Newsletter
April 2012

QSIT Quantum Science and Technology
National Centre of Competence in Research

1. Scientific News:

Klaus Ensslin's, Thomas Ihn's, and Andreas Wallraff's groups, Zurich:

Dipole-coupling of a double quantum dot to a microwave resonator: We demonstrate the realization of a hybrid solid-state quantum device, in which a semiconductor double quantum dot is dipole coupled to the microwave field of a superconducting coplanar waveguide resonator. The double dot charge stability diagram extracted from measurements of the amplitude and phase of a microwave tone transmitted through the resonator is in good agreement with that obtained from transport measurements. Both the observed frequency shift and line width broadening of the resonator are explained considering the double dot as a charge qubit coupled with a strength of several tens of MHz to the resonator.

- T. Frey, P. J. Leek, A. Blais, M. Beck, T. Ihn, K. Ensslin, and A. Wallraff; **Phys. Rev. Lett. 108**, 046807 (2012): http://prl.aps.org/abstract/PRL/v108/i4/e046807

Tilman Esslinger's group, Zurich:

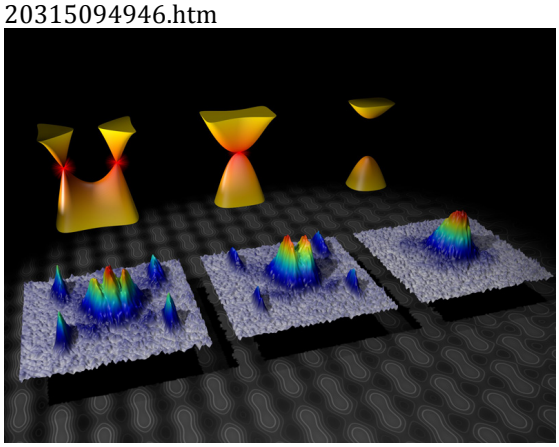
Cold atoms simulate graphene: Scientists in the group used a set of laser beams to create a honeycomb-like structure similar to that found in graphene. By loading ultracold atoms into this optical lattice, they can simulate electronic properties of this promising material. Such experiments may be used to identify electronic properties of materials, which have yet to be discovered.

- L. Tarruell, D. Greif, T. Uehlinger, G. Jotzu & T. Esslinger, ***Nature* 483**, 302–305: http://www.nature.com/nature/journal/v483/n7389/full/nature10871.html

- ETH Life: http://www.ethlife.ethz.ch/archive_articles/120315_Dirac_Point_su/index_EN

- Neue Zürcher Zeitung March 21, 2012

- Science daily: http://www.sciencedaily.com/releases/2012/03/120315094946.htm



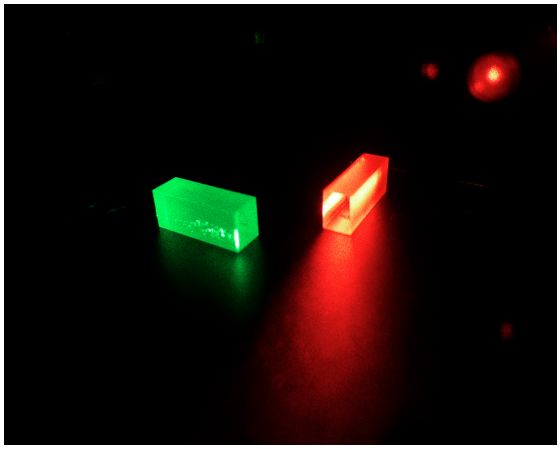
Jérôme Faist's group, Zurich:

Ultrastrong light-matter coupling in the THz range: Scientists in this group have created an hybrid light-matter particle combining an extremely clean gas of electrons orbiting in a magnetic field with a meta-surface of subwavelength metallic resonators. The energy exchange between the light and the matter part of this magnetopolariton happens almost as fast as the electromagnetic field oscillation itself. This realization can lead to observation of a modification of the quantum vacuum state of the system.

- G. Scalari, C. Maissen, D. Turcinková, D. Hagenmüller, S. De Liberato, C. Ciuti, C. Reichl, D. Schuh, W. Wegscheider, M. Beck, J. Faist; Ultrastrong coupling of the cyclotron transition of a 2D electron gas to a THz metamaterial; ***Science,* 335** (6074), 1323: http://www.sciencemag.org/content/335/6074/1323.full.html

Nicolas Gisin's group, Geneva:

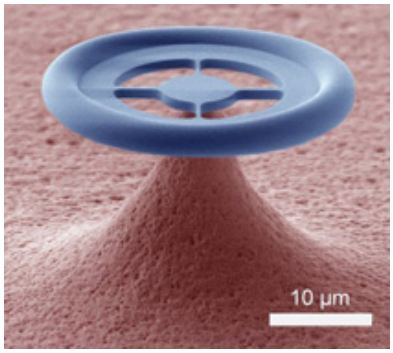
A quantum wedding of two crystals: Quantum networks require the crucial ability to entangle quantum nodes. A prominent example is the quantum repeater, which allows overcoming the distance barrier of direct transmission of single photons, provided remote quantum memories can be entangled in a heralded fashion. Building on our recent progress with quantum memories based on rare-earth-ions-doped crystals, we have recently demonstrated heralded entanglement between two quantum nodes. The entanglement is created by storing a spatially delocalized heralded single photon state into the memories. Then, the entanglement is revealed by mapping it back to optical modes and by performing quantum state tomography on the retrieved state. Our results show that two macroscopic crystals can be entangled together in an heralded fashion. This brings quantum networks based on solid-state devices one step closer.



- Imam Usmani, Christoph Clausen, Félix Bussières, Nicolas Sangouard, Mikael Afzelius & Nicolas Gisin. ***Nature Photonics*** **6**, 234–237 (2012): http://www.nature.com/nphoton/journal/v6/n4/full/nphoton.2012.34.html
- Press release from Geneva University: http://www.unige.ch/communication/communiques/2012/CdP120305.html
- Interview avec Nicolas Gisin à la radio TSR Impatience, Mars 8, en français: http://www.nccr-qsit.ethz.ch/news/gisin

Tobias Kippenberg's group, Lausanne:

Quantum-coherent coupling of a mechanical oscillator to an optical cavity mode. Optical laser fields have been widely used to achieve quantum control over the motional and internal degrees of freedom of atoms and ions, molecules and atomic gases. A route to controlling the quantum states of macroscopic mechanical oscillators in a similar fashion is to exploit the parametric coupling between optical and mechanical degrees of freedom through radiation pressure in suitably engineered optical cavities. If the optomechanical coupling is 'quantum coherent'—that is, if the coherent coupling rate exceeds both the optical and the mechanical decoherence rate—quantum states are transferred from the optical field to the mechanical oscillator and vice versa. This transfer allows control of the mechanical oscillator state using the wide range of available quantum optical techniques. So far, however, quantum-coherent coupling of micromechanical oscillators has only been achieved using microwave fields at millikelvin temperatures. Optical experiments have not attained this regime owing to the large mechanical decoherence rates and the difficulty of overcoming optical dissipation. Here quantum-coherent coupling between optical photons and a micromechanical oscillator is achieved. Simultaneously, coupling to the cold photon bath cools the mechanical oscillator to an average occupancy of 1.7 ± 0.1 motional quanta. Excitation with weak classical light pulses reveals the exchange of energy between the optical light field and the micromechanical oscillator in the time domain at the level of less than one quantum on average. This optomechanical system establishes an efficient quantum interface between mechanical oscillators and optical photons, which can provide decoherence-free transport of quantum states through optical fibres. Our results offer a route towards the use of mechanical oscillators as quantum transducers or in microwave-to-optical quantum links.



- E. Verhagen, S. Deléglise, S. Weis, A. Schliesser and T. J. Kippenberg. ***Nature*** **482**, 63–67 (2012): http://www.nature.com/nature/journal/v482/n7383/abs/nature10787.html
- Neue Zürcher Zeitung: http://www.nzz.ch/nachrichten/hintergrund/wissenschaft/mit_der_kraft_des_lichts_1.14864713.html
- Press release of the SNSF: http://www.snf.ch/E/CURRENT/Pages/default.aspx?NEWSID=1613&WEBID=F6B532FB-64ED-466F-8816-193D4DE8DC94

Daniel Loss' group, Basel

Long-Distance Spin-Spin Coupling via Floating Gates: Synopsis: Floating Gates

The spin of an electron can act as a qubit—the on/off switch that is the building block of a quantum computer. In 1998, in a paper in Physical Review A, Daniel Loss and David DiVincenzo presented a scenario for implementing spin qubits in semiconductor quantum dots. Considerable experimental progress has since been made, evidenced in particular by longer decoherence times—the time after which the spin's phase irreversibly changes—that are now around 270 microseconds, an improvement of 7 orders of magnitude.

One barrier to building a scalable quantum computer remains: how to accommodate sufficient qubits in an arrangement without overrunning it with wires and metallic gates. In a paper in Physical Review X, Luka Trifunovic at the University of Basel, Switzerland, and his coauthors propose a setup using a two-dimensional array of quantum dots to address this challenge by spacing dots far enough apart to provide sufficient gaps for wirings and gates, while bridging the distance with a mechanism to enable long-range interdot tunnel coupling of sufficient strength.

Central to the proposal is an ingenious architecture that connects dots in a two-dimensional electron gas with floating metallic gates (classical objects), leading to a robust entanglement (a quantum phenomenon) between spin qubits that are some distance apart. The authors claim that the technology to build this configuration, a seemingly substantive step towards a full-scale quantum computer, already exists. - Sami Mitra

- Luka Trifunovic, Oliver Dial, Mircea Trif, James R. Wootton, Rediet Abebe, Amir Yacoby, and Daniel Loss; Phys. Rev. X 2, 011006 (2012): http://physics.aps.org/synopsis-for/10.1103/PhysRevX.2.011006

Patrick Maletinsk's group, Basel:

Starting February 1st, the "Quantum-sensing" group has launched its research activities at the University of Basel. The group will explore and apply quantum systems for various high-performance sensing applications. A particular focus will lie on nanoscale sensing and imaging of minute quantities such as magnetic fields emerging from single electronic spins or lattice distortions generated by individual phonons. While we will explore various possible quantum-systems for such applications, the workhorse for our experiments will be the "Nitrogen-Vacancy" center in diamond whose excellent quantum-coherent properties (which persist up to room-temperature!) make it a nearly ideal quantum sensor.

We have recently finalized our first paper on nanoscale imaging using a single, scanning NV center. This work was performed over the last two years at Harvard University and presents a conceptually completely novel way to implement scanning-probe microscopy using a single quantum system. Due to the robustness and versatility of our approach, this technique will also form the basis of our experiments in Basel. The paper is currently in print in Nature Nanotechnology (DOI: 10.1038/NNANO.2012.50); a preprint can be found under http://arxiv.org/abs/1108.4437

Currently, we also have job-openings on the masters-, Ph.D.- and postdoc-level.

Please visit our homepage
http://quantum-sensing.physik.unibas.ch
or contact P. Maletinsky
(patrick.maletinsky@unibas.ch) for further details.

Martino Poggio's group, Basel:

On November 21st, Physical Review B published our paper, "Measurement of statistical nuclear spin polarization in a nanoscale GaAs sample". The publication was selected as an Editors' Suggestion. The papers concerns the measurement of the statistical polarization of quadrupolar nuclear spins in a submicrometer (0.6 μm^3) particle of GaAs using magnetic resonance force microscopy. The crystalline sample is cut out of a GaAs wafer and attached to a micromechanical cantilever force sensor using a focused ion beam technique. Nuclear magnetic resonance is demonstrated on ensembles containing less than 5×10^8 nuclear spins and occupying a volume of around $(300\ nm)^3$ in GaAs with reduced volumes possible in future experiments. We discuss how the further reduction of this detection volume will bring the spin ensembles into a regime where random spin fluctuations, rather than Boltzmann polarization, dominate their dynamics. The detection of statistical polarization in GaAs therefore represents an important first step toward 3D magnetic resonance imaging of III-V structures on the nanometer scale.

- Fei Xue (薛飞), D. P. Weber, P. Peddibhotla, and M. Poggio, **Phys. Rev. B 84**, 205328 (2011): http://dx.doi.org/10.1103/PhysRevB.84.205328

Renato Renner's and Nicolas Gisin's groups, Zurich/Geneva:

Reassure security in quantum cryptography: Despite enormous theoretical and experimental progress in quantum cryptography, the security of most current implementations of quantum key distribution is still not rigorously established. One significant problem is that the security of the final key strongly depends on the number, *M*, of signals exchanged between the legitimate parties. Existing security proofs are often only valid asymptotically, for unrealistically large values of *M*. Another challenge is that most security proofs are very sensitive to small differences between the physical devices used by the protocol and the theoretical model used to describe them. Here they show that these gaps between theory and experiment can be simultaneously overcome by using a recently developed proof technique based on the uncertainty relation for smooth entropies.

- Marco Tomamichel, Charles Ci Wen Lim, Nicolas Gisin & Renato Renner: Tight finite-key analysis for quantum cryptography. ***Nature Communications*** 3:634 doi: 10.1038/ncomms1631 (2012): http://www.nature.com/ncomms/journal/v3/n1/full/ncomms1631.html
- Licht aus für Hacker: Sonntagszeitung 12.2.2012
- ETH Life: http://www.ethlife.ethz.ch/archive_articles/120124_sichere_Quantenkryptographie_su/index

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Christian Schönenberger's group, Basel

Spontaneously Gapped Ground State in Suspended Bilayer Graphene: Bilayer graphene bears an eightfold degeneracy due to spin, valley, and layer symmetry, allowing for a wealth of broken symmetry states induced by magnetic or electric fields, by strain, or even spontaneously by interaction. We have studies the electrical transport in ultraclean current annealed suspended bilayer graphene. Two type of devices can be distinguished: In bilayers of type B 1 the eightfold zero-energy Landau level is partially lifted above a threshold field revealing an insulating nu=0 quantum-Hall state at the charge neutrality point. In bilayers of type B 2 the Landau level lifting is full and a gap appears in the differential conductance even at zero magnetic and electric field, suggesting an insulating spontaneously broken symmetry state. Unlike B 1, the minimum conductance in B 2 is not exponentially suppressed, but remains finite with a value G of order $e^{2/h}$ even in a large magnetic field. We suggest that this phase of B 2 is insulating in the bulk and bound by compressible edge states.
- F. Freitag, J. Trbovic, M. Weiss, and C. Schönenberger, **Phys. Rev. Lett. 108**, 076602 (2012) : http://prl.aps.org/abstract/PRL/v108/i7/e076602

Quantum Hall effect in graphene with superconducting electrodes: We have realized an integer quantum Hall system with superconducting contacts by connecting graphene to niobium electrodes. Below their upper critical field of 4 T, an integer quantum Hall effect coexists with superconductivity in the leads but with a plateau conductance that is larger than in the normal state. We ascribe this enhanced quantum Hall plateau conductance to Andreev processes at the graphene-superconductor interface leading to the formation of so-called Andreev edge-states. The enhancement depends strongly on the filling-factor and is less pronounced on the first plateau due to the special nature of the zero energy Landau level in monolayer graphene.
- P. Rickhaus, M. Weiss, L. Marot, and C. Schönenberger,; Nano Letters (in press), **DOI:** 10.1021/nl20441

Phillip Treutlein's group, Basel

Hybrid optomechanical system in the media: In a recent paper, the Treutlein group reported the experimental realization of a hybrid atom-membrane optomechanical system (Phys. Rev. Lett. 107, 223001 (2011)). In their experiment, an optical lattice couples laser-cooled ultracold atoms to the vibrations of a micromechanical membrane oscillator. Such hybrid systems offer a novel approach to controlling mechanical systems in the quantum regime. This work triggered some further articles in newspapers and journals addressed at a broad audience:
- Frankfurter Allgemeine Zeitung, "An der Schnittstelle zwischen zwei Welten", 24.03.2011, by M. Lindinger: http://www.faz.net/aktuell/wissen/physik-chemie/makroskopische-quantenphaenomene-an-der-schnittstelle-zwischen-zwei-welten-1610164.html

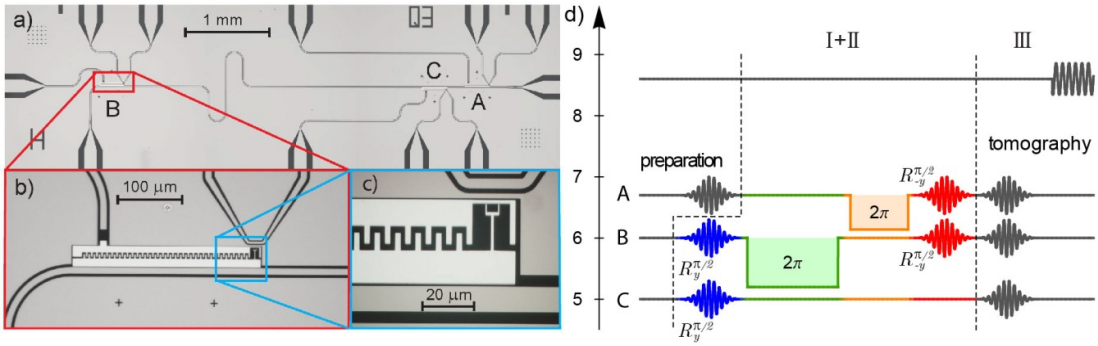
- Physik Journal 01/2012, p. 20, "Atomare Dämpfer", by K. Hammerer (University of Hannover): http://www.pro-physik.de/details/physikjournalIssue/1430829/PJ_01_2012.html

- Physics Viewpoint by A. Schliesser and T. Kippenberg (EPFL), Physics 4, 97 (2011): http://physics.aps.org/articles/v4/97

Andreas Wallraff's group, Zurich

Benchmarking a Quantum Teleportation Protocol in Superconducting Circuits Using Tomography and an Entanglement Witness: Teleportation of a quantum state may be used for distributing entanglement between distant qubits in quantum communication and for quantum computation. In this publication, the group of Andreas Wallraff at ETH Zurich demonstrated the implementation of a teleportation protocol, up to the single-shot measurement step, with superconducting qubits coupled to a microwave resonator. Using full quantum state tomography and evaluating an entanglement witness, they show that the protocol generates a genuine tripartite entangled state of all three qubits. Calculating the projection of the measured density matrix onto the basis states of two qubits allows them to reconstruct the teleported state. Repeating this procedure for a complete set of input states they find an average output state fidelity of the teleportation process of 86%.

- M. Baur, A. Fedorov, L. Steffen, S. Filipp, M. P. da Silva, and A. Wallraff ***Phys. Rev. Lett.*** 108, 040502 (2012): http://prl.aps.org/abstract/PRL/v108/i4/e040502



Implementation of a Toffoli gate with superconducting circuits*:* The Toffoli gate is a three-qubit operation that inverts the state of a target qubit conditioned on the state of two control qubits. It enables universal reversible classical computation, forms a universal set of gates in quantum computation together with a Hadamard gate and is also a key element in quantum error correction schemes. Here, Andreas Wallraff and colleagues at ETH-Zurich demonstrated the implementation of a Toffoli gate with three superconducting transmon qubits coupled to a microwave resonator. By exploiting the third energy level of the transmon qubit, the number of elementary gates needed for the implementation of the Toffoli gate has been greatly reduced in comparison to theoretical proposals using two-level systems only. The gate fidelity evaluated with use of full process tomography and Monte Carlo process certification is found to be 68.5±0.5%. The results reinforce the potential of macroscopic superconducting qubits for implementation of complex quantum operations and point at the possibility to implement quantum error correction schemes.

- Fedorov, L. Steffen, M. Baur, M. P. da Silva, and A. Wallraff: ***Nature* 481**, 170–172 (2012)*:* http://www.nature.com/nature/journal/v481/n7380/full/nature10713.html

Media Article:
December 15, 2011
Eliminating errors in quantum computing, ETH life (Simone Ulmer):
http://www.ethlife.ethz.ch/archive_articles/111215_Toffoli_Gatter_su/index_EN

2. Awards and grants:

Christian Schönenberger, University of Basel, was awarded an ERC-Advanced Investor Grant from the European Research Council. The funded project focuses on the physics of entangled pairs of electrons – a subject previously little studied experimentally in quantum mechanics. The research aims to provide an important basis for the development of quantum computers and new, secure encryption possibilities..
Press release by the University of Basel:
http://www.unibas.ch/index.cfm?uuid=1E0ABB6595BEDD215455271FA1A0D458&type=search&show_long=1&o_lang_id=2

3. Recent Events

First Site Visit
December 8 - 9, 2011, ETH Science City

NCCR QSIT went through its first review in December 2011. The review panel consisting entirely of internationally highly respected scientists delivered a detailed assessment on the scientific activities of all projects as well as on our efforts on the advancement of women and young scientists, technology transfer, outreach and communication. The overall evaluation is very positive and details what NCCR QSIT researchers have achieved over the first year. In particular the overall scientific strategy of NCCR QSIT is fully endorsed. We also received constructive hints where improvements are possible, in particular to provide a coherent picture of each project.

NCCR QSIT Student School
Jan 30 - Feb 1, 2012, Arosa, GR

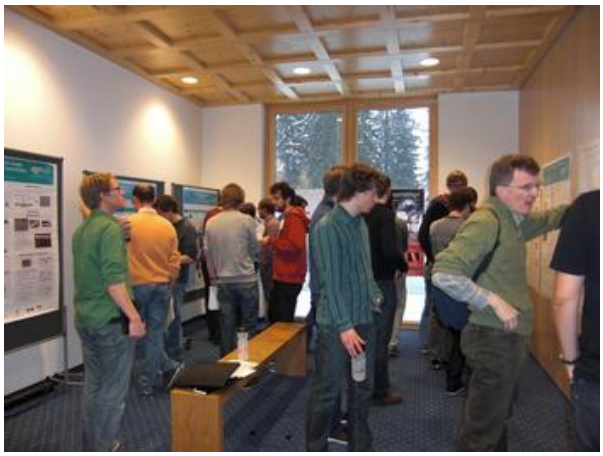
For the first time the NCCR QSIT organized a Student School preceding the General Meeting in Arosa. Around 50 students attended lectures by Phillipp Treutlein, Martin Kroner, Renato Renner, Andreas Nunnenkamp, Andreas Wallraff, and Alberto Morpurgo. The topics covered cold atoms, quantum dots, quantum information, cavity optomechanics, superconducting devices, and graphene. The feedback from the students was very positive: one not untypical example…
"I think the winter school can be considered as a great success! The lectures were kept general and understandable for the audience with its wide range of scientific backgrounds. Therefore, the school was an ideal opportunity to develop an understanding of the different research fields pursued in the QSIT network. On the other hand, the relaxed atmosphere and the favorable size stimulated scientific discussions among the participants and one was really able to meet the majority of the people." (Heiner, PhD student)

http://www.nccr-qsit.ethz.ch/news/events/arosa2012/programstudentschool

http://www.nccr-qsit.ethz.ch/news/events/arosa2012/feedbackschool

NCCR QSIT General Meeting
February 1 - 3, 2012, Arosa, GR

More than 170 people attended the NCCR QSIT General Meeting taking place for the second time at the Waldhotel National in Arosa. The program contained 4 talks by senior speakers giving an overview on a special topic, and 15 talks by group members presenting recent results of their research. A lecture by Dr. Tresch-Biederman introduced QSIT researchers to the subject of intellectual property. Ample time for discussions was given in the two poster sessions, presenting 56 posters, as well as in



the evening and during social events. Our traditional ski race took place on Thursday afternoon, with nearly 100 participants.
Furthermore this year's meeting brought a novelty: a rump session. Intended as an informal platform for not so serious and mostly entertaining presentations it loosened up the atmosphere after a long day of quantum science talks. As hardly any participant had attended a rump session before, we were eager to see what the presenters would come up with, and we were all amazed by the variety of humorous contributions! We learned about Alice in Wonderland, the profound realty of writing EU proposals and new approaches to visualize entanglement. As the atmosphere heated up with a movie quiz, the issue of how to attract more women to our field was discussed. A presentation on how tiny differences between fabrication recipes in different languages can seriously distort ion chip electrodes was elected by the audience and the jury to be the best scientific, humorous contribution to this session. Thank you all for your contributions and let's hope that next year's rump session will be as legendary again.

http://www.nccr-qsit.ethz.ch/news/events/arosa2012

Workshop on trapped-ion technologies

February 24, 2102, ETH Science City

This one-day workshop brought together the groups of Jonathan Home and Stefan Willitsch for seminars from various members of each group. The setting was relatively informal, leading to lively discussions and a fruitful exchange of ideas on both scientific and technical issues between two groups with diverse backgrounds in chemistry and physics. A particular focus on common challenges exposed possibilities for further collaborations between the groups.
http://www.nccr-qsit.ethz.ch/news/events/trappedions

International Workshop on Zeeman Deceleration 2012

April 13 - 14, 2102, ETH Science City

The International Workshop on Zeeman Deceleration, jointly organized by ETH Zurich and the Fritz-Haber-Institute Berlin, took place at ETH Zurich in April 2012. The workshop featured invited lectures as well as contributed talks from experts in the field of supersonic-beam deceleration, who highlighted ongoing efforts and discussed future directions in the rapidly evolving field of cold molecule research. In particular, young researchers at the PhD student and Post Doc level were invited to the workshop to present and discuss their work in an open and stimulating atmosphere.

http://zeeman2012.ethz.ch/zeeman2012

4. Mini-sabbaticals

Each PhD student and post-doc associated with this NCCR will have the opportunity to work one week per year in another NCCR group of his/her choice. This step will promote collaboration and exchange between the younger researchers and will also serve the purpose of general education. These research stages will be centrally financed by the NCCR and are open for all young researchers working on NCCR-related projects in the participating research groups, even if the salary of these researchers is not directly provided by NCCR resources.
Please contact your supervisor or the NCCR office for further information.

The Mini-sabbaticals have started to take place between the groups in Basel, Geneva, Lausanne, and Zurich. Future internships will hopefully be envisaged during the next months.
http://www.nccr-qsit.ethz.ch/education/minisabbaticals

5. Agenda

Quantum Systems and Technology
June 17 - 22, 2012, Centro Stefano Franscini, Monte Verità, TI
Organizer: Gianni Blatter
http://www.nccr-qsit.ethz.ch/news/events/monteverita2012

Quantum Spintronics and Related Phenomena
International School of Physics "Enrico Fermi"
June 19 - 29, 2012, Varenna (Lake of Como, Italy)
http://www.sif.it/SIF/it/portal/attivita/scuola_fermi/mmxii

Meeting of the Swiss Physical Society
June 21 - 22, 2012, ETH Zurich
with special sessions committed to the NCCR QSIT
http://www.sps.ch/events/spg_jahrestagung_2012

NCCR QSIT Junior Meeting
July 3 - 6, 2012, Passug, GR, Switzerland
Organizers: Andreas Kuhlmann and Tobias Theile
http://www.nccr-qsit.ethz.ch/news/events/JuniorMeeting2012

NanoMRI Conference 2012
July 22 - 27, 2012, Centro Stefano Franscini, Monte Verità, TI
Organizer: Christian Degen (ETH / QSIT)
Co-organizer: Martino Poggio (Basel / QSIT)
Co-organizer: Beat Meier (ETH)
http://www.spin.ethz.ch/NanoMRI/index

31st International Conference on the Physics of Semiconductors – ICPS 2012
July 29 - August 3, 2012
Organizer: Klaus Ensslin
http://www.icps2012.ethz.ch

NCCR QSIT Site Visit

November 29 - 30, 2012, ETH Science City, HIT Building.
Detailed information will be communicated in due time

NCCR QSIT Student School
Jan 29 – Jan 30, 2013 and
NCCR QSIT General Meeting
Jan 30 – Feb 1, 2013
Waldhotel National, Arosa
Organizer: NCCR QSIT

6. New collaborators

Since March 2011 **Pitt Allmendinger** is a PhD student in the group of Frédéric Merkt (ETH Zürich), where he develops methods to decelerate and trap Rydberg atoms and molecules using on-chip surface electrodes.

Mathieu Munsch will join Richard Warburton's group at the beginning of May 2012, funded by QSIT. Mathieu, a post-doc, joins us from Jean-M ichel Gerard's group at CEA, Grenoble where he has been working on photonic nanowires.

Mathieu will attend the Monte Verita meeting and is looking forward to meeting his new colleagues.

Anthony Leverrier has joined Renato Renner's group at the beginning of February. In his award-winning PhD, supervised jointly by Philippe Grangier and Gilles Zemor, he has been investigating information processing with continuous quantum systems. He continued this research as a postdoc at ICFO in Barcelona, where he spent the past two years.

Sebastian Krinner is a PhD student in Tilman Esslinger's quantum optics group at ETH Zürich. He works in the field of ultracold Fermi gases, where he currently investigates the conduction properties of strongly interacting Fermions across the superfluid-to-normal phase transition.

Dr. Hari Shankar Solanki received his Bachelor of Science in 2003 from CSJM University in Kanpur India followed in 2005 by his Masters in Physics from the Indian Institute of Technology in Roorkee. In late 2011, he earned his Ph. D. in Physics from the Tata Institute of Fundamental Research under the supervision of Dr. Mandar Deshmukh. His thesis, titled "Semiconducting nanowire electromechanics," focuses on low-temperature transport experiments performed on nanowire devices in a regime where both single-electron physics and nanomechanics play an important role. Dr. Solanki joined Martino Poggio's group in August 2011.