SYUA 1 Atom Chip Physics

Zeit: Mittwoch 11:00–13:00 Raum: HU Audimax

Hauptvortrag SYUA 1.1 Mi 11:00 HU Audimax

Atom Chips: Mesoscopic Physics with Cold Atoms — •Jörg Schmiedmayer — Physikalisches Institut, Universität Heidelberg, Philosophenweg 12, 69120 Heidelberg, Germany

In mesoscopic quantum electronics, electrons move inside semiconductor structures and are manipulated using potentials where at least one dimension is comparable to the de-Broglie wavelength of the electrons. Similar potentials can be created for neutral atoms moving microns above surfaces using charged and current carrying structures nano-fabricated onto a surface. We will give an overview of the experiments studying the manipulation of cold thermal atoms and BECs on Atom Chips. Atoms can be held and manipulated in strongly confining traps and guides using magnetic, electric and optical fields. Using our atom chips, lithographically fabricated into high quality evaporated Gold layers, previously observed huge disorder potentials are orders of magnitude smaller in our experiments. With Bose-Einstein condensates as a sensitive probe, we could study the spatial variation of magnetic potentials down surface distances in the mikrometer range. A series of experiments are performed by looking at various topics in mesoscopic and 1-d physics of degenerate quantum gases in, and far from, thermal equilibrium.

Hauptvortrag SYUA 1.2 Mi 11:30 HU Audimax

Atomic Matter Waves in Magnetic Micro Potentials — •Claus Zimmermann — Physikalisches Institut, Universität Tübingen, Auf der Morgenstelle 14, 72076 Tübingen, Germany

With micro fabricated current conductors on the surface of a substrate it is possible to trap atoms in magnetic potentials of almost arbitrary geometry. Since also Bose-Einstein condensates can be loaded into such micro traps the vision of an integrated atom optics becomes realistic. First versions of matter wave interferometers for sensitive detection of forces and accelerations have been demonstrated recently, but also integrated quantum gates for quantum information processing are conceivable. Furthermore, the close distance to the surface of the substrate makes the atoms a sensitive probe for surface effects.

Hauptvortrag SYUA 1.3 Mi 12:00 HU Audimax

Nonlinear resonant transport of Bose-Einstein condensates — •Peter Schlagheck — Institut für Theoretische Physik, Universität Regensburg, 93040 Regensburg, Germany

The rapid progress of atom chip technology opens the perspective for experiments that probe the transport of Bose-Einstein condensates through mesoscopic waveguides. Particularly interesting in this context is the propagation of the condensate through a double barrier potential created by a sequence of two constrictions in the waveguide, which can serve as a Fabry-Perot interferometer for the condensate. We show that resonant is suppressed in interaction-induced regimes of bistability, where multiple scattering states exist at the same chemical potential and the same incident current. We demonstrate, however, that a temporal control of the external potential can be used to circumvent this limitation and to obtain enhanced transmission near the resonance on experimentally realistic time scales.

Hauptvortrag SYUA 1.4 Mi 12:30 HU Audimax

Atomic Quantum Dots in a Bose-Einstein-Condensate — •Wilhelm Zwerger — Institut für Theoretische Physik, Technikerstraße 25, 6020 Innsbruck, Austria

We discuss a possible realization of atomic quantum dots formed by single atoms in a tight optical trap which are coupled to a superfluid reservoir via laser transitions. Quantum interference between the collisional interactions and the laser induced coupling to the phase fluctuations of the condensate results in a tunable interaction of an effective two state system to a dissipative phonon bath. It allows to completely switch off the coupling to the environment. Embedding the trapped atoms in an atomic wire of cold bosonic atoms, a dissipative phase transition may be crossed beyond which Rabi oscillations entirely disappear.