

Quasi-monomode guided atom-laser

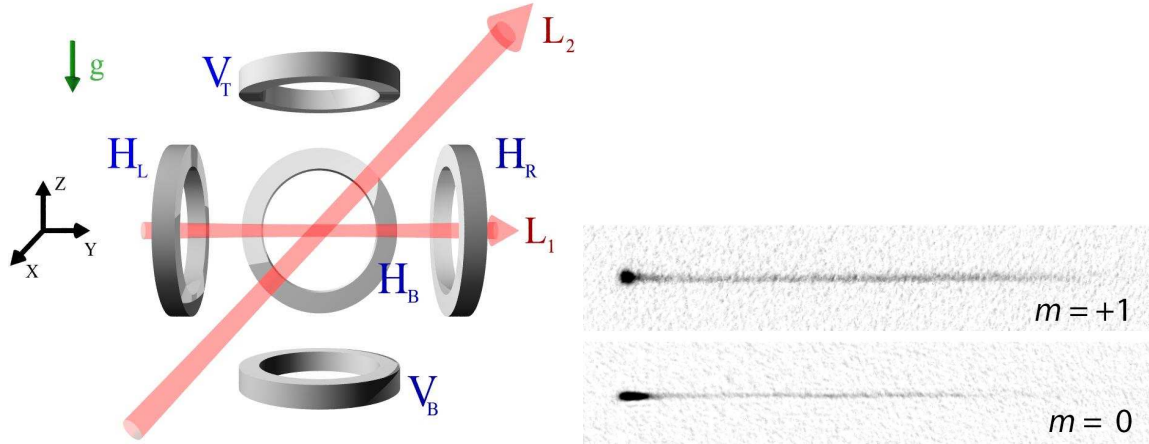
A. Couvert¹, M. Jeppesen^{1,2}, T. Kawalec¹, G. Reinaudi¹, R. Mathevet³
and D. Guéry-Odelin^{1,3}

¹ Laboratoire Kastler Brossel, CNRS UMR 8852, Ecole Normale Supérieure, 24 rue Lhomond, 75005 Paris, France

² Australian Centre for Quantum Atom Optics, Physics Department, The Australian National University, Canberra, 0200, Australia

³ Laboratoire Collisions Agrégats Réactivité, CNRS UMR 5589, IRSAMC, Université Paul Sabatier, 118 Route de Narbonne, 31062 Toulouse CEDEX 4, France.

We report the achievement of an optically guided and quasi-monomode atom laser, in all spin projection states ($m_F = -1, 0$ and $+1$) of $F = 1$ in Rubidium 87 [1]. The atom laser source is a Bose-Einstein condensate (BEC) in a crossed dipole trap, purified to any one spin projection state by a spin-distillation process applied during the evaporation to BEC. The atom laser is outcoupled by an inhomogeneous magnetic field, applied along the waveguide axis. The mean excitation number in the transverse modes is $\langle n \rangle = 0.65 \pm 0.05$ for $m_F = 0$ and $\langle n \rangle = 0.8 \pm 0.3$ for the low field seeker $m_F = -1$. Using a simple thermodynamical model, we infer from our data the population in each transverse excited mode. We will discuss the ultimate limitations for our outcoupling scheme. An interesting prospect deals with the study of atomic intensity fluctuations and the investigation of the longitudinal coherence with guided atom lasers produced in different interacting regime including out-of-thermal equilibrium state.



Reference

[1] A. Couvert, M. Jeppesen, T. Kawalec, G. Reinaudi, R. Mathevet and David Guéry-Odelin, *A quasi-monomode guided atom-laser from an all-optical Bose-Einstein condensate* arXiv/cond-mat :0802.2601, submitted to Europhysics Letters.