SEMINAR F-5

ODSEK ZA FIZIKO TRDNE SNOVI

Sreda, 20. november 2013,
ob 11.00

v seminarski sobi fizike (soba 106)
Institut »Jožef Stefan«

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Dynamics of the perturbed magneto optical trap of rubidium atoms

The ability to cool the atoms down to the microK temperatures and than to capture and store them in a magneto-optical trap (MOT) has stimulated a broad field of research in atomic physics and quantum optics including cold collisions, high precision measurement, non-linear spectroscopy and non-linear dynamics.

The main cooling mechanism of the MOT is Doppler cooling [1] which uses the Doppler effect to shift red-detuned light field into resonance with atoms that are moving in the opposite direction of the field propagation. By incorporating a linearly varying field from an anti-Helmholtz coil, a harmonic trap can be formed to obtain a cloud of millions of atoms. Since MOT is a starting point for experiments concerning ultracold molecules and quantum degenerate gasses (bosons and fermions) the dynamics of the MOT is a subject of great interest.

I will present the results of Zagreb group on the investigations of ultracold 87Rb atoms in a perturbed MOT. Perturbation is introduced in MOT via additional laser fields (cw and fs lasers) which induce the change in the dynamics of the trap as well as the change in the phase-space distribution of the cold atoms. Measurement of the trap parameters were performed using pushing beam which induce center-off-mass oscillations [2].

At the end the new theoretical approach of Doppler cooling using frequency comb will be presented [3]. The nature of frequency comb, where each comb mode effectively acts as a cw laser, enables simultaneous cooling of multiple atomic species and hold potential for the preparation of coherent ultracold mixtures.

[1] H.J. Metcalf and P. van der Straten, Laser Cooling and Trapping (Springer-Verlag, New York, 1999).
[2] G. Moon et al., Phys. Rev. A 81, 033425 (2010).
[3] D. Aumiler and T. Ban, Phys. Rev. A 85, 063412 (2012).

Vljudno vabljeni!