# High resolution measurement of the momentum transfer of an evanescent wave atomic mirror using velocity selective Raman transitions

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Evanescent wave atomic mirrors have been shown to be very sensitive to the surface roughness of the glass substrate on which the evanescent wave is formed [1]. Non specular reflection of slow atoms at normal incidence has been previously observed for surface roughness as low as 0.1 nm. We interpret this behaviour in terms of diffraction of the atomic de Broglie wave ($\lambda_{dB}/2\pi \approx 1\,\mathrm{nm}$) on the modulated potential created by the interference of the evanescent wave with light scattered by the rough surface [2]. However these experiments could not separate the specular peak of reflected atoms from the diffuse part.

We present the results of a new measurement of the momentum transfer of an evanescent wave mirror for atoms, with the finest ever resolution in velocity. We select a velocity class from a falling cloud of laser cooled atoms, which bounce on the mirror, and then we analyse the velocity distribution. The resolution in velocity is less than the recoil velocity, $v_r$.

We have developed this new method to measure the velocity distribution of the atoms after the bounce with a much better resolution, using Raman transitions. Two phase locked counter-propagating laser beams induce a Raman transition between the ground state hyperfine levels of $^{85}$Rb atoms falling from a magneto-optical trap. The resonance condition is only fulfilled for atoms with a transverse velocity within a range typically smaller than $v_r$, controlled by the interaction time between the atoms and the beams. These velocity selected atoms bounce on the mirror and their velocity distribution after reflection is measured using the same Raman beams, by scanning the Raman detuning.

[1] A. Landragin et al., *Opt. Lett* **21** 1591 (1996)
[2] A. Landragin et al., *Europhys. Lett.* **39** 485 (1997)