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Cavity QED with a narrow linewidth

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Bose-Einstein condensates in optical cavities have been a research area for years, but still there are advanced, yet important, questions waiting for experimental investigation, e.g. several cavity cooling mechanisms or the experimental realization of non-destructive quantum phase probing. The experiments up to now suffer from a large cavity linewidth $\kappa \sim 1/L$, as the length L of the cavities used is usually in the micrometer range; in our experiment we reduced the linewidth by operating in the centimeter range. Unfortunately this requires a more advanced frequency stabilization, which gave rise to many experimental difficulties. By now most of these tasks have been tackled and the experiment is ready to investigate physics.

In the talk I will briefly discuss some of the physical topics with emphasis on their experimental realization.

Then I will present the experiment, its aims, the cavity, the sophisticated frequency stability mechanism and the laser setup. Finally I will discuss the mode detection scheme and further improvements thereof.