## Tightly confining optical surface trap

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Our gravito-optical surface trap (GOST) provides easy access to large and dense samples of cesium atoms close to an evanescent-wave atom mirror. It can serve as an excellent starting point for loading further optical surface trapping schemes. We have realized a tightly confining surface trap by focussing a Nd:YAG laser beam (waist  $30 \,\mu\text{m}$ ) to the middle of the trapped atoms (Fig.1) providing a two dimensional gaussian potential. In vertical direction the atoms are trapped by gravitation and an evanescent wave (EW).



Figure 1: Illustration of the microtrap configuration. The hollow beam holds the reservoir whereas the far red-detuned Nd:YAG laser creates the microtrap potential.

In this scheme we can trap  $1.5 \times 10^5$  cesium atoms in a volume of  $2100 \,\mu\text{m}^3$ , the achieved temperature is about  $2.9 \,\mu\text{K}$ . Efficient loading of the fully conservative trap is provided by elastic collisions from a reservoir of optically and evaporatively precooled atoms in the GOST [1]. Through this mechanism the "dimple trap" [2] leads to a local increase of number and phase space density by more than two orders of magnitude. We achieve a peak-number density of  $7 \times 10^{13} \,\text{cm}^{-3}$  and a peak phase space density of  $7 \times 10^{-3}$ . With these conditions one finds the elastic collision rate to be as high as 1 kHz. Consequently after loading the microtrap and removing the atomic reservoir we start ramping down the microtrap potential to evaporatively cool the atomic sample. An initially efficient and fast evaporation on a timescale of about 100 ms is interrupted by strong losses due to inelastic collisions when the phase space density reaches about 1/50. However so far all evaporative cooling has been done on an unpolarized atomic sample. We expect evaporation to proceed to higher phase-space density as one uses polarized atoms.

In the near future we intend to investigate 2D quantum degenerated gases in a doubleevanescent-wave trap [3]. This 2D-microtrap will be loaded by thermalization processes as demonstrated in the red detuned trap.

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