

Journées IRSAMC

Visit in the cold atoms group (LCAR)

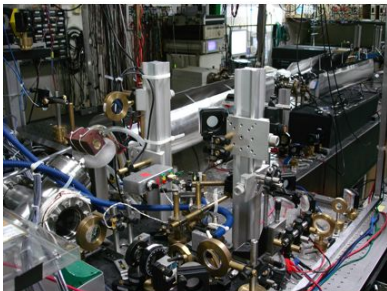
David Schwandt

June 2009

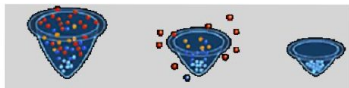
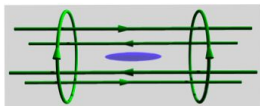
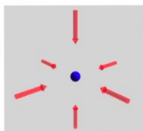
Outline

- 1 How to create a BEC
- 2 Optimal transport of ultracold atoms

Experiment

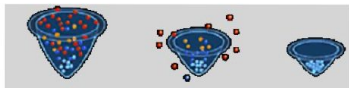
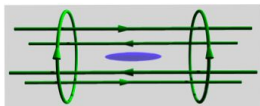
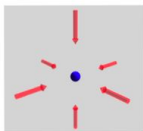


BEC



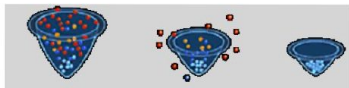
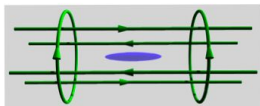
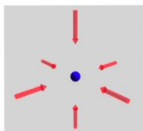
- Zeeman slower
 - Magneto optical trap + Doppler cooling
- $T \sim 100\mu K$
 $N \sim 10^9$
 $n\lambda_{dB}^3 \sim 10^{-6}$

BEC



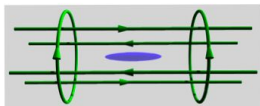
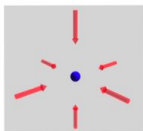
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BEC



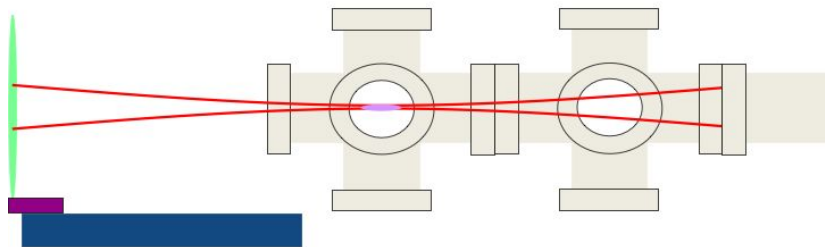
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 - $T \sim 100 \mu K$
 - $N \sim 10^9$
 - $n\lambda_{dB}^3 \sim 10^{-6}$
- Non-dissipative trap
- Cooling by evaporation
 - $T \sim 0.2 \mu K$
 - $N \sim 10^5$
 - $n\lambda_{dB}^3 \sim 1$

BEC

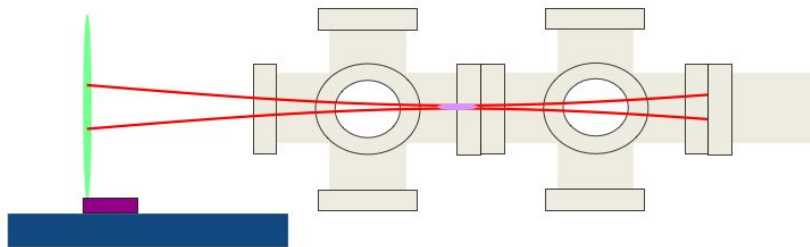


- Zeeman slower
- Magneto optical trap + Doppler cooling
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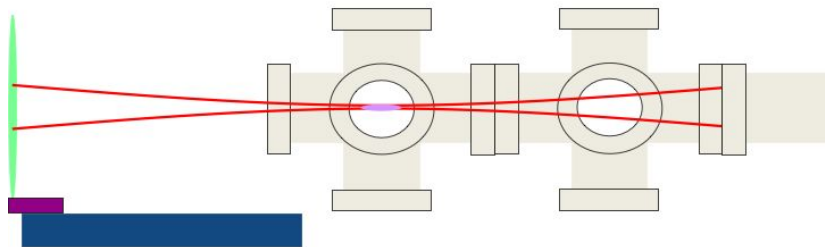
Transport of trapped atoms



Transport of trapped atoms



Transport of trapped atoms



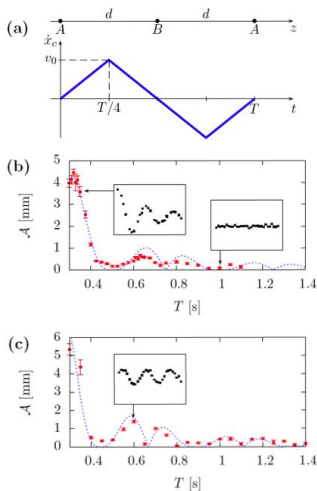
Non-optimal transport

- Transport results in a strong excitation of center of mass motion

Non-adiabatic optimal transport

- Center of mass motion minimal after transport

Experiment



- Fourier transform of velocity profile gives amplitude of center of mass motion after transport

$$\mathcal{A}(T, \omega_0) = |\mathcal{F}[\dot{x}_c](\omega_0)|$$

- Adiabatic transport for $\omega_0 T \gg 1$
- Optimal transport for $\mathcal{A} = 0$ with $\omega_0 T \sim 1$ possible

Bibliography

THANK YOU



[1] A. Couvert *et al* 2008 Europhys. Lett. **83** 13001.



[2] D. Guéry-Odelin et Thierry Lahaye

La mécanique classique appliqué à la physique contemporaine

velocity profile imposed to the trap

