Abstract Submitted
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Study of mesoscopic clouds of cold atoms in the interacting regime[1] RONAN BOURGAIN, ANDREAS FUHRMANEK, JOSEPH PELLEGRINO, YVAN R.P SORTAIS, ANTOINE BROWAEYS, Laboratoire Charles Fabry – Institut Optique - CNRS - Palaiseau France — We present studies on cold and dense atomic ^{87}Rb clouds containing $N \sim 2-100$ interacting atoms. We produced such mesoscopic ensembles by loading a microscopic optical dipole trap from a MOT. Due to 2-body light-assisted collisions, we have found that in steady state such ensembles exhibit reduced number fluctuations with respect to a Poisson distribution. For $N \geq 2$, we measured a reduction Fano factor $F = 0.72 \pm 0.07$ consistent with the value $F = 3/4$ predicted at large N by a general stochastic model [1,2]. To enhance interactions between the atoms, we are following two tracks. Firstly we evaporatively cooled a few hundreds of trapped atoms and obtained ~ 10 atoms close to quantum degeneracy ($n\lambda_{dB}^3 \sim 1$) in the microscopic trap. In this regime s-wave interactions dominate ($n = 2\ 10^{14}$ at.cm^{-3}). Secondly we sent near resonant light (λ_p) on the small cloud (size l). When $l < \lambda_p/2\pi$, dipole-dipole interactions should lead to collective behaviour.

[1] A. Fuhrmanek, Y.R.P. Sortais, P. Grangier, A. Browaeys, Phys. Rev. A **82**, 023623 (2010).
[2] Y.R.P. Sortais, A. Fuhrmanek, R. Bourgain, A. Browaeys, "Sub-Poissonian atom number fluctuations using light-assisted collisions," arXiv:1111.5203 (2011).

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