ID de Contribution: **282** Type: **Poster**

A new laser system for a rubidium quantum gas experiment

The rubidium 87 quantum gas experiment at the Laboratoire de Physique des Lasers produces degenerate gas samples in a quadrupole magnetic trap dressed with a radio frequency field. In this experiment, the atoms are located near an isomagnetic ellipsoidal surface of the inhomogeneous static field. In the presence of gravity, this ellipsoidal trap allows a two-dimensional confinement in a smooth and highly tunable potential.
I will present the new laser system that we are setting up in the experiment.
This system is based on a reference laser locked to a hyperfine transition of rubidium 85, and three laser diodes dynamically phaselocked onto the reference, with frequency spacing up to 6 GHz. It will provide all the beams necessary for the experimental sequence: cooling, pumping and imaging beams. This new system aims at improving the robustness and flexibility of the laser sources. It will also allows the experiment to switch easily between resonant destructive imaging of the atomic samples and a non-destructive imaging technique [1, 2] recently implemented on our experiment. This technique, in which a single atomic cloud can be probed multiple times, allows to study its dynamics much more directly and thus will be a valuable asset for the study of non-equilibrium processes, such as dissipation of a superfluid flow in the supersonic regime.

[1] Non-destructive shadowgraph imaging of ultra-cold atoms, P. B. Wigley et al, Opt. Lett. 41, 4795-4798 (2016)
[2] See also contribution #279

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Classification de Session: Session Poster 1: MC3, MC5, MC6, MC11, MC13, MC15, MC16, MC18, MC19, MC25, REDP, posters hors MC

Classification de thématique: MC16 Fluides classiques et quantiques hors équilibre