Pushing Frontiers in Quantum Information with Atoms and Photons

September 1st — 3rd
Internationales Wissenschaftsforum Heidelberg

Conference Program

General information

Conference site:
Internationales Wissenschaftsforum Heidelberg (IWH)
Hauptstrasse 242
69117 Heidelberg
Germany

Important phone numbers:
IWH secretary: +49 (0) 6221 54 36 90
IWH reception desk: +49 (0) 6221 7299 758
IWH fax: +49 (0) 6221 54 161 3691
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Emergency call in Germany: 112

Scientific coordination and organization
Claudia Wagenknecht
Thomas Amthor

Conference fee
The conference fee is 150 Euros, to be paid cash upon arrival.
You may also transfer the money to the following bank account in advance:
Name of bank: BW-Bank Stuttgart
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Acknowledgements
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Heidelberg graduate school for fundamental physics

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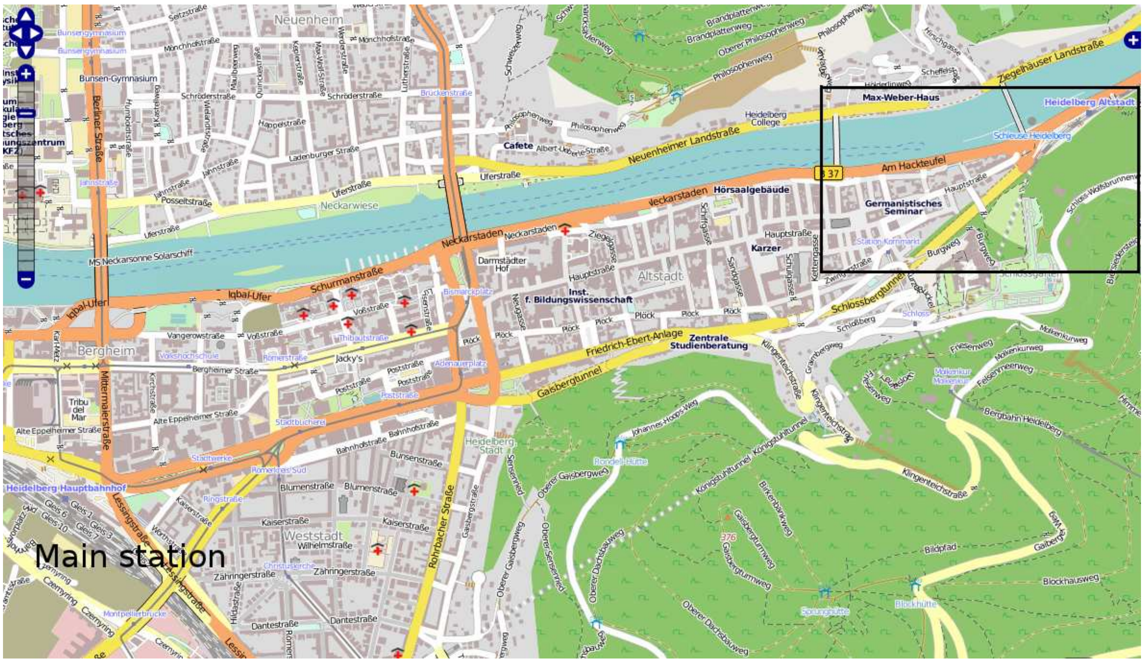
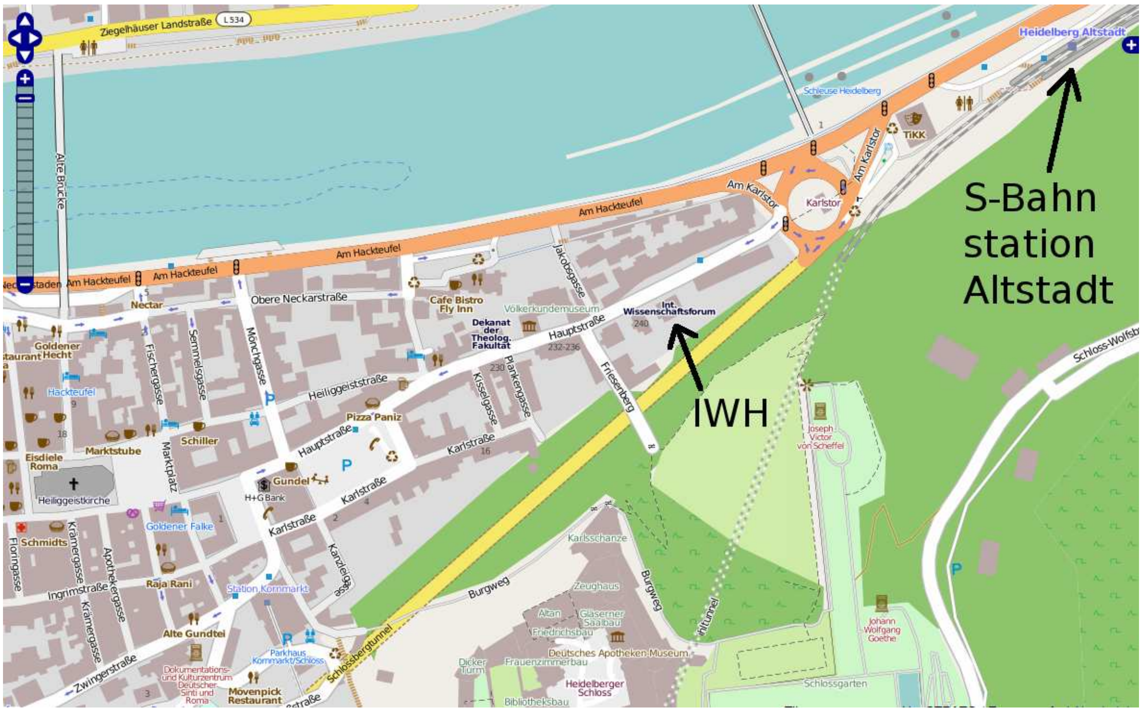
Heidelberg Old Town and location of the IWH





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How to find the IWH

I. From Frankfurt Airport

1. By German Railway to Heidelberg Main Station (Hauptbahnhof).
   Follow directions under II.

2. Using the Airport Transfer and Limousine Service (TLS; phone +49 6221 770077, reservations online: https://www.tls-heidelberg.de/en/airport/online-booking). Depending on which airline you are using, you will be picked up at the Meeting Point at either Terminal 1 or 2. TLS will take you directly to the IWH. Advance reservation with information on the airline and flight number is required (EUR 32.00).

3. The service provided by Wörns T.S. GmbH (http://www.woerns-ts.de, phone +49 6227 3589222) is slightly more comfortable and slightly faster. Prices vary depending on the number of passengers.

4. By Lufthansa Airport Bus. The bus stops at the Meeting Point in Terminal 1 B 3/Arrivals level. It will take you to the Crowne Plaza Hotel (Kurfürstenanlage 1–3) in Heidelberg (EUR 20.00 single way; EUR 36.00 round trip). From there, you can take a taxi to the IWH.

II. From Heidelberg Main Station (Hauptbahnhof)

Take the S-Bahn (S1 or S2 – destination Osterburken), or bus 33 (direction "Köpfel", stops in front of the train station) and get off at "S-Bahnhof Altstadt" (formerly "Karlstor"). It is a 3-minute walk to the IWH from there (see map). Travel time by S-Bahn 5 minutes, by bus 17 minutes.

Events

Poster session

The poster session will take place on Thursday afternoon at the IWH. Beer and german pretzels will be served. Don't forget to bring your poster already in the morning so that we can start the poster session in time.

Castle tour

On Friday afternoon everyone is invited to visit the famous Heidelberg Palace, which is situated on the hills right above our conference site. Guides in historical costumes will show us around and will present fascinating stories about how life at the castle was like centuries ago.

Conference Dinner

Coming back from the castle tour, food and drinks will be waiting for us at the IWH. The conference dinner will be a good opportunity to get to know all the other participants.

Time	**Thursday, 1st**	**Friday, 2nd**	**Saturday, 3rd**
09:00 – 09:45	*Welcome*	I. Bloch	P. Zoller
09:45 – 10:30	J.W. Pan	A. Browaeys	T. Calarco
10:30 – 11:00	*Coffee break*	*Coffee break*	*Coffee break*
11:00 – 11:45	O. Gühne	K. Mølmer	G. Birkl
11:45 – 12:30	D. Bruß	M. Saffman	A. Kuzmich
12:30 – 14:00	*Lunch*	*Lunch*	*Lunch*
14:00 – 14:45	M. Weidemüller	H. Krauter	D. Oblak
14:45 – 15:30	C. Adams	Z.S. Yuan	A. Imamoglu
15:30 – 16:00	*Coffee break*	*Coffee break*	
16:30 – 16:45	R. Löw	*Social event: Castle tour*	
17:00	*Poster session*		
19:00		*Conference Dinner*	

Manipulation of Photonic and Atomic Qubits: Towards Scalable Quantum Communication, Computation and Simulation

Jian-Wei Pan[1,2]

1 Department of Modern Physics and National Laboratory for Physical Sciences at Microscale, University of Science and Technology of China, Hefei, Anhui 230026, China

2 Physikalisches Institut, Universität Heidelberg, Philosophenweg 12, Heidelberg 69120, Germany

In my talk I shall present a brief overview on some recent exciting experimental progress towards scalable quantum communication, quantum computation and quantum simulation, via manipulation of photonic and atomic qubits. In particular, by exploiting a new Bell-state synthesizer, we have experimentally generated ultra-bright entangled photon source and the eight-photon Schrödinger-cat state; Further we created a state-of-the-art eight-photon cluster state, with which we demonstrated a proof-of-principle topological error correction code; Based on the ultra-bright entangled photon source, we have experimentally teleported independent qubits over a 97-kilometre one-link free-space channel with multi-photon entanglement and further distributed the entanglement over a 102-kilometre two-link channel. Together with our experimental research on atomic ensemble based quantum repeater, it is foreseen that with ongoing development, quantum communication over 1000 km scale and coherent quantum manipulation of up to a few tens photonics and atomic qubits shall be feasible in the next five years.

Characterizing multiparticle entanglement

Otfried Gühne

Universität Siegen, Fachbereich 7, Emmy-Noether-Campus, Walter-Flex-Straße 3, 57068 Siegen, Germany

Entanglement is a valuable resource in quantum information processing, therefore its characterization is important for the field. Moreover, many experiments nowadays aim at the generation of multiparticle entanglement between several particles, and up to fourteen qubits have been entangled using polarized photons or trapped ions.

In this talk, I present recent results on the characterization of multiparticle entanglement. First, I will discuss a simple method which allows to prove that a given state is separable and not entangled. This has been used to characterize the decay of entanglement in a recent trapped-ion experiment [1]. Then, I will introduce a method to characterize genuine multipartite entanglement using a multipartite extension of the criterion of the positivity of the partial transpose [2]. This criterion can simply be evaluated using semidefinite programming, even if the density matrix is not completely known. Combined with the first method, it results in necessary and sufficient criteria for genuine multipartite entanglement for important families of states.

[1] J. T. Barreiro et al., Nature Physics 6, 943 (2010).
[2] B. Jungnitsch et al., arXiv:1010.6049

Non-classical correlations versus entanglement

Alexander Streltsov, Hermann Kampermann, Dagmar Bruß

Heinrich-Heine-Universität Düsseldorf, Institut für Theoretische Physik III, Universitätsstraße 1, 40225 Düsseldorf, Germany

Non-classical correlations can arise even without the existence of entanglement. They can be quantified e.g. via the quantum discord or the one way information deficit. We present an approach to non-classical correlations by quantifying how much entanglement must be created in a von Neumann measurement on a part of a composite quantum system, and connect the minimal entanglement to the correlation measures mentioned above. This correspondence allows us to formulate necessary conditions for a ”good” measure of non-classical correlations and to define new measures for non-classical correlations. A generalisation to multipartite systems is also provided.

Ultracold Rydberg aggregates – Controlled interactions and perspectives for quantum information processing

Matthias Weidemüller*

Physics Department and Heidelberg Center for Quantum Dynamics, Ruprecht-Karl University Heidelberg, Germany

Due to the long-range character of the interaction between highly excited atoms, the dynamics of an ultracold gas of Rydberg atoms is entirely determined by van-der-Waals and dipole-dipole interactions. One outstanding property is the tunability of the strength and the character of the interactions with static electric fields. This allows one to explore the transition from a weakly coupled two-body system to a strongly coupled many-body system. The long-range interaction leads to many-body entanglement and has possible applications in quantum computing. In my presentation I will give an overview over the field, and then address some of recent advances achieved by our group. We studied coherent phenomena in an ultracold gas of Rydberg atoms under the influence of dipolar interactions. The Rydberg gas is formed in in a magneto-optical trap via cw two-photon excitation of Rb atoms into states with principal quantum number 30...100 using cw lasers at 780 nm and 480 nm [1]. Our recent results include coherent Rabi oscillations between ground and Rydberg states [2,3] and the observation of the dipole blockade [4] and antiblockade [5] in a mesoscopic sample, stimulated rapid adiabatic passage with 90% transfer efficiency into Rydberg states [6], and studies of the many-body character of resonant energy transfer processes [7,8]. Our experiments reveal the role of interaction-induced mechanical forces [9] as well as the influence of black-body radiation on the many-particle motional dynamics of the system [10]. In a recent series of experiments, we have explored coherent population trapping under the influence of long-range van-der-Waals forces [11]. Currently, we are setting up a new experiment to achieve quantum-degeneracy in an optical trap with subsequent Rydberg excitation.

* Work performed in collaboration with C. Hofmann, G. Günter, H. Schempp, A. Faber, H. Busche, T. Amthor (now at Philips Research), M. Robert de Saint Vincent, and S. Whitlock

[1] K. Singer et al., J. Phys. B 38, S321 (2005)

[2] M. Reetz-Lamour et al., Phys. Rev. Lett. 100, 253001 (2008)

[3] M. Reetz-Lamour et al., New J. Phys. 10, 045026 (2008)

[4] K. Singer et al., Phys. Rev. Lett. 93, 163001 (2004)

[5] T. Amthor et al., Phys. Rev. Lett. 104, 013001 (2010)

[6] J. Deiglmayr et al., Opt. Comm. 264, 293 (2006)

[7] S. Westermann et al., Eur. J. Phys. D 40, 37 (2006)

[8] O. Mülken et al., Phys. Rev. Lett. 99, 090601 (2007)

[9] T. Amthor et al., Phys. Rev. Lett. 98, 023004 (2007)

[10] T. Amthor et al., Phys. Rev. A 76, 054702 (2007)

[11] H. Schempp et al., Phys. Rev. Lett.,104, 173602 (2010)

Rydberg non-linear optics

Charles Adams

Department of Physics, Durham University, Rochester Building, South Road, Durham DH1 3LE, United Kingdom

When near resonant photons enter a medium where the excited state is coupled to a highly excited Rydberg state they evolve into Rydberg polaritons and interact via long range dipole–dipole interactions. The strong interaction between photons gives rise to a large cooperative optical non-linearity [1] that could be exploited for single photon non-linear optics.

[1] J. D. Pritchard et al. Phys. Rev. Lett. 105, 193603 (2010).

Coherent control of Rydberg atoms in thermal vapors

Robert Löw

5. Physikalisches Institut, Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart, Germany

The strong interaction between Rydberg atoms promise the realisation of quantum devices as single photon sources and detectors, quantum repeaters, quantum gates, etc. Most experimental results on interacting Rydberg atoms so far have been achieved in ultracold samples, but the extreme strength of the van der Waals interaction is also effective for atoms at room temperature. In this talk I will present spectroscopic results on coherent Rydberg spectroscopy in microscopic vapor cells and on the observation of coherent Rabi oscillations into Rydberg states at room temperature. The coherent control over the time evolution of Rydberg states is a crucial step towards the goal of simple and scalable quantum devices based on microscopic vapor cells.

Controlling and Imaging Quantum Gases at the Single Atom Level

Immanuel Bloch

Max-Planck-Institut für Quantenoptik, Hans Kopfermann Str. 1, 85748 Garching b. München, Germany

Over the past years, ultracold quantum gases in optical lattices have offered remarkable opportunities to investigate static and dynamic properties of strongly correlated bosonic or fermionic quantum many-body systems. In this talk I will show how it has recently not only become possible to image such quantum gases with single atom sensitivity and single site resolution, but also how it is now possible to coherently control single atoms on individual lattice sites within a strongly correlated quantum gas. Using a tightly focussed laser beam atoms on selected lattice sites can be addressed and their spin state fully controlled. Magnetic resonance control techniques were employed to achieve sub-lattice period and sub-di ffraction limited resolution in our addressing scheme.

The ability to address single atoms on a lattice opens a whole range of novel research opportunities ranging from quantum information processing over the investigation of quantum spin systems to local entropy control, some of which will be discussed in the talk.

Rydberg Blockade and entanglement of two atoms

Antoine Browaeys

Laboratoire Charles Fabry, Institut d'Optique, CNRS, Univ Paris-Sud, Campus Polytechnique, RD 128, 91127 Palaiseau cedex, FRANCE

When two quantum systems interact strongly, their simultaneous excitation by the same driving pulse may be forbidden: this is called blockade of excitation. Recently, extensive studies have been devoted to the so-called Rydberg blockade between neutral atoms, which appears due to the interaction induced by their large dipole moments when they are in highly excited states. In particular, this blockade has been proposed as a basic tool in quantum information processing with neutral atoms and can be used to deterministically generate entanglement of several atoms.

This talk will describe our demonstration of the Rydberg blockade between two atoms individually trapped in optical tweezers. A direct follow-up is the preparation of an entangled state of the two atoms. The talk will describe this preparation and the caracterization of the amount of entanglement produced. Finally the talk will show our progress towards the measurement of the interaction energy between two atoms, in order to improve the efficiency of the blockade.

Quantum optics and efficient quantum computing with Rydberg excitation blockade

Klaus Mølmer

Department of Physics and Astronomy, University of Aarhus, Ny Munkegade, DK 8000 Aarhus C., Denmark

The significant dipole-dipole interaction between Rydberg excited atoms provides an on/off controllable interaction with promising applications for entanglement operations and quantum computing with neutral atoms. The blockade interaction may be used to carry out quantum gate operations between individually addressed atomic qubits, and in small ensembles, the Rydberg blockade may couple all atoms and thus enable quantum control of their collective many-body state. On the one hand, this permits few step implementation of entire quantum algorithms and on the other hand, it offers possibilities to prepare a variety of non-classical states of collective excitation which may subsequently be released as non-classical light.

[1] M. Saffman, T. G. Walker, K. Mølmer, Quantum information with Rydberg atoms; Rev. Mod. Phys. 82, 23132363 (2010)
[2] Anne E. B. Nielsen and Klaus Mølmer, Deterministic multi-mode photonic device for quantum information processing; Phys. Rev. A 81, 043822 (2010)
[3] Klaus Mølmer, Larry Isenhower, and Mark Saffman, Efficient Grover search with Rydberg blockade; To appear in J. Phys. B. Special Issue on Strong Rydberg interactions in ultracold atomic and molecular gases, 2011; arXiv:1102.3573

Strongly interacting Rydberg atoms: from quantum gates towards quantum processors

Mark Saffman

Department of Physics, University of Wisconsin, 1150 University Avenue, Madison, Wisconsin, 53706, USA

Neutral atoms are attractive candidates for quantum information processing due to their stability and weak interaction with the environment. Implementing a strong and controllable two-atom interaction has, however, been a long standing challenge. This challenge was recently met with the demonstration of Rydberg blockade, and its use for a two-qubit quantum logic gate that creates entanglement between pairs of atoms. I will present experimental results showing deterministic entanglement, and outline the path we have embarked on towards a many bit quantum information processor. Prospects for efficient implementation of many-qubit gates using a long range Rydberg interaction will be discussed.

Quantum interface of macroscopic atomic ensembles with light

Hanna Krauter

Quantop, Niels Bohr Institute, Blegdamsvej 17, 2100 Copenhagen OE, Denmark

The talk will review precision quantum engineering of macroscopic atomic ensembles via a quantum interface of atoms with light. Key experimental operations, such as generation of entangled states of atoms and light, quantum non-demolition measurements, and the possibility of swapping of quantum states between photons and atoms will be described. The most recent development atomic entanglement which has been continuously maintained for up to one hour will be highlighted. Applications ranging from quantum memory for light, to magnetometry with record sensitivity, and to atom clocks will be presented.

Quantum information processing with photonic and atomic qubits

Zhen-Sheng Yuan

Physikalisches Institut, Universität Heidelberg, Philosophenweg 12, Heidelberg 69120, Germany

Bridging light and matter quantum mechanically will offer a novel platform for making quantum information processing more efficient compared with the quantum systems solely composed of photonic qubits and linear optical components. I will present in this talk the recent progress of integrating atomic quantum memories into the linear optical systems. On the one hand, the quality of cold-atomic-ensemble based quantum memories is being improved. On the other hand, hybrid systems are developed, e.g., entangled photons emitted from a narrow-band down-conversion source are stored in atomic quantum memories. I will introduce as well the ongoing experiments with ultracold atoms and optical lattices in our group for scalable quantum network and quantum simulation.

Quantum Information Processing via Engineered Dissipation

Peter Zoller

Institute for Theoretical Physics, Univ of Innsbruck, and Institute for Quantum Optics and Quantum Information of the Austrian Academy of Sciences, A-6020 Innsbruck, Austria

Systems of cold atoms allow a controlled coupling to an engineered bath, i.e. the design of a dissipative time evolution. This is of interest both as a new tool for generating and manipulating entangled states, as well in the context of a nonequilibrium many body dynamics. We will discuss in detail the example of a 1D quantum wire coupled to a BCS bath realized with atoms in optical lattices. This setting gives rise to dissipation induced Majorana edge states and leads to a dissipative version braiding of Majorana fermions. This extends the notion of topological quantum information processing from the familiar Hamiltonian dynamics to systems whose evolution is described by a master equation.

Pushing the limits of quantum device performance via optimal control

Tommaso Calarco

Institut für Quanteninformationsverarbeitung, Universität Ulm, Albert-Einstein-Allee 11, 89069 Ulm, Germany

The underlying idea of quantum information is that the full power of quantum coherence has not yet been tapped for technological applications. The exquisite level of control of current atomic physics experiments may enable this — but scalable quantum information processing requires extremely precise operations. Quantum optimal control theory allows to design the evolution of realistic systems in order to attain the best possible performance that is allowed by the laws of quantum mechanics. I will present a range of its applications to a variety of quantum technologies, and discuss its use in probing the ultimate limits to the scales of the corresponding quantum processes, in terms of speed as well as size.

Scalable Architecture for Quantum Information Processing with Neutral Atoms

Gerhard Birkl

Institut für Angewandte Physik, Technische Universität Darmstadt, Schlossgartenstraße 7, 64289 Darmstadt, Germany

We present recent progress towards the realization of a scalable architecture for quantum information processing and quantum simulation using neutral atoms in two-dimensional (2D) arrays of optical microtraps as qubit registers [1]. Based on the application of micro-fabricated lens arrays, this approach is simultaneously targeting the important issues of single-site addressability and scalability, and provides versatile configurations for quantum state storage, manipulation, and retrieval [2]. We present the initialization and coherent one-qubit rotation of up to 100 individually addressable qubits [3], the coherent transport of atomic quantum states in a scalable quantum shift register [4], the sub-Poissonian loading of 2D qubit registers with of 0 or 1 atom, and discuss the feasibility of two-qubit gates in 2D architectures.

[1] R. Dumke, M. Volk, T. Müther, F.B.J. Buchkremer, G. Birkl, W. Ertmer, Micro-optical Realization of Arrays of Selectively Addressable Dipole Traps: A Scalable Configuration for Quantum Computation with Atomic Qubits, Phys. Rev. Lett. 89, 097903 (2002)
[2] A. Lengwenus, J. Kruse, M. Volk, W. Ertmer, G. Birkl, Coherent Manipulation of Atomic Qubits in Optical Micropotentials, Applied Physics B 86, 377–383 (2007)
[3] J. Kruse, C. Gierl, M. Schlosser, G. Birkl, Reconfigurable site-selective manipulation of atomic quantum systems in two-dimensional arrays of dipole traps, Phys. Rev. A 81, 060308(R) (2010)
[4] A. Lengwenus, J. Kruse, M. Schlosser, S. Tichelmann, G. Birkl, Coherent Transport of Atomic Quantum States in a Scalable Shift Register, Phys. Rev. Lett. 105, 170502 (2010)

Quantum memories for telecom networks

Alex Kuzmich

School of Physics, Georgia Institute of Technology, Atlanta, GA 30332, USA

Quantum mechanics provides a mechanism for absolutely secure communication between remote parties for distances greater than 100 kilometers direct quantum communication via optical fiber is not viable, due to fiber losses, and intermediate storage of quantum information along the transmission channel is necessary, leading to the concept of the quantum repeater. I will outline our program on the use of long-lived atomic memories as an interface for telecom quantum networks. Work done in collaboration with A. Radnaev, Y. Dudin, R. Zhao, J. Blumoff, H. H. Jen, S. Jenkins, and B. Kennedy.

Quantum memory and entanglement storage in rare-earth ion doped crystals

D. Oblak[1], E. Saglamyurek[1], N. Sinclair[1], J. Jin[1], J.A. Slater[1], M.R. Lamont[1], F. Bussières, M. George[2], R. Ricken[2], W. Sohler[2], and W. Tittel[1]

1 Institute for Quantum Information Science, and Department of Physics and Astronomy, University of Calgary, 2500 University Drive NW, Calgary, Alberta. T2N 1N4, Canada

2 Department of Physics - Applied Physics, University of Paderborn, Warburger Strasse 100, 33095 Paderborn, Germany

Quantum computers and networks based on repeaters usually involve efficient and high fidelity quantum memories [1]. Realisations using rare-earth dopants in crystalline hosts offer numerous prospects. Long coherence and life times hold promise of extended memory storage times and persistent tailoring of inhomogeneously broadened absorption lines. The latter points to broadband memories allowing for storage of single photons from commonplace second-harmonic sources. In our implementation a thulium doped waveguide in a lithium-niobate crystal is cryogenically cooled to <4 K and by optical pumping, using a serrodyne chirped waveform, an up to 10 GHz wide atomic-frequency-comb (AFC) can be written on the inhomogeneously broadened absorption spectrum [2]. Single photons matched to the AFC bandwith are thus stored and recalled by a time inversely proportional to the AFC period [3]. Hence, we are able to store and retrieve with near unity fidelity arbitrary single photon (time-bin) qubit states [4] including entangled bi-photon states [5,6]. Moreover, the memory exhibits excellent multimode capacity enabling both time and frequency domain multiplexing [7]. Though our demonstrated storage times and efficiencies are yet to reach the desired level we demonstrate the initial steps towards a universal quantum memory that can be integrated in compact solid-solid state quantum computing and communication devices.

[1] N. Sangouard et al., Rev. Mod. Phys. 83, 33 (2011)
[2] N. Sinclair et al., J. Lumin. 130, 1586 (2010)
[3] de Riedmatten et al., Nature 456, 773 (2008)
[4] E. Saglamyurek et al., (2011)
[5] E. Saglamyurek et al., Nature 469, 512 (2011)
[6] C. Clausen et al., Nature 469, 508 (2011)
[7] I. Usmani, Nature Comm. 1, 12 (2010)

Quantum optics meets mesoscopic physics

Atac Imamoglu

ETH Zürich, Institute of Quantum Electronics, Wolfgang-Pauli-Strasse 16, 8093 Zürich, Switzerland

Spins confined in semiconductor quantum dots offer new possibilities for realizing quantum optical systems with unique properties. Conversely, optical measurement techniques provide a powerful tool for studying mesoscopic condensed-matter systems. Specific recent experiments I will discuss include the observation of photon blockade in a quantum dot coupled to a photonic crystal nano-cavity and the optical signatures of the Kondo effect.

No.	Name	Poster title
P1	Andrea Alberti University of Bonn, Germany	Discrete interferometer with individual trapped atoms
P2	Durga B Rao Dasari Aarhus University, Denmark	Error control for efficient implementation of multi-qubit Rydberg blockade gates
P3	Reinhard Erdmann Air Force Research Laboratory, Rome, NY, USA	Local realism for photons – considerations without Bell's inequalities
P4	Jörg Evers Max-Planck-Institut für Kernphysik, Heidelberg, Germany	Quantum information with hard x-rays
P5	Bernhard Huber University of Stuttgart, Germany	Coherent Rydberg Excitation in Thermal Vapor Cells
P6	Matthias Kleinmann University of Siegen, Germany	Memory usage in quantum contextuality
P7	Archan S. Majumdar S. N. Bose National Centre for Basic Sciences, Kolkata, India	Single particle hybrid entangled states as resource for information processing
P8	Miguel Martinez-Dorantes University of Bonn, Germany	Control of Refractive Index and Motion of a Single Atom by Quantum Interference

No.	Name	Poster title
P9	Ahmed Omran Max-Planck-Institut für Quantenoptik, Garching, Germany	Creating Ultracold Rydberg Atoms In Optical Lattices
P10	Andreas Reingruber University of Heidelberg, Germany	High-performance quantum memory with cold atoms inside a ring cavity
P11	Peter Schauß Max-Planck-Institut für Quantenoptik, Garching, Germany	Quantum Many-Body Systems on the Single-Atom Level
P12	Malte Schlosser TU Darmstadt, Germany	Quantum Information Processing with Atoms in Dipole Potentials
P13	Nobuyuki Takei Institute for Molecular Science, Okazaki, Japan	Ultrafast coherent control of an ultracold Rydberg gas
P14	Andre Wenz University of Heidelberg, Germany	Three-Component Fermi Gases in Optical Lattices
P15	Hashem Zoubi Innsbruck University, Austria	Collective Electronic Excitations for Optical Lattice Ultracold Atoms
P16	Gerhard Zuern University of Heidelberg, Germany	Experiments with a Tunable Few-Fermion System