Route to BEC and future experiments

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Our project is dedicated to the investigation of interactions in ultracold quantum gases. The first step, the setup for the generation of a ^{87}Rb-BEC, is presented in this poster.

Starting from an intense 2D-MOT ($\sim 6 \cdot 10^{10}$ atoms/s [1]) which is loading an elongated 3D-MOT with a loading time of 5 s, we can collect and cool a maximum of $5 \cdot 10^{10}$ atoms in this 3D-MOT. Since in usual MOT's the density is limited to approximately 10^{10} cm^{-3} [2], we use large elliptical laser beams to gather a large atom number in a large-volume-MOT. The Temperature in this unconventional MOT is rather high (about 1 mK) and the cloud is optically dense. To increase phase-space density before loading the sample in a magnetic trap, it is cooled below Doppler Temperature and compressed to about 10^{11} cm^{-3} by further detuning to -9Γ within 40 ms. Thus we load about $3 \cdot 10^9$ atoms in out magnetic trap where we continue with evaporative cooling. The magnetic trap is in Ioffe-Pritchard-configuration with a strong radial and a weak axial confinement resulting in an aspect ratio of $\omega_\rho/\omega_z \approx 70$.

In future, the BEC will be loaded into a blue-detuned optical lattice for the study of light-induced dipole-dipole-interactions and Rydberg-excitations in the lattice.

[1] J. Schoser, A. Batär, R. Löw, V. Schweikhard, A. Grabowski, Y. B. Ovchinnikov, T. Pfau, An Intense Source of cold Rb Atoms from a Pure 2D-MOT, *arXiv:physics/0201034v1*, submitted to Physical Review A

[2] C. G. Townsend, N. H. Edwards, C. J. Cooper, K. P. Zetie, C. J. Foot, Phase-Space density in the magneto-optical trap, *Phys. Rev. A*, **52** 1423 (1995)