

# First measurement of the re-absorption cross section for cold atoms in the multiple scattering regime

Rudy Romain<sup>1</sup>, H el ene Louis<sup>1</sup>, Daniel Hennequin<sup>1</sup>, Philippe Verkerk<sup>1</sup>

<sup>1</sup>*Laboratoire de Physique des Lasers, Atomes et Mol cules,  
Universit  de Lille1, Cit  Scientifique 59665 Villeneuve d'Ascq, France  
rudy.romain@ed.univ-lille1.fr*

In dense cooled atomic gases, the absorption of the laser beams has to be considered. Therefore we have to take into account three processes in order to describe the magneto-optical trap, this is called the multiple scattering regime. This is well known for about 20 years [1], each of these processes can be described by a coefficient. The coefficients related to the spatial trapping (spring constant) [2] and to the laser beam absorption (shadow effect) have ever been measured. It is not the case of the multiple scattering which is characterized by the probability that a cold atom absorbs a scattered photon.

In this work, we give a method leading to the measurement the re-absorption cross section. This method is based on size measurements of the atomic cloud. An experimental determination of this cross section is very useful because this quantity is very tricky to calculate. We also discuss agreement with theoretical expressions.

## References:

- [1] D.W. Sesko, T.G. Walker and C.E Wieman, J. Opt. Soc. Am. B **9**, 946 (1991).
- [2] K. Kim, H. Noh and W. Jhe, Phys. Rev. A **71**, 033413 (2005).