

ing. The technique also spatially separates the cold subset of atoms from the remaining hotter cloud. In addition to selecting a colder subset of atoms, this technique imposes a sharp cutoff in the velocity distribution, making the technique useful for experiments requiring non-thermal distributions. Experimental verification of the velocity cut is shown.

14:24

R2 3 Two Species Far-Off Resonance Optical Dipole Force Trap G. XU, EMEK YESILADA, D. J. HEINZEN, *Dept. of Physics, The University of Texas at Austin* We have confined Li and Cs atoms in a two-species magneto-optical trap (MOT), and have constructed a dual-wavelength far-off resonance optical dipole force trap (FORT) that will be used to tightly confine the Li and Cs atoms. More than 10^7 atoms of each species have been trapped in the MOT. The FORT consists of two spatially overlapped, tightly focused laser beams of 680 nm and 900 nm wavelengths, and with more than 200 mW power. These beams produce a trap depth of several mK for each species. Experiments are in progress to demonstrate loading of the FORT and to investigate photoassociation of the trapped atoms by the FORT beams. The high density of atoms in a FORT and the high intensity of the FORT beams should lead to strong photoassociation signals, and to efficient production of ultracold heteronuclear Li-Cs molecules.

14:36

R2 4 Feedback Control of Atomic Motion in Optical Lattices NATALYA MORROW, SUBRATA DUTTA, GEORG RAITHEL, *University of Michigan* Atoms in an optical lattice perform a slight random motion that reflects the non-zero temperature of the trapped atoms. We are proposing a way of reducing such random motion using real-time feedback. This method is related to the stochastic cooling used to transversely cool particle beams. We measure the coherent redistribution of photons between laser beams of the optical lattice, which is caused by stimulated Raman transitions of the atoms. The signal gives a real-time, non-destructive reading on the average deviation of the atoms from their ideal well positions. If atoms get displaced from their well positions by an environmental effect that affects all atoms the same way, such as a mirror vibration or a sudden shift of the lattice, the photon exchange signal is proportional to the number of atoms and consequently strong. The signal is fed into a PID circuit, which drives a phase modulator. For a suitable gain setting, the feedback loop dampens the atomic motion by continuously back-shifting the lattice such that the average energy is decreased. We will report on our experiments and present models of the feedback. The application of the feedback mechanism to damp the random fluctuations of the atomic motion in the lattice will be discussed.

14:48

R2 5 Loading Mechanism for Atomic Guides BOONKENG TEO, *University of Michigan* GEORG RAITHEL, *University of Michigan* We present a method for coupling laser-cooled atoms from a vapor-cell magneto-optical trap into a magnetic atom guide. We demonstrate the loading of atoms into two and four wire guides with efficiencies ranging from 5% to 25%. A MOT is formed directly on the axis of the guide, which is tilted at a small angle. The atoms are released from the MOT into the guide when the light and MOT coils shut off. The guide incorporates a tapered section, in which the distance between the guide wires gradually decreases and the field gradient increases. The tapering allows large laser beams to enter in the wide section of the guide and to

form the MOT, while transversely compressing the atomic distribution during its propagation in the guide. We study the longitudinal and transverse profiles of atomic clouds propagating in the guide over distances of up to 18 cm (limited by the guide length). The compression in the tapered guide section causes the transverse temperature to rise above the longitudinal temperature. When the compression is large, collisions cause the distribution to re-thermalize. Fast re-thermalization is a pre-requisite to evaporatively cool the atoms in the guide.

15:00

R2 6 Recoil Induced Resonance in Nonlinear Ground-State Pump-Probe Spectroscopy PAUL BERMAN, CHRISTOPHER SEARCH, *Physics Department, University of Michigan, Ann Arbor, MI* A theory of pump-probe spectroscopy is developed in which optical fields drive two-photon Raman transitions between ground state sublevels. Effects related to the recoil the atoms undergo as a result of their interactions with the fields is fully accounted for in this theory. The linear absorption coefficient of a weak probe field in the presence of two pump fields of arbitrary strength is calculated. For subrecoil atoms, the spectrum consists of eight absorption lines and eight emission lines. The probe spectrum exhibits novel quantum interference effects that allow one to adjust the strength of the lines by varying the ratio of the Rabi frequencies for the pump fields and the sign of the pump field detuning. The absorption spectrum is given a simple interpretation in terms of dressed states of the atoms with an effective two-photon pump field. The extension of these results to an interacting Bose-Einstein condensate is also discussed.

15:12

R2 7 Trapping atoms with evanescent light fields from integrated optical waveguides JAMES BURKE, *NIST, Gaithersburg MD* SAI-TAK CHU, *University of Maryland, College Park MD* GARNETT BRYANT, *NIST, Gaithersburg MD* CARL WILLIAMS, *NIST, Gaithersburg MD* PAUL JULIENNE, *NIST, Gaithersburg MD* We theoretically investigate three approaches to trapping atoms above linear integrated optical waveguides. A two-color scheme balances the decaying evanescent fields of red- and blue-detuned light to produce a potential minimum above the guide. A one-color surface trap proposal uses blue-detuned light and the attractive surface interaction to provide a potential minimum. A third proposal uses blue-detuned light in two guides positioned above and below one another. The atoms are confined to the "dark" spot in the vacuum gap between the guides. We find that all three approaches can be used in principle to trap atoms in two- or three-dimensions with a few 10's of mW of laser power. Of these three methods, we show that the dark spot guide is the most robust to power fluctuations and provides the most viable design approach to constructing integrated optical circuits that could transport and manipulate atoms in a controlled manner.

15:24

R2 8 Quantum mechanics of the dynamic Kingdon trap* REINHOLD BLUMEL, IAN GARRICK-BETHELL, *Dept. of Physics, Wesleyan University, Middletown, CT 06459-0155* As a function of the trap control parameters a classical charged particle stored in a dynamic Kingdon trap may display a period-doubling route to chaos. This talk presents the quantum theory of the single-particle dynamic Kingdon trap and explores the quantum mechanical analog of the classical bifurcation cascade.

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