YOUNG EUROPEAN PHYSICISTS MEETING 2004

30.November - 4.December 2004

Budmerice, Slovakia

http://www.quniverse.sk/conf/budmerice2004/

Supported by EU project
CONQUEST

This meeting is organized by RCQI, Bratislava
and Quniverse

List of speakers

1. **Christoph Becher** (University of Innsbruck):
   "Tutorial on quantum information with trapped ions"

2. **Martina Bieliková** (RCQI, Bratislava):
   "Multipartite protocols: an overview"
   Multi-party protocols deal with cryptographic problems in which more then two players are involved. Today some of them are remarkable particulary regarding possible applications in information technologies. e.g. there is a connection between formulation of byzantine agreement problem and distributed data processing. Secret sharing is well known problem considering the cases where information should be shared forceing more parties to work jointly when determining it instead of undergoing higher risk by giving the secret to each of them. An overview of these protocols will be presented.

3. **Alex Monras Blasi** (IFAE, Barcelona):
   "State estimation for ensembles of identically prepared qubits"
   I will present different local measurement schemes and estimation techniques for reconstructing a pure qubit given a large number of identical copies. Also, I will compare the performance with that of the most general approach, which consists of a collective measurement on all the copies. Both, the general qubit case and that of real amplitudes will be discussed. Special attention will be paid to a) non adaptive schemes and b) schemes which make use of classical communication (LOCC).

4. **Jan Bouda** (Masaryk University, Brno):
   "Spices and flavouring of pickled camembert"
   Pickled camemebert is one of the most popular snacks in Czech republic. It is usually served with beer or wine. In this talk we will give an introduction to preparation of pickled camembert and we will propose three different flavourings. The practical part of the talk will guide the audience step-by-step through the standard preparation procedure. Finally, a number of samples will be served as a practical demostration of achievements of this method.

5. **Francesco Buscemi** (University of Pavia):
   "Ordering of Measurements According to Quantum Noise"
   In quantum mechanics the statistics of the outcomes of a measuring apparatus is described in full generality by positive operator valued measure (POVM). A channel (classical or quantum) transforms POVM's into POVM's, generally irreversibly, thus loosing some of the information retrieved from the measurement. This poses the problem of which POVM's are "undisturbed", namely, they are not irreversibly connected to another POVM. We will call such POVM "clean". In a sense, the clean POVM's would be "perfect", since they would not have any additional "extrinsical" noise. The problem has been partly solved: some open problems will also be discussed.

6. **Alessandro Cere** (University of Camerino):
   "Implementation of quantum cryptography"

7. **Giulio Chiribella** (University of Pavia):
   "Absolute alignment of reference frames using quantum systems"
   After a brief review on the problem of reference frames communication, I will present a new protocol for the absolute alignment of Cartesian frames. This protocol exhibits higher efficiency with respect to the previously known protocols, and its efficiency relies on a suitable use of equivalent irreducible representations of the rotation group.

8. **Sonja Daffer** (Imperial College, London):
"Completely Positive Non-Markovian Decoherence"
The prevailing description for dissipative quantum dynamics is given by the Lindblad form of a Markovian master equation, used under the assumption that memory effects are negligible. However, in certain physical situations, the master equation is essentially of a non-Markovian nature. This talk explores master equations in the context of noisy quantum channels that possess a memory kernel, leading to a replacement of white noise by coloured noise. The conditions under which this leads to a completely positive, trace-preserving map are discussed for an exponential memory kernel. A physical model that possesses such an exponential memory kernel is presented. This model contains a classical, fluctuating environment based on random telegraph signal stochastic variables.

9. **Jos Dingjan** (Institus d'Optique, Orsay):
"Rapid Adiabatic Passage on single Rb atoms"
When doing experiments on individually trapped rubidium atoms, it is desirable to have a single shot excitation system that can transfer an atom from the ground state to the excited state with high probability. As we trap atoms not inside a cavity but essentially in free space, Stimulated Raman Adiabatic Passage (STIRAP) is *not* the obvious choice. Instead, we will do direct Rapid Adiabatic Passage (RAP) on the D_2 transition of ^{87}Rb.

   It is a happy coincidence that the D_2 transition wavelength of 780.24 nm is almost exactly half the wavelength of one of the standard optical telecommunications channels (ITU-grid channel C21: $\lambda = 1560.61$ nm). This allows us to use easily available and relatively affordable commercial laser diodes, modulators and amplifiers, and frequency-double the resulting output to obtain light around 780 nm. Using these components, we have constructed a laser system that can deliver chirped pulses with a length of 1–5 ns and a peak power of ~ 10 W. The maximum chirp rate is 1 GHz/ns, and the chirp direction can be either red-to-blue or blue-to-red.

   In this talk, I will describe the laser system, and experiments to verify the correct operation of the system. Furthermore, I will present our first results using this laser system on single trapped rubidium atoms.

10. **Rachele Fermani** (Imperial College, London):
"Weak Force Measurement Entanglement Assisted"
We study the role of the entanglement in weak force detection. Initially we consider massive probes, experiencing a weak force. They are monitored through optical meters which may be entangled. We reduce the problem of force detection to quantum binary decision. Secondly, we focus on a cavityless configuration where a pendular mirror is the probe coupled this to a radiation field, which acts as the meter. We determine the sensitivity of such schemes and show that the use of an entangled meter state greatly improves the ultimate detection limit.

11. **Joe Fitzsimons** (NUI Maynooth):
"Quantum State Transfer using Spinchains"
The transfer of quantum states, from one location to another, plays an important role in quantum computing. Phenomena such as quantum cryptography, teleportation and superdense coding rely on the ability to generate and distribute pairs of entangled qubits. Over large distances optical fibers are well suited to this purpose, but for communication between different parts of a quantum computer, spin chains are a more promising candidate. Several schemes have been proposed for transferring quantum states perfectly through spin chains of arbitrary length [1,2], however these largely depend on either the ability to engineer the coupling strengths in the chain or the ability to perform multiqubit gates. Schemes for imperfect quantum state transfer also exist [3], which can be used in spin chains of uniform or random couplings. By modeling the system as a point source it is

possible to derive expressions for the variance of the wave function, and for concurrence within both uniform and random spin chains.

[1] D. Burgarth and S. Bose, quant-ph/0406112
[2] D. Burgarth, V. Giovannetti and S. Bose, quant-ph/0410175
[3] S. Bose, Phys. Rev. Let. 91, 207901

12. **Andreas Griessner** (University of Innsbruck):
"Phonons as a new element of the *Optical Lattices Toolbox*"
In this talk I will introduce atoms in Optical Lattices as a flexible and highly tuneable system, which allows the implementation of parallel quantum computation and the simulation of interesting many body quantum systems. These applications and especially the realization of quantum computation with atoms in optical lattices require the ability to prepare atoms in high fidelity quantum registers. After discussing existing schemes I will present a novel phonon-assisted loading procedure, which cools the system into a high quality pattern of atoms in an optical lattice. The cooling mechanism relies on the interaction of one atomic species with an external gas of cold atoms, which represent an effective T=0 reservoir.

13. **Richard Hendricks** (Imperial College, London):
"Dynamic and coherent manipulation of ions in the Penning trap"
I describe recent experiments aimed at precisely controlling the dynamics of small numbers of Calcium ions in a Penning trap. I discuss laser cooling in the Penning trap and the use of the axialisation technique by which it can be improved. This work is geared towards investigating the viability of trapped-ion quantum information processing in the Penning trap and I briefly outline our plans for coherent manipulation of trapped Calcium ion qubits.

14. **Beatrix Hiesmayr** (University of Vienna):
"Decoherence in meson-antimeson system and their connection to entanglement measures"
Particle Physics has become an interesting testing ground for fundamental questions of quantum mechanics (QM). The massive entangled meson-antimeson systems are specially suitable as it offers a unique laboratory as well to test various aspects of particle physics (CP violation, CPT violation,.) as also to test the foundations of QM (local realistic theories versus QM, Bell inequalities, decoherence effects, .).

In this talk we focus on decoherence effects by studying the time evolution of the entangled meson–antimeson systems by considering the Liouville–von Neuman equation with an additional term which allows for decoherence. We will compare this model of decoherence with experimental data. For the neutral kaon system we can derive an upper bound via data of the CPLEAR experiment performed at Cern. For the neutral B-meson system there are investigations of the HEPHY group in Vienna analyzing the date of the BELLE-experiment of the KEK-B accelerator in Japan.

Further we discuss our model in the light of different measures of entanglement, i.e. von Neumann entropy, entanglement of formation, and concurrence where we can relate the decoherence parameter, i.e. the strength of the decoherence, to the loss of entanglement.

15. **Mark Howard** (NUI Maynooth):
"Quantum Process Tomography"
The interaction of a quantum system with its environment causes the system to degrade and lose coherence. This loss poses serious difficulties for quantum information processing and the study of these loss mechanisms and their remediation constitutes a large subject of study within the community. The mathematical theory describing this decoherence is well established, but the reverse,

inferring the decoherence process from the results of measurements on the system, is less well developed. Researchers, however, have developed the technique of Quantum Process Tomography (QPT), which can reconstruct the effects of the decoherence process at a single snapshot in time. The experimental execution of a quantum process tomogram on a quantum system will yield enough information to predict the outcome of these decoherence effects on any initial state of that system (i.e. QPT obtains a mapping from input states to output states). Quantum process tomography has been executed already in test-bed quantum information systems such as NMR-quantum computing (nuclear spins in a molecule at room temperature), and all-optical quantum computing (the polarization states of single photons). Previous QPT methods, however, have sometimes resulted in unphysical representations of the process. These unphysicalities are due to small experimental errors in the measurements required in the QPT method and so it is necessary to use numerical fitting procedures which ensure realistic results. It is possible to obtain the master equation for time evolution of the density operator in the so-called Lindblad form and this can be used to identify the physical sources of decoherence. Through collaborations with the single-molecule spectroscopy experimental group of Prof. J. Wrachtrup in the University of Stuttgart, we are applying these estimation techniques to QPT in a promising new technology for quantum information processing : Nitrogen-Vacancy defects in diamond. This system exhibits many desirable properties for the purpose of quantum computation, e.g. long coherence times and precise controllability.

16. **Jaewoo Joo** (Imperial College, London):
"Security of quantum secure communication via W states"
We propose three variant protocols for quantum secure communication via W states, i.e., quantum key distribution, partial quantum secret sharing, and their synthesis. By the synthesis we mean that both quantum key distribution and partial quantum secret sharing are executed in a single protocol. In this paper, we focus on how authorized communicators detect individual attacks by an eavesdropper.

17. **Ben Keitch** (Oxford University Physics Department):
"Coherent Manipulation of Calcium Ion Qubits"
We look at the use of trapped calcium ions for coherent experiments towards Quantum Information Processing (QIP). We present the results of a Schroedinger Cat experiment using the motional state of the ion, and we present results from single- and two-ion cooling experiments. We will also look at the future of QIP using the hyper-fine structure of Ca43 and the technology required to achieve it.

18. **Matyás Koniorczyk** (RCQI, Bratislava):
"Mutually unbiased basises in 6 dimensions: yet another attempt"
The quest for mutually unbiased basises (MUBs) in non-Galois Hilbert spaces is maybe the most obviously sounding open problem of the field of quantum information processing. The simplest non-Galois Hilbert space is six dimensional, thus there should be seven MUBs available. I will give an introductiory summary of the problem, and report on our (moderately successful) attempt to find the 7 MUBs in argument.

19. **Jozef Košík** (RCQI, Bratislava):
"Quantum random walks in multiple dimensions"
Quantum random walks have been defined as an analogue of classical random algorithms. The interference which is the result of quantum nature contributes to the mixing properties which are greater than in the classical case. We define the quantum random walk on a d-dimensional lattice and investigate whether it is transient or recurrent – i.e. the probability that it returns to the initial point after many steps. This is compared to the classical case, at which the random walk is recurrent

for dimension < 3 and transient otherwise. However, for quantum case, the opposite may be true: for special quantum coin the recurrent properties are greater for large dimensions.

20. **Rüdiger Mack** (University of Ulm):
    "Correlations in S-Waves"
    An s-state consists mainly of interference. Wigner functions express the interference nature of quantum mechanics in negative domains of phase space. These domains strongly depend on the number of dimensions and manifest themselves in the time evolution of the average separation ¡r¿ of the s-wave from the origin. Especially in D=2 dimensions the wave first contracts and then expands. We investigate different initial s-waves in order to enlarge this contraction effect. Moreover we address the question of the existence of an optimum wave function.

21. **Jeremy Metz** (Imperial College, London):
    "Entanglement generation in atom-cavity systems"
    Atom-Cavity systems have been recognized as an important candidate for Quantum Information Processing. In recent years the Cavity QED community has proposed schemes to perform some of the more basic processes which could in principal be scaled up to realise large scale Quantum Computing. In this talk I plan to discuss several recent papers specifically related to entaglement generation using Atom-Cavity systems, highlighting the similarities and differences between them.

22. **Carlo Ottaviani** (University of Camerino):
    "Quantum Phase Gate with giant Kerr Nonlinearities in EIT media"
    We analyze the non-linear optical response of two multilevel atomic system driven into a tripod and a M-configuration respectively. We show that using the large resonant Cross-Kerr nonlinearities, that occur in both such systems we can produce a non-linear phase shift of the order of π degrees. Such a substantial phase shift could be observed in a cold MOT trap where it could be feasibly exploited towards the realization of a polarization quantum phase gate.

23. **Stefano Pirandola** (University of Camerino):
    "Encoding a qubit in optical continuous variables"
    We show how a qubit can be fault-tolerantly encoded in the infnite-dimensional Hilbert space of an optical mode. The scheme is efficient and realizable with present technologies. In fact, it involves two travelling optical modes coupled by a cross-Kerr interaction, initially prepared in coherent states, one of which is much more intense than the other. At the exit of the Kerr medium, the weak mode is subject to a homodyne measurement and a quantum codeword is conditionally generated in the quantum fluctuations of the intense mode.

24. **Martin Plesch** (RCQI, Bratislava):
    "Reconstruction of quantum channels from incomplete data"
    Reconstruction of quantum channels (quantum processes) can be performed using a set of test states that are transformed by the action of the channel. Using correlations between inputs of test states (these are assumed to be known) and results of measurements of these states at the output one can estimate a map that characterizes the action of the channel. We analyze in detail various scenarios of reconstruction. In particular, we study in detail the situation when just finite ensembles of test states are available.

25. **Peter Rabl** (University of Innsbruck):
    "Generation of Squeezed States of a Nanomechanical Resonator"
    Using lithographic techniques, nanomechanical resonators with frequencies between 100 MHz and 1 GHz can nowadays be fabricated. In a low temperature environment (T ¡= 50 mK) these mesoscopic

systems are close to their groundstate but the experimental demonstration of the quantum nature of a nanomechanical resonator is still an outstanding task. In this talk I discuss a theoretical proposal how this goal can be achieved by coupling the resonator to a superconducting Cooper pair box which acts as a dissipative two level system. Such a coupling can be used to cool the resonator and also to drive it into a squeezed state. Furthermore, like in CQED, information about the resonator state can be deduced from state measurements on the Cooper pair box. All together the combined system provides a general toolbox to generate and to detect a variety of non-classical states and therefore to demonstrate quantum effects of the mesoscopic resonator.

[1] I. Martin, A.Shnirman, L. Tian, and P. Zoller, Phys. Rev. B 69, 125339 (2004)

[2] P. Rabl, A. Shnirman, and P. Zoller, Phys. Rev. B 70, 205304 (2004)

26. **Peter Rapčan** (RCQI, Bratislava):
"Dynamics of entanglement in small spin rings"
We have studied the dynamics of spin-1/2 systems arranged into a ring, initially in a product state. The evolution by certain different Hamiltonians has been numerically, and study the temporal behaviour of certain quantities related to classical and quantum correlations. I summarize the rather interesting behaviour of these quantities according to numerical experience.

27. **Marián Roško** (RCQI, Bratislava):
"Entanglement and quatum phase transitions in Dicke model"
Even 50 years since the publication of the seminal paper by R.H. Dicke "Coherence in spontaneous radiation process", [*Phys. Rev.* **93**, 99 (1954)] new fascinating effects can be discovered that are described by the Dicke model. This model describes a set of N two-level atoms interacting with a single-mode bosonic field and serves as a generic framework for many investigations in quantum electrodynamics. In our work we will show that using tools of quantum information theory one can discover new results related to the presence of quantum correlations in the ground state of the model. In particular, we will show that the ground state of the model exhibits a sequence of N the quantum-phase-like transitions. These phase transitions appear at specific values of the coupling constant κ_j that are functions of the number of atoms N. The ground state just before the $j^{\rm th}$ phase transition is represented by a superposition of j state vectors with number of excitations ranging from zero to $j-1$, while after the $j^{\rm th}$ phase transition the ground state is composed of state vectors with up to j excitations of the form $|\Xi^{(j)}\rangle = \sum_{l=0}^{j} A_l|\{e^{\otimes l}; g^{\otimes(N-l)}\}\rangle|j-l\rangle$, where $|\{e^{\otimes l}; g^{\otimes(N-l)}\}\rangle$ is a completely symmetric state of N atoms with l atoms in the excited state $|e\rangle$ and $(n-l)$ atoms in the ground state $|g\rangle$, while $|j-l\rangle$ is a Fock state of a bosonic mode with $(j-l)$ excitations. For small values of κ, i.e. for $0 \leq \kappa \leq \kappa_1 = 1/\sqrt{N}$, the ground state of the atom-field system is represented by a state vector $|\Xi^{(0)}\rangle = |g^{\otimes N}\rangle|0\rangle$ with the eigenenergy $E^{(0)}(k) = -\frac{N}{2}\omega$. The first phase transition appears at $\kappa_1 = 1/\sqrt{N}$ after which the ground state of the atom-field system reads $|\Xi^{(1)}\rangle = (-|g^{\otimes N}\rangle|1\rangle + |\{e; g^{\otimes(N-1)}\rangle|0\rangle)/\sqrt{2}$. The second phase transition appears when $\kappa = \kappa_2 = 1/(\sqrt{2(2N-1)} - \sqrt{N})$. After this point the ground state is composed of state vectors with two excitations, etc. In the limit of large N all the critical points "merge" together, that is $\kappa_j \simeq 1/\sqrt{N}$. By selecting the value of the coupling constant κ one can control the character of the ground state of the physical system under consideration. We prove that the ground state of the Dicke model exhibits bi-partite entanglement between arbitrary pair of atoms for an arbitrary value of the coupling constant $\kappa \geq \kappa_1$. In addition, the degree of the entanglement between the atoms (as measured by concurrence) is discontinuously changed at the points κ_j of phase transitions. We show that the largest value of the bipartite concurrence is observed for the values of the coupling constant κ such that $\kappa_1 \leq \kappa \leq \kappa_2$, i.e. when the ground state of the Dicke model is characterized by a single excitation. For these values of the coupling constant the value of entanglement measured in terms of the concurrence between an arbitrary pair of atoms is given by the expression $C^{(1)} = 1/N$. In

the next region of the coupling constants ($\kappa_2 \leq \kappa \leq \kappa_3$) when the ground state has two excitations the concurrence takes the value $C^{(2)} = [4N - 5 - 2\sqrt{2N^2 - 5N + 4}]/[N(2N - 1)]$ that is less than $C^{(1)}$. We prove that even in the large coupling-constant limit the concurrence is non-zero. That means that the atoms always do exhibit entanglement that is created via the interaction with the same single-mode field. We also show that the Cofman-Kundu-Wootters inequalities are saturated in the region of coupling constant $\kappa_1 \leq \kappa \leq \kappa_2$ which means that there is no intrinsic multipartite entanglement generated by the atom-field interaction in the Dicke model.

28. **Pierre Thoumany** (MPI, Garching):
"Phase Diffusion in the micromaser "
The one-atom maser, or micromaser, is a unique tool for the investigation f quantum aspects of the interaction of radiation and matter. The big dipole matrix-elements of single Rydberg atoms and a superconducting microwave cavity with a Q-factor on the order of 10^{10} allow the production of nonclassical field states. In this talk we discuss ideas to extend the measurements, which were so far limited to photon statistics, to the phase properties of the field. This can allow us to measure the linewidth of the micromaser spectrum and study the relevant decoherence problem in cavity QED. The main steps are (i) the preparation of the cavity field in a suitable coherent state, (ii) the transfer of information on the dynamics of field coherences to probe atoms by the action of an external resonant coherent field and (iii) the derivation of the phase diffusion rate, hence the micromaser linewidth, from the measured population statistics of the probe atoms. In this way, phaseproperties of the field can be mapped to the photon statistics and become measurable.

29. **Sarah Schröder** (University of Ulm):
""Chaotic Ratchets in Optical Lattices"
Thermal ratchets show a directed current due to rectification of noise. In some systems chaotic dynamics can mimic the effects of thermal fluctuations. Here we investigate the experimental realisation of a chaotic Hamiltonian ratchet in a two-dimensional optical lattice and analyse the mechanism leading to a directed current in this deterministic system.

30. **Norbert Schuch** (MPI, Garching):
"Optimal squeezing and entanglement generation with noisy Gaussian channels"
In continuous variable quantum information with Gaussian states, squeezing and entanglement are valuable resources which are difficult to create. Furthermore, devices creating these resources will in practice be noisy, i.e., non-unitary. Here, we investigate the optimal generation of squeezing and entanglement with noisy Gaussian channels.

    In the case of squeezing, we consider a fixed N mode channel with arbitrary passive operations in between. We show that the maximally obtainable squeezing does only depend on the squeezing of the input, and that thus multiple iterations of the channel can be optimized step by step. We also give an explicit formula for the maximally attainable squeezing and a method how to reach it with fixed passive operations in between.

    In the case of entanglement creation, we focus on symmetric 1x1 mode Gaussian channels, i.e. channels preserving symmetric states. We show that also in this case the maximal entanglement of the output does only depend on the entanglement of the input so that again a step by step optimization in the creation of entanglement is sufficient.

31. **Michal Sedlák** (RCQI, Bratislava):
"Decomposition of unitary matrices"
Decomposition of a given unitary matrix to elementary quantum gates corresponds to finding a quantum logic circuit for concrete quantum algorithm. We briefly sketch the decomposition proposed by A. Barenco et.al., Physical Review A, March 22, 1995 (AC5710). The way of decomposition is

highly nonunique. We describe some techniques for optimization of n-qubit quantum circuits into the set of gates containing the generalized Toffoli gates. We also compare our results obtained from optimization of this decomposition with recent results in this field.

32. **Viktor Steixner** (University of Innsbruck):
"Feedback Cooling of Single Trapped Ions"
By placing a trapped ion, modeled as a two-level system, in front of a mirror, it's position can be detected via a modification in the rate of spontaneous emission, as performed in an experiment by [1] and theoretically explained by [2]. The information obtained from the system can be fed back into the system, thus allowing for a method of changing the motional state of the atom. I will talk about calculations for the cooling of such an ion below the Doppler limit using a quantum trajectory method for the non-Markovian behavior of the system.

[1] J. Eschner et al., Nature (London) 431,495 (2001)

[2] U. Dorner and P. Zoller, Phys. Rev. A 66, 023816 (2002)

33. **Peter Štelmachovič** (RCQI, Bratislava):
"Dynamics of open systems: quantum homogenization"

34. **Linas Urbonas** (MPI, Garching):
"Stochastic Resonances in the Micromaser"
Stochastic resonance is a paradigm of the counterintuitive role that noise can play in nonlinear systems. Therefore there is a large interest in systems allowing to observe stochastic resonances experimentally. The micromaser is a very suitable system for this purpose offering the advantage that it represents a pure quantum device. Stochastic resonances get observable in the micromaser when the bistable behaviour of the maser field is investigated. The switching is performed by thermal noise in the maser cavity. In the talk a detailed description of the realisation of such an experiment will be presented. Simulations will be shown and the possible bottlenecks described. The current experimental status will be given.

35. **Mário Ziman** (RCQI, Bratislava):
"All qubit decoherences"
Decoherence is defined as a transformation in which the off-diagonal elements vanish, whereas the diagonal remains preserved. All possible quantum channels with such property will be discussed. Two pictures of decoherence will be presented: (i) all decoherences due to collisions, and (ii) all decoherences caused by a stochastic application of different coherent dynamics. Both pictures of decoherence are important from different point of views. For the collision model we will derive a master equation, and finally we will present the set of all possible time evolutions that lead a system to decohere. The results will be presented mainly for qubit, and the possible generalization will be discussed.

List of participants

Christoph Becher (University of Innsbruck)
Martina Bieliková (RCQI, Bratislava)
Alex Monras Blasi (IFAE, Barcelona)
Jan Bouda (Masaryk University, Brno)
Vladimír Bužek (RCQI, Bratislava)
Francesco Buscemi (University of Pavia)
Alessandro Cere (University of Camerino)
Giulio Chiribella (University of Pavia)
Sonja Daffer (Imperial College, London)
Jos Dingjan (Institus d'Optique, Orsay)
Rachele Fermani (Imperial College, London)
Joe Fitzsimons (NUI Maynooth)
Andreas Griessner (University of Innsbruck)
Richard Hendricks (Imperial College, London)
Mark Howard (NUI Maynooth)
Jaewoo Joo (Imperial College, London)
Ben Keitch (Oxford University)
Matyás Koniorczyk (RCQI, Bratislava)
Jozef Košík (RCQI, Bratislava)
Rüdiger Mack (University of Ulm)
Jeremy Metz (Imperial College, London)
Carlo Ottaviani (University of Camerino)
Stefano Pirandola (University of Camerino)
Martin Plesch (RCQI, Bratislava)
Peter Rabl (University of Innsbruck)
Peter Rapčan (RCQI, Bratislava)
Marián Roško (RCQI, Bratislava)
Pierre Thoumany (Max Planck Institute, Garching)
Sarah Schröder (University of Ulm)
Norbert Schuch (Max Planck Institute, Garching)
Michal Sedlák (RCQI, Bratislava)
Viktor Steixner (University of Innsbruck)
Peter Štelmachovič (RCQI, Bratislava)
Linas Urbonas (Max Planck Institute, Garching)
Mário Ziman (RCQI, Bratislava)

Conference program
Wednesday, 1. December

	Tuesday, 30. November
Evening	Arrival to Budmerice
18:15 - 18:45	Registration
19:00 - 19:30	Dinner
	Wednesday, 1. December
8:25 - 8:45	Breakfast
9:00 - 10:30	Morning session: chaired by Jan Bouda **Matyás Koniorczyk:** Mutually unbiased basises in 6 dimensions: yet another attempt **Rachele Fermani:** Weak Force Measurement Entanglement Assisted **Giulio Chiribella:** Absolute alignment of reference frames using quantum systems
10:30 - 11:00	Coffee break
11:30 - 12:30	**Stefano Pirandola:** Encoding a qubit in optical continuous variables **Rüdiger Mack:** Correlations in S-waves
12:30 - 13:00	Lunch
14:00 - 15:00	Afternoon session: chaired by Martin Plesch **Christoph Becher:** Quantum information with trapped ions
15:00 - 15:30	Tea break
15:30 - 17:00	**Peter Rabl:** Generation of Squeezed States of a Nanomechanical Resonator **Linas Urbonas:**Stochastic Resonances in the Micromaser **Jeremy Metz:** Entanglement generation in atom-cavity systems
17:00 - 17:30	Tea break
17:30 - 19:00	**Sarah Schröder:** Chaotic Ratchets in Optical Lattices **Pierre Thoumany:** Phase Diffusion in the micromaser **Ben Keitch:** Coherence manipulation of calcium ion qubits
19:00 - 19:30	Dinner
20:00 - 1:00	Social program

Conference program
Thursday, 2. December

	Thursday 2. December
8:25 - 8:45	Breakfast
9:00 - 10:30	Morning session: chaired by Peter Štelmachovič; **Carlo Ottaviani:** Quantum Phase gate with giant Kerr nonlinearities in EIT media **Andreas Griessner:** Phonons as a new element of the Optical Lattices Toolbox **Richard Hendricks:** Dynamic and coherent manipulation of ions in Penning trap
10:30 - 11:00	Coffee break
11:00 - 12:00	**Christoph Becher:** Quantum optics with trapped ions
12:30 - 13:00	Lunch
14:00 - 16:00	Afternoon session: chaired by Mário Ziman **Jan Bouda:** tba **Martina Bieliková:** Multipartite protocols: an overview **Jaewoo Joo:** Security of quantum secure communication via W states **Alessandro Cete:** Implementation of quantum cryptography
16:00 - 16:30	Tea break
16:30 - 18:00	**Francesco Busceni:** Ordering of measurements according to quantum noise **Joe Fitzsimons:** Quantum state transfer using spin chains **Peter Rapčan:** Dynamics of entanglement in small spin rings **Marián Roško:** Entanglement and quatum phase transitions in Dicke model
19:00 - 19:30	Dinner
20:00 - 1:00	Social program

Conference program
Friday, 3. December

	Friday 3. December
8:25 - 8:45	Breakfast
9:00 - 10:30	Morning session: chaired by Matyás Koniorczyk **Alex Monras Blasi:** State estimation for ensembles of identically prepared qubits **Mark Howard:** Quantum Process Tomography **Martin Plesch:** Reconstruction of quantum operations from incomplete data
10:30 - 11:00	Coffee break
11:00 - 12:30	**Jozef Košík:** Quantum random walks in multiple dimensions **Michal Sedlák:** Decomposition of unitary matrices **Viktor Steixner:** Feedback Cooling of Single Trapped Ions
12:30 - 13:00	lunch
14:00 - 15:30	Afternoon session: chaired by Vladimír Bužek **Sonja Daffer:** Complete positive non-markovian decoherence **Jos Dingjan:** Rapid Adiabatic Passage on single Rb atoms **Norbert Schuch:** Optimal squeezing and entanglement generation with noisy Gaussian channels
15:30 - 16:00	Tea break
16:00 - 18:00	**Peter Štelmachovič:** Quantum homogenization **Mário Ziman:** All qubit decoherences **Beatrix Hiesmayr:** Decoherence in meson-antimeson system and its connections to entanglement
18:30 -	**Conference banquet**
	Saturday 4. December
8:25 - 8:45	Breakfast
Morning	Leaving from Budmerice