dept.of Physics
Palai, Kottayam Dist.
686574 Kerala
INDIA

Permanent Institute e mail vincent@stcp.ac.in, vincentmathew@rediffmail.com

Present institute:

University of Pecs
Institute of Physics
Ifjusag u. 6
7624 Pecs
Hungary

Until when: **31 JULY 2007**

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
59.	**MOLITOR Francoise Alice Jacqueline** Permanent Institute: Eidgenossiche Technische Hochschule ETH Zurich Solid State Physics Laboratory Nanophysics Group Schaffmattstrasse 16 8093 Zurich SWITZERLAND Permanent Institute e mail fmolitor@phys.ethz.ch	LUXEMBOURG	**PARTICIPANT**	3-Jun-2007	9-Jun-2007
60.	**MON PEREZ Elis** Permanent Institute: Universidad de las Ciencias Informaticas (UCI) Carretera a San Antonio de los Banos Km 2 1/2, Reparto Torrens, Boyeros Havana CUBA Permanent Institute e mail elis@uci.cu	CUBA	**PARTICIPANT**	3-Jun-2007	9-Jun-2007
61.	**NGUYEN Thi Que Huong** Permanent Institute: Marshall University Physics Department One John Marshall Drive WV Huntington 25701 UNITED STATES OF AMERICA Permanent Institute e mail nguyenh@marshall.edu	VIET NAM	**PARTICIPANT**	3-Jun-2007	9-Jun-2007
62.	**NGUYEN Tri Lan** Permanent Institute: Institute of Physics and Electronics Vietnamese Academy of Science and Technology (VAST) formerly called National Center for Natural Science and Technology (NCST) 10 Dao Tan, Ba Dinh 10000 Hanoi VIET NAM	VIET NAM	**AFFILIATE**	1-Jun-2007	10-Jul-2007
63.	**NKRUMAH-BUANDOH George Kofi** Permanent Institute: University of Ghana Department of Physics P.O. Box 63 Legon Accra GHANA Permanent Institute e mail CSUCC@GHANA.COM. LAFOC@NCS.GH.COM	GHANA	**JUNIOR ASSOCIATE**	28-May-2007	10-Aug-2007

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
64.	**NOSSA MARQUEZ Javier Francisco**	COLOMBIA	**AFFILIATE**	2-Jun-2007	10-Jun-2007

Permanent Institute:

Universidad de Los Andes
Facultad de Ciencias
Departamento de Fisica
Calle 18A. 10 1E
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4976 Bogota
COLOMBIA

Permanent Institute e mail ja-nossa@uniandes.edu.co

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
65.	**NOVOSEL Nikolina**	CROATIA	**PARTICIPANT**	3-Jun-2007	9-Jun-2007

Permanent Institute:

University of Zagreb
Faculty of Science
Department of Physics
Bijenicka Cesta 32
P.O. Box 162
10000 Zagreb
CROATIA

Permanent Institute e mail nnovosel@py.hr

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
66.	**PAN Hui**	PEOPLE'S REPUBLIC OF CHINA	**PARTICIPANT**	3-Jun-2007	9-Jun-2007

Permanent Institute:

Beihang University
Department of Physics
37 Xueyang Rd. Haidian District
100083 Beijing
PEOPLE'S REPUBLIC OF CHINA

Permanent Institute e mail hpan@buaa.edu.cn, huipan@tsinghua.org.cn

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
67.	**PEREIRA Joan Milton**	BRAZIL	**PARTICIPANT**	3-Jun-2007	9-Jun-2007

Permanent Institute:

Universidade Federal do Ceara
Departamento de Fisica
Campus do Pici
Caixa Postal 6030
60455-970 Fortaleza
Ceara
BRAZIL

Permanent Institute e mail pereira@fisica.ufc.br

Present institute:

University of Antwerpen (RUCA)
Department of Physics
Groenenborgerlaan 171
B-2020 Antwerp
Belgium

Until when: **30 JULY 2007**

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
68.	**QUADER Khandker Fazlul**	UNITED STATES OF AMERICA	**PARTICIPANT**	4-Jun-2007	9-Jun-2007

Permanent Institute:

Kent State University
Department of Physics
P.O. Box 5190
Ohio
44242-0001 Kent
UNITED STATES OF AMERICA

Permanent Institute e mail quader@scorpio.kent.edu

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
69.	**ROMEO Francesco**	ITALY	PARTICIPANT	3-Jun-2007	9-Jun-2007

Permanent Institute:

Universita degli Studi di Salerno
Dipartimento di Fisica 'E.R. Caianiello'
Via S. Allende
84081 Baronissi
ITALY

Permanent Institute e mail fromeo@sa.infn.it

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
70.	**ROMITO Alessandro**	ITALY	PARTICIPANT	3-Jun-2007	14-Jun-2007

Permanent Institute:

The Weizmann Institute of Science
Department of Condensed Matter Physics
76100 Rehovot
ISRAEL

Permanent Institute e mail alessandro.romito@weizmann.ac.il

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
71.	**RUFEIL FIORI Elena**	ARGENTINA	PARTICIPANT	2-Jun-2007	10-Jun-2007

Permanent Institute:

Universidad Nacional de Cordoba
Fac. Matematica, Astronomia y Fisica (Fa.M.A.F.)
Medina Allende y Haya de la Torre
Ciudad Universitaria
5000 Cordoba
ARGENTINA

Permanent Institute e mail rufeil@famaf.unc.edu.ar

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
72.	**RUSSELL Alan**	UNITED KINGDOM	PARTICIPANT	3-Jun-2007	9-Jun-2007

Permanent Institute:

University of Lancaster
Department of Physics
LA1 4YB Lancaster
UNITED KINGDOM

Permanent Institute e mail a.russell2@lancaster.ac.uk

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
73.	**RUTONJSKI Milica**	REPUBLIC OF SERBIA	AFFILIATE	2-Jun-2007	9-Jun-2007

Permanent Institute:

University of Novi Sad
Institute of Physics
Faculty of Physics
Trg Dositeja Obradovica 4
21000 Novi Sad
REPUBLIC OF SERBIA

Permanent Institute e mail milman@im.ns.ac.yu

No.	NAME and INSTITUTE	Nationality	Function	Arrival	Departure
74.	**SAVCHENKO Alexander K.**	UNITED KINGDOM	PARTICIPANT	3-Jun-2007	9-Jun-2007

Permanent Institute:

University of Exeter
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Stocker Road
EX4 4QL Exeter
UNITED KINGDOM

Permanent Institute e mail a.k.savchenko@ex.ac.uk

No.	NAME and INSTITUTE	Nationality	Function	Dates Arrival	Departure
75.	**SHOKRI Ali Asghar**	ISLAMIC REPUBLIC OF IRAN	PARTICIPANT	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Institute for Studies in Theoretical Physics & Mathematics (IPM)
Department of Nano-Science
Computational Physical Science Research Lab.
P.O. Box 19395-55531
Tehran
ISLAMIC REPUBLIC OF IRAN

Permanent Institute e mail aashokri@nano.ipm.ac.ir

Present institute:

Payame Noor University
Physics Department
Center of Tehran
Nejatollahi St.
Fallahpour St.
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Islamic Republic of Iran

Present Institute e mail aashokri@nano.ipm.ac.ir, aashokri@yahoo.com

Until when: **31 DECEMBER 2007**

76.	**SIMO Elie**	REPUBLIC OF CAMEROON	REGULAR ASSOCIATE	9-Apr-2007 -	8-Jul-2007

Permanent Institute:

Universite' de Yaounde' I
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P.O. Box 812
Yaounde
REPUBLIC OF CAMEROON

Permanent Institute e mail esimoch@yahoo.fr

77.	**STAMPFER Christoph**	ITALY	PARTICIPANT	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Eidgenossiche Technische Hochschule
ETH Zurich
Solid State Physics Laboratory
Nanophysics Group
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8093 Zurich
SWITZERLAND

Permanent Institute e mail stampfer@phys.ethz.ch

78.	**TAGLIACOZZO Arturo**	ITALY	PARTICIPANT	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Universita' di Napoli 'Federico II'
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Complesso Universitario
Monte S. Angelo
Via Cintia
80126 Napoli
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Permanent Institute e mail arturo@na.infn.it

79.	**TEBER Sofian**	FRANCE	PARTICIPANT	3-Jun-2007 -	9-Jun-2007

Permanent Institute:

Centre National de La Recherche Scientifique
Laboratoire Louis Neel
25. Avenue Des Martyrs
B.P. 166X
38042 Grenoble Cedex 9
FRANCE

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