Q 34 Poster Quantengase

Zeit: Dienstag 16:30–18:30 Raum: Labsaal

Q 34.1 Di 16:30 Labsaal

2D BEC in an optical surface trap — •A. D. LANGE[1], B. ENGESER[1], K. PILCH[1], A. JAAKKOLA[1], H.-C. NÄGERL[1], and R. GRIMM[1,2] — [1]Inst. für Experimentalphysik, Uni Innsbruck, Technikerstr. 25, Innsbruck — [2]Österreichischen Akademie der Wissenschaften, Otto-Hittmair-Platz 1, Innsbruck

We report on an improved apparatus for the production of a 2D Cs BEC in an optical surface trap. Our goal is to enlarge the BEC compared to the previous setup [1], enabling us to systematically study low dimensional quantum systems. The main part of the new system is a glass cell with a super-polished glass prism inserted and glued in at the bottom, providing optimal optical access and a more accurate and faster control of the magnetic field. The atoms are located a few microns above the dielectric prism surface. Strong confinement in the vertical direction leads to a highly anisotropic potential. The implementation of a spatially scanning laser trap allows compression and the controlled excitation of the atomic sample. Sisyphus- and Raman sideband cooling are applied to reach temperatures of a few μK. We further increase the phase-space density via evaporative cooling techniques, which cool down the vertical motion of the atoms to the ground state. A recent experiment, in collaboration with another setup for the production of a Cs BEC, provides first experimental evidence for the existence of Efimov states [2].

\Zitat{1}{D. Rychtarik et al., Phys. Rev. Lett. 92, 173003 (2004)} \Zitat{2}{T. Kraemer et al., submitted}

Q 34.2 Di 16:30 Labsaal

A Fermi mixture of ^{6}Li and ^{40}K — •ANTJE LUDEWIG, TOBIAS TIECKE, STEVE GENSEMER, and JOOK WALRAVEN — Van der Waals-Zeeman Instituut, Universiteit van Amsterdam, Valckenierstraat 65, 1018 XE Amsterdam, The Netherlands

We report on our progress in the construction of a new apparatus for the simultaneous cooling of the Fermionic Alkali isotopes ^{6}Li and ^{40}K. Our goal is to cool the mixture to degeneracy and search for novel pairing mechanisms involving Fermions of different masses.

We have constructed, for the first time, a 2D-MOT source of cold Li atoms directly loaded from a thermal vapor, thereby circumventing the need for a Zeeman slower. The 2D-MOT is loaded from a effusive Li oven source and the trapping light is derived from a YAG-pumped dye laser.

As a source for K, a 2D-MOT is loaded from ^{40}K-enriched thermal vapor. The cold beams of both species are then loaded via differential pumping sections into the main chamber, where we have already observed a dual MOT. The dual MOT will be transferred into a optically plugged magnetic trap and from there into a optical trap. With forced evaporative cooling the Fermi mixture will be cooled to degeneracy.

Q 34.3 Di 16:30 Labsaal

A Quantum Scanning Electron Microscope for Ultracold Atoms — •TATJANA GERICKE, CLAUDIA UTFELD, and HERWIG OTT — Institut für Physik, Universität Mainz, Staudingerweg 7, 55128 Mainz

Ultracold atoms have proven to be a powerful tool for studying fundamental quantum effects of many body systems. In most experiments the information about the system is extracted from absorption images. This widely used technique has two major limitations. First, it is not sensitive on the single atom level and second, its spatial resolution is restricted by the optical wavelength. In fact, only very few experiments have demonstrated a resolution of better than 1 μm. This is especially relevant, as the average atomic distance in degenerate quantum gases is typically between 100 and 500 nm. In our experiment we want to develop a new imaging technique, which overcomes both limitations. It is based on the principles of scanning electron microscopy and employs the spatially resolved ionization of ultracold atoms. An electron beam which can be focussed down to 20 nm is directed onto an atomic ensemble. Atoms that move through the electron beam can be ionized and subsequently detected with high efficiency on an ion detector. The scanning capability of the electron beam allows for the imaging of small areas as well as for time resolved *in situ* measurements. The ultracold atoms will be loaded from a 2D MOT and prepared in a CO_2-dipole trap. The current state of the experiment is presented.

Q 34.4 Di 16:30 Labsaal

Aufbau eines frequenzkamm-basierten Diodenlasersystems zur Synthese absoluter optischer Frequenzen — •CHRISTIAN GROSS, THORSTEN BEST und IMMANUEL BLOCH — Institut für Physik, Johannes Gutenberg Universität Mainz,* Staudingerweg 7, 55128 Mainz

Die in den letzten Jahren entwickelte Frequenzkammtechnik, bestehend aus Femtosekundenlaser und nichtlinearer photonischer Faser, ermöglicht die direkte Synthese und absolute Messung beliebiger optischer Frequenzen.

Wir wollen dieses neue Werkzeug nutzen um Diodenlaser auf beliebige Abstände im Frequenzraum relativ zueinander zu stabilisieren. Dies ermöglicht Raman Übergänge bei großen Frequenzabständen z.B. für die Raman-Photoassoziation in stark gebundene Molekülzustände. Der Aufbau des Frequenzkamm-Systems beinhaltet die Kontrolle von Repetitionsrate ν_{Rep} und Carrier-Envelope-Offset Frequenz ν_{CEO} eines kommerziellen fs-Lasers, sowie die Entwicklung eines optischen Phasenregelkreises um die Diodenlaser auf einzelne Moden des Frequenzkamms zu stabilisieren. Zur Ermittlung der absoluten Frequenz der einzelnen Moden $\nu_n = \nu_{CEO} + n\nu_{Rep}$ verbreitern wir den Kamm auf eine optische Oktave und bestimmen durch Frequenzverdopplung der infraroten Komponenten des Spektrums ν_{CEO} aus dem Schwebungssignal mit den grünen Komponenten. Erfahrungen im Aufbau des Frequenzkamm-Systems werden vorgestellt.

Q 34.5 Di 16:30 Labsaal

Beugung eines Kondensats am magnetischen Gitter — •ANDREAS GÜNTHER, SEBASTIAN KRAFT, CLAUS ZIMMERMANN und JÓZSEF FORTÁGH — Physikalisches Institut der Universität Tübingen, Auf der Morgenstelle 14, 72076 Tübingen

Wir untersuchen die Interferenz von Kondensaten nach der Beugung an einem magnetischen Gitter. Das Interefernzmuster entsteht durch die Überlagerung der verschiedenen Beugungsordnungen, die eine feste Phasenbeziehung untereinander haben. Wir zeigen, dass die Beugung zu einer phasenkohärenten Aufteilung des Kondensats führt und diskutieren die Anwendung zur empfindlichen Messung von Kräften aufgrund des Interferenzmusters.

Q 34.6 Di 16:30 Labsaal

Bose-Einstein Kondensate in ungeordneten Potentialen — •R. TIEMEYER, T. SCHULTE, S. DRENKELFORTH, G. KLEINE BÜNING, W. ERTMER und J. ARLT — Institut für Quantenoptik, Universität Hannover, Welfengarten 1, 30167 Hannover

Wir berichten über unsere Experimente mit Bose-Einstein Kondensaten in ungeordneten optischen Potentialen. Die experimentelle Realisierung des ungeordneten Potentials wird präsentiert, und wir diskutieren die physikalischen Eigenschaften dieses Vielteilchensystems im kombinierten Potential aus Unordnung und Magnetfalle.

Besonders interessante Phänomene sind zu erwarten, wenn ungeordnete Potentiale der perfekten periodischen Struktur eines optischen Gitters überlagert werden [1]. Wir berichten über unsere Experimente mit ungeordneten 1D-Gittergasen und diskutieren, unter welchen Bedingungen das Auftreten nichttrivialer Lokalisierungsphänomene zu erwarten ist [2].

Wir präsentieren darüber hinaus den Stand unserer derzeitigen Arbeiten mit ultra-kalten Bosonen in ungeordneten Potentialen und geben einen Ausblick auf die zukünftigen Projekte unseres Experiments.

[1] B.Damski *et al.*, Phys.Rev.Lett. 91, 080403 (2003).
[2] T.Schulte, S.Drenkelforth, J.Kruse, W.Ertmer, J.Arlt, K.Sacha, J.Zakrzewski, M.Lewenstein, Phys.Rev.Lett.95, 170411 (2005)

Q 34.7 Di 16:30 Labsaal

Detection of Bose-Einstein condensates with partially incoherent light — •LARS NEUMANN, CHRISTOPH BECKER, JOCHEN KRONJÄGER, KAI BONGS, and KLAUS SENGSTOCK — Institut für Laserphysik, Luruper Chaussee 149, Gebäude 69, 22761 Hamburg

When imaging the time evolution of eg 87Rb Bose-Einstein condensates often low optical densities are to be detected with high precision. Interference effects within the detection system, such as parasitic optical resonators together with mechanical oscillations, may impose fringes on the images which are of comparable length and brightness as the structures of interest in the condensate. The fringes can be subtracted by post processing with a set of reference images. However, this procedure is strongly limited if the optical densities of fringes and components are on the same scale. To improve the resolution of our detection system, an offset-locked tunable high power laser is set up. Subsequently the laser light is scattered by a diffusive liquid to remove spatial coherence. The detection of BEC with scattered, partially incoherent light eliminates spurious fringe patterns at the cost of speckle patterns. Our detection set up may allow a resolution of down to 2μm.

Q 34.8 Di 16:30 Labsaal

Excitations and correlations in the dynamics of Bose-Einstein condensates — •Thomas Ernst, Michael Hartung, Tobias Paul, Klaus Richter, and Peter Schlagheck — Institut für Theoretische Physik, Regensburg

We study the coherent flow of a Bose-Einstein condensate through a quantum point contact in a magnetic waveguide beyond the quasi one-dimensional adiabatic mean-field regime [1]. The population of transverse excitations in the waveguide is accounted for by a Bogoliubov-like linearization procedure. We show, that the contribution of such transverse excitations may cause significant modifications of the transmission through the point contact. In order to go beyond the mean-field approximation, we use a refined version of a microscopic quantum dynamics approach [2] which is based on the method of noncommutative cumulants. Instead of using normal-ordered correlation functions and their system of equations, we calculate the dynamics of their appropriate cumulants according to Wick's theorem. This method is number-conserving, contains for situations close to equilibrium the Bogoliubov approach, but accounts also for highly non-equilibrium situations and allows to compute excitations of the condensate as well as its depletion rate. We apply this approach to elementary transport processes in one dimension.

[1] P. Leboeuf and N. Pavloff, Phys. Rev. A 64, 033602 (2001)
[2] T. Köhler and K. Burnett, Phys. Rev. A 65, 033601 (2002)

Q 34.9 Di 16:30 Labsaal

Interacting Rubidium and Caesium atoms — •Michael Haas, Daniel Frese, Christian Grachtrup, Shincy John, Vanessa Leung, Dietmar Haubrich, Arno Rauschenbeutel und Dieter Meschede — Institut für Angewandte Physik, Universität Bonn, Wegelerstr. 8, 53115 Bonn

Our experimental set up allows us to cool Rubidium to quantum degeneracy and magnetically trap Rubidium and Caesium simultaneously. We are able to selectively cool Rubidium by forced evaporation on the 6.8 GHz hyperfine transition. By analysing measurements of the thermalisation dynamics, the interspecies scattering cross section can be calculated, which at ultra cold temperatures is determined by the s-wave scattering length.

Q 34.10 Di 16:30 Labsaal

Kalium-Rubibium Gemische in QUIC Falle: Erzeugung und Charakterisierung — •Ulrich Schneider[1], Thorsten Best[1], Tim Rom[1,2], Dries van Oosten[1] und Immanuel Bloch[1] — [1]Institut für Physik, Universität Mainz, 55099 Mainz — [2]Department für Physik, LMU München, 80799 München

Wir präsentieren ein neues Experiment zur Erzeugung und Untersuchung von Bose-Fermi Gemischen in optischen Gittern. Bosonisches ^{87}Rb und fermionisches ^{40}K werden in einer Magneto-Optischen-Falle gefangen und gekühlt, wobei als Atomquellen für ^{40}K selbstgebaute Dispensoren eingesetzt werden. Nach einer anschließenden optischen Molasse werden die Wolken über einen magnetischen Transport in eine UHV-Glaszelle transferiert und in eine QUIC-Falle umgeladen.

Dort wird mittels evaporativen Kühlens ein Gemisch aus einem Bose-Einstein-Kondensat sowie einem –sympathetisch mitgekühlten– entarteten Fermigas hergestellt. Dieses Gemisch soll schließlich in ein optisches 3D-Gitter geladen und untersucht werden.

Es werden Messungen zur Produktion und Charakterisierung der ultrakalten Wolken und zum aktuellen Stand des Gitter-Aufbaus diskutiert.

Q 34.11 Di 16:30 Labsaal

Kohärente Kontrolle von Spindynamik in optischen Gittern — •Artur Widera, Simon Fölling, Fabrice Gerbier, Torben Müller, Olaf Mandel und Immanuel Bloch — Institut für Physik der Universität Mainz; 55099 Mainz, Germany

Für verschiedenste Anwendungen in Quanteninformationsverarbeitung oder Festkörpersimulationen benötigt man eine Methode, um kohärente Wechselwirkung zwischen zwei Teilchen effizient zu kontrollieren. Kürzlich wurde beobachtet, daß die spinändernden Stöße zwischen zwei Atomen in einem optischen Gitter zu kohärenten Populationsoszillationen zwischen Zeeman-Niveaus führen. Wir demonstrieren hier eine Methode, um diese Dynamik mittels Mikrowellenstrahlung durch einen AC-Zeemaneffekt – analog zum AC-Starkeffekt – zu manipulieren. Insbesondere können wir die stoßinduzierten Oszillationen in Resonanz stimmen oder komplett unterdrücken. Diese Technik ermöglicht es uns unter anderem, die Atomzahlstatistik sowohl im superfluiden Regime der Atome im optischen Gitter, als auch tief im Mott-Isolator Regime zu untersuchen.

Q 34.12 Di 16:30 Labsaal

Long lifetime of Feshbach molecules made from bosonic atoms — •Dominik Bauer, Thomas Volz, Niels Syassen, Eberhard Hansis, Stephan Dürr, and Gerhard Rempe — Hans-Kopfermann-Str. 1, 85748 Garching, Germany

Feshbach molecules made from bosonic atoms usually decay within a few milliseconds due to inelastic collisions with other atoms or molecules [1]. We report how the lifetime of the molecules is increased in an optical lattice.

We load a ^{87}Rb BEC into an optical lattice and achieve a quantum phase transition from a superfluid to a Mott insulator. This can be used to tailor the number of atoms per lattice site. We prepare a Mott insulator in which a large fraction of the sites is occupied by two atoms each. Feshbach molecules are created at sites containing two or more atoms by ramping the magnetic field through the Feshbach resonance at 1007 G [2]. Sites with three or more atoms are rapidly depleted by inelastic collisions. What is left are isolated $^{87}Rb_2$ molecules. We find lifetimes around 100ms for these isolated molecules. The creation of long-lived Feshbach molecules in optical lattices is also reported in [3].

[1] T. Mukaiyama et al., Phys. Rev. Lett. 92, 180402 (2004)
[2] S. Dürr et al., Phys. Rev. Lett. 92, 020406 (2004)
[3] G. Thalhammer et al., cond-mat/0510755

Q 34.13 Di 16:30 Labsaal

Manipulation und Zustandspräparation von Fermi-Bose-Mischungen aus ^{87}Rb und ^{40}K mit RF, Mikrowellenstrahlung und Braggstreuung — •Manuel Succo, Christian Ospelkaus, Silke Ospelkaus-Schwarzer, Philip Ernst, Leif Humbert, Klaus Sengstock und Kai Bongs — Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg

Wir stellen verschiedene Möglichkeiten zur Zustandspräparation von ^{87}Rb- und fermionischen ^{40}K-Atomen vor. Spezielle Anforderungen in unserem Projekt sind u.a. die Adressierung spezieller K-Rb-Feshbachresonanzen oder die Präperation des absoluten atomaren Grundzustands des Ensembles. Für Rb erfolgt die Manipulation über Hochmischen einer variablen Radiofrequenz auf 6.8 GHz, Verstärkung und Abstrahlung mittels eines offenen Hohlleiters. Aufgrund der hervorragenden Kopplung werden vergleichsweise niedrige Leistungen (<1W) benötigt. In einem ähnlichen System für die Hyperfeinmanipulation von K erfolgt die Abstrahlung über eine durch "Stub-Tuning" impedanzangepasste Schleifenantenne. Zudem steht dem Projekt zur Untersuchung des Impulsspektrums von K ein Bragg-Lasersystem zur Verfügung, das auf einem gitterstabilisierten Diodenlaser bei 767nm basiert.

Q 34.14 Di 16:30 Labsaal

Many-body quantum states in few mode Hamiltonians and applications to bosonic spinor gases — •Carsten Weiss, Reinhold Walser, Lev Plimak, and Wolfgang P. Schleich — Abteilung Quantenphysik, Universität Ulm, Germany

Well isolated trapped spinor Bose-Einstein condensates [1-3] represent an ideal environment to investigate exact many-body dynamics of simple spin systems [4, 5]. The great challenge of many body physics is to find the appropriate physical description that aids the intuition.

In this contribution, we will discuss few mode bosonic Hamiltonians, which arise naturally from spinor Bose-Einstein condensates. We will compare the number-symmetry breaking mean-field approximation with exact numerical solutions of the many-body Schrödinger equation. Furthermore, we will introduce convenient analytical approximations for the stationary many-body eigenstates.

[1] W. Zhang *et al.*, Phys Rev. A, **72**, 013602 (2005).
[2] J. Kronjäger *et al.*, Phys. Rev. A, **72**, 1 (2005).
[3] L. Plimak, C. Weiß, R. Walser and W.P. Schleich, Opt. Comm. submitted (2005).
[4] J. R. Anglin, P. Drummond, and A. Smerzi, Phys. Rev. A, **64**, 063605 (2001).
[5] M. Holthaus, Phys. Rev. A, **64**, 11601(R) (2001).

Q 34.15 Di 16:30 Labsaal

Micromanipulation of ultra-cold atoms close to conducting surfaces — •Bettina Fischer[1], Sebastian Hofferberth[1], Stephan Wildermuth[1], Thorsten Schumm[2], Daniel Gallego[1], Igor Lesanovsky[1], Mauritz Andersson[3], Peter Krueger[4], Jose Verdu[1], and Jörg Schmiedmayer[1] — [1]Physikalisches Institut Heidelberg, University of Heidelberg, Philosophenweg 12,D- 69120 Heidelberg, Germany — [2]Laboratoire Charles Fabry de l'Institut d'Optique, UMR 8105 du CNRS, F-91403 Orsay, France — [3]Department of Microelectronics and Information Technology, The Royal Institute of Technology, SE-164 40, Kista, Sweden — [4]Laboratoire Kastler Brossel, Ecole Normale Superieure , 24 Rue Lhomond, F-75005 Paris, France

Cold neutral atoms can be controlled and manipulated in microscopic potentials near surfaces of atom chips. We present the results of various experiments carried out over the last year on our atom chip setup. (1) The realization of a coherent matter-wave beam splitter based on radio-frequency induced adiabatic potentials; (2) The implementation of a "BEC-microscope", where observed density modulations in trapped 1d-BECs are used to reconstruct the current density in a conductor; (3) the characterization of quasi 1d quantum gases and the 1d-3d cross over; (4) experiments with a combined magnetic and optical atom chip trap, demonstrating 2d trapping and Bloch oscillations.

[1] Schumm, T. et al, Nature Physics 1, 57 (2005) [2] Wildermuth S. et al, Nature 435, 440 (2005) [3] Wildermuth, S., Phd thesis, University Heidelberg, (2005)

Q 34.16 Di 16:30 Labsaal

Non-equilibrium dynamics of a Bose gas in a double-well trap — •Kristan Temme and Thomas Gasenzer — Institut für Theoretische Physik, Philosophenweg 16, 69120 Heidelberg

The time evolution of a Bose-Einstein condensate trapped in a double-well potential is studied away from thermal equilibrium, using a full quantum many-body treatment on the basis of Green-functions techniques in field theory. Two-well trapping potentials have gained much importance in studying the matter-wave analogue of the Josephson effect in solid state physics. Due to the physical scales governing the tunneling-coupled matter wave packets, details of the dynamical evolution become amenable to experimental studies. The far-from-equilibrium configurations of particular interest are those where quantum fluctuations become important which are not taken into account in mean-field theory. An approach to beyond-mean-field quantum many-body theory is presented which allows to describe both the short and long-time evolution of a gas away from equilibrium. The dynamical many-body theory remains applicable at long times, where thermal equilibrium is approached. The method allows to distinguish quantum and classical statistical aspects of the dynamical evolution.

Q 34.17 Di 16:30 Labsaal

Superconducting Microtraps for Bose-Einstein Condensates — •Brian Kasch, Daniel Cano, Dieter Koelle, Reinhold Kleiner, Claus Zimmermann, and Jozsef Fortagh — Physikalisches Institut der Universitaet Tuebingen, Auf der Morgenstelle 14, 72076

We are building an experiment to produce Bose-Einstein Condensates in a microtrap with superconducting niobium wires. The microtrap will be cooled below 5K by the cold finger of a cryostat inside a vacuum chamber. Condensates will initially be produced in a compact Ioffe trap setup, and then transfered via optical tweezers to the chip located 5 cm away. The chip design will include periodic microstructures for novel atom optics experiments. Early experiments will probe the interaction of the cold surface with the condensate, and the coupling of superconducting-condensate wavefunctions.

Q 34.18 Di 16:30 Labsaal

Towards Feshbach resonaces in an ultracold mixture of ^{6}Li and ^{87}Rb — •Carsten Marzok, Benjamin Deh, Christian Silber, Sebastian Günther, Philippe W. Courteille, and Claus Zimmermann — Physikalisches Insitut, Universität Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen, Germany

The interatomic potentials of ultracold fermionic ^{6}Li and bosonic ^{87}Rb are currently only inaccurately known. Measuring locations of Feshbach resonances tightens constraints on these potentials since Feshbach resonances are extremely sensitive to the position of the last bound state of the interatomic groundstate potential. Furthermore, Feshbach resonances provide a powerful tool for transforming atoms into molecules. As proposed by Stwalley, such vibronically excited dipolar molecules could be converted into stable groundstate molecules by a coherent STIRAP process [1]. We will perform a search for Feshbach resonances by loading a quantum degenerate mixture of ^{6}Li and ^{87}Rb recently realized in our group [2] into an optical dipole trap and scanning a magnetic field. We describe the status of the implementation of the dipole trap and the results to date.

[1] W.C. Stwalley, Eur. Phys. J. D **31**, 221–225 (2004)
[2] C. Silber et al., Phys. Rev. Lett. **95**, 170408 (2005)

Q 34.19 Di 16:30 Labsaal

Towards an All-Optical Realisation of a Quantum-Degenerate Potassium-40 Fermi-Gas — •Christian Bolkart, Alexander Gatto, and Martin Weitz — Physikalisches Institut, Auf der Morgenstelle 14, 72076 Tübingen

We are working on the realization of a degenerate 40K Fermi gas based on direct evaporative cooling of atoms in an optical dipole trap. The quantum gas will we used for the search for novel quantum phase transitions in optical lattices.

The required near-resonant radiation for laser cooling and trapping of atoms is derived from a home-made Oscillator-Optical Power Amplifier (MOPA) system. Our setup uses a magneto optical trap (MOT) for the fermionic atoms that is loaded by the cold atomic beam created with a 2D-MOT. After a temporal dark-MOT phase, the atoms will transferred into an optical dipole trap realised with a focused CO2-laser beam. To enhance the collisional cross section during the subsequent evaporative cooling towards quantum degeneracy, a Feshbach-resonance of the $m_F = -7/2$ and $m_F = -9/2$ spin projections of the $F = 9/2$ hyperfine ground state is employed. The interaction of atoms in these two states can be controlled by an external magnetic field.

Q 34.20 Di 16:30 Labsaal

Towards an atom laser by all-optical means — •Maic Zaiser, Tobias Müller, Thijs Wendrich, Michael Gilowski, Ernst Maria Rasel und Wolfgang Ertmer — Institut für Quantenoptik, Universität Hannover, Welfengarten 1, 30167 Hannover

Pulsed (or even continuous) atom lasers represent a highly monochromatic source of atoms in a well-defined quantum state with extremely high brilliance. We present a new concept for an experimental setup which aims at Bose-Einstein-Condensation (BEC) in dilute atomic gases of ^{87}Rb by all-optical means. The atomic source consists of a two stage design, where the atoms will be pre-cooled in two dimensions in a magneto-optical trap (2D-MOT) and then loaded into a 3D-MOT. In the 3D-MOT the atoms will be further cooled down to typically ~ 10 μK and then loaded into an optical dipole trap generated by a far-off resonant laser beam. In the new setup this trap may be realized in various configurations, like a single or crossed beam geometry or even a 3D-lattice. Quantum degeneracy will then be achieved by evaporative cooling in the dipole trap. The new setup will provide a high degree of flexibility and transportability allowing for various different kinds of experiments. We will investigate the potential of such an atomic source for precision atom interferometry, such as the Cold Atom Sagnac Interferometer (CASI) [1], an extremely sensitive inertial sensor for rotation and acceleration currently being set up in Hannover. This work is part of the project FINAQS funded by the European Union.

[1] C. Jentsch, T. Müller, E. M. Rasel, and W. Ertmer, Gen. Rel. Grav. 36(10), 2197 (2004)

Q 34.21 Di 16:30 Labsaal

Transport of Bose-Einstein-Condensates in quantum dot potentials — •Michael Hartung, Tobias Paul, Klaus Richter, and Peter Schlagheck — Institute for Theoretical Physics, University of Regensburg, D-93040 Regensburg, Germany

The rapid progress in the "atom chip" technology permits detailed studies of the dynamics of Bose-Einstein condensates in presence of atomic quantum dot potentials. We particularly focus on the quasi-stationary resonant transport through such a potential [1] as well as on the decay of the associated quasi-bound resonance state. To this end we developed a numerical method to calculate bound states and resonances within the mean-field approximation of the condensate's dynamics. This approach is combined with the time-dependent calculation of the nonlinear scattering problem, where we use a novel, unambiguous definition of the transmission coefficient for the interacting condensate. We discuss the relation between the decay rate of quasi bound states [2] and the width of scattering resonances. Furthermore we investigate to which extent bound states of the quantum dot potential can be populated via beak-to-beak crossings of scattering resonances [3].

[1] T. Paul, K. Richter, and P. Schlagheck, Phys. Rev. Lett. 94, 020404 (2005)
[2] P. Schlagheck, and T. Paul, cond-mat/0402089
[3] K. Rapedius, D. Witthaut, and H. J. Korsch, cond-mat/0507679