lattice design is proposed, estimates of relevant temperature scales are given and experimental signatures of the circulating current phase are identified. Related phenomena in bosonic and spin systems with ring exchange are discussed.

TT 38.7 Fri 12:00 H 3010

Vorticity in rotating 2D Bose-Einstein condensates in the regime of strong coupling — •Tanja Rindler-Daller — Institut für Theoretische Physik, Universität zu Köln, Zülpicher Strasse 77, 50937 Köln, Germany

When Bose-Einstein condensates are subjected to an external rotation different vortex structures appear depending on the applied angular velocity Ω. We study the ground state within the Gross-Pitaevskii theory in the limit of large coupling constant for condensates which are confined in (asymptotically) homogeneous trap potentials [1,2]. We identify three regimes in Ω, which are characterized by a distinctive behaviour in the density profile and vortex structures, by rigorous estimates.

[1] M.Correggi, T.Rindler-Daller, J.Yngvason, J.Math.Phys. 48, 042104 & 102103 (2007)

[2] T.Rindler-Daller, accepted by Physica A

TT 38.8 Fri 12:15 H 3010

Shuttle for cold atoms: atomic quantum dot inside Bose Josephson junction. — •Anna Posazhennikova[1], Uwe R. Fischer[2], and Christian Iniotakis[3] — [1]Physikalisches Institut, Universitaet Bonn, Germany — [2]Institut fuer Theoretische Physik, Eberhard-Karls-Universitate Tuebingen, Germany — [3]ETH Zuerich, Institut fuer Theoretische Physik, Zuerich, Switzerland

We study an atomic quantum dot representing a single hyperfine "impurity" atom which is coherently coupled to two well-separated Bose-Einstein condensates. It is demonstrated that the quantum dot by itself can induce coherent oscillations of the particle imbalance between the condensates even when the conventional tunneling between the two condensates is exponentially small and can be completely neglected. In the limit of noninteracting condensates, we provide an analytical solution to the coupled nonlinear equations of motion which is in agreement with the full numerical treatment.

TT 38.9 Fri 12:30 H 3010

Condensate formation in Bose-gas upon cooling — •Roman Saptsov[1], Efim Brener[1], and Sergey Iordanskiy[2] — [1]IFF, FZ-Jülich, Jülich, Germany — [2]Landau Istitute for Theoretical Physics, Moscow, Russia

The mechanism for the transition of a Bose gas to the superfluid state via thermal fluctuations is considered. It is shown that in the process of external cooling some critical fluctuations (instantons) are formed above the critical temperature. The probability of the instanton formation is calculated. It is found that this probability increases as the system approaches the transition temperature.

TT 38.10 Fri 12:45 H 3010

Construction of an optical dipole trap for studying bosonic mixtures — •Lars Steffens[1,2], Shincy John[1], Claudia Weber[1], Artur Widera[1], Manfred Fiebig[2], and Dieter Meschede[1] — [1]IAP, Universität Bonn, Wegelerstr. 8, 53115 Bonn, Germany — [2]HISKP, Universität Bonn, Nussallee 14-16, 53115 Bonn, Germany

Because of their well controlable behaviour, ultracold atomic gases are a useful tool for studying quantum mechanical many body systems. A variety of problems of solid state physics could be modelled by using systems of ultracold gases. In addition, studying *mixtures* of ultracold gases lead to an improved understanding of quantum mechanical multi component systems. Up to now, mostly boson-fermion mixtures were considered while only little research has been done on boson-boson mixtures of different atomic species. Here the construction of an simple optical dipole trap designed for Feshbach spectroscopy of Rb-Cs mixtures is presented. The response of the atomic species to the light field is discussed. A precise simulation of the optical potential by a 3D-simulation of the light field including aberration and diffraction effects is given. These results can be used as a basis for the construction of other dipole potential setups that can be used to describe a broad variety of external parameters.

TT 39: Transport: Nanoelectronics II - Spintronics and Magnetotransport

Time: Friday 10:15–13:00 Location: EB 202

Invited Talk TT 39.1 Fri 10:15 EB 202

EuO_{1-x} Epitaxially Integrated with Silicon — •Andreas Schmehl[1,2], Stefan Thiel[2], Christoph Richter[2], Ross Ulbricht[1], Tassilo Heeg[1], Marco Liberati[3], Martin Röckerath[4], Sebastian Mühlbauer[6], Peter Böni[6], Yuri Barash[5], Jürgen Schubert[4], Yves Idzerda[3], Jochen Mannhart[2], and Darrell G. Schlom[1] — [1]Pennsylvania State University, University Park, PA, USA — [2]Universität Augsburg, Augsburg — [3]Montana State University, Bozeman, MT, USA — [4]Forschungszentrum Jülich, Jülich — [5]Russian Academy of Sciences, Chernogolovka, Russia — [6]Technische Universität München, Garching

The ferromagnetic semiconductor EuO is well known for its outstanding magneto-transport and magneto-optical properties, but for decades its instability in air has prevented the thorough exploration of this exciting material. Exploiting oxide MBE and advanced capping techniques, we are now able to epitaxially integrate EuO with a multitude of substrates including silicon and GaN and pattern it using photolithography. Using Andreev reflection spectroscopy, we demonstrate that these films have spin-polarizations exceeding 90%, rendering EuO a very promising candidate to establish spin-selective ohmic contacts to silicon. A novel patterning process, combining *insitu* ion etching and sputtering, allows for the patterning of the films, paving the way to exploit EuO in semiconductor-based spintronic devices as well as in devices making use of its exceptional magneto-transport and magneto-optical properties.

TT 39.2 Fri 10:45 EB 202

Simultaneous ferromagnetic semiconductor-metal transition in Gd-doped EuO — •Michael Arnold and Johann Kroha — Physikalisches Institut, Universität Bonn

At room temperature, europium oxide, EuO, is a paramagnetic semiconductor with a large band gap of 1.2 eV which undergoes a ferromagnetic ordering transition at a Curie temperature of $T_C = 69$ K. Upon minute electron doping, this transition turns into a simultaneous ferromagnetic semiconductor-metal transition, with nearly 100 % of the conduction electrons polarized and a huge magnetoresistance effect. This has made EuO a prototypical material for possible spintronics applications.

Here we present a general framework for describing this phase transition in Gd-doped EuO. This system is described by a Heisenberg lattice of the Eu 4f moments S=7/2, a conduction band (which in the high-temperature phase is empty), and singly occupied impurity levels in the gap, provided by the Gd 5d orbitals. The theory correctly describes detailed experimental features of the conductivity and of the magnetization, in particular the enhancement of T_C by a minute Gd doping concentration. The existence of correlation-induced local moments on the impurity sites is essential for this description. We also predict that the ferromagnetic semiconductor-metal transition can be switched by applying a gate voltage to EuO films.

TT 39.3 Fri 11:00 EB 202

Effect of spin-orbit coupling on transport through ferromagnetic atomic-sized contacts — •Michael Häfner[1,2,3], Janne Viljas[1,2], and Juan Carlos Cuevas[3,1,2] — [1]Institut für Theoretische Festkörperphysik, Universität Karlsruhe, D-76128 Karlsruhe — [2]Institut für Nanotechnologie, FZ Karlsruhe, D-76021 Karlsruhe — [3]Departamento de Física Teórica de la Materia Condensada, Universidad Autónoma de Madrid, E-28049 Madrid

Based on a tight-binding model we analyze the effect of spin-orbit coupling on the transport through ferromagnetic atomic-sized contacts. Our calculation shows a strong dependence of the conductance on the direction of magnetization. The results suggest that the anisotropic magnetoresistance found in recent experiments on transport through ferromagnetic atomic-sized contacts [1] stems from the spin-orbit coupling.

[1] K. Bolotin et al., Phys. Rev. Lett. **97**, 127202 (2006)