Highly collimated source of cold Rb atoms from a 2–dimensional magneto-optical trap

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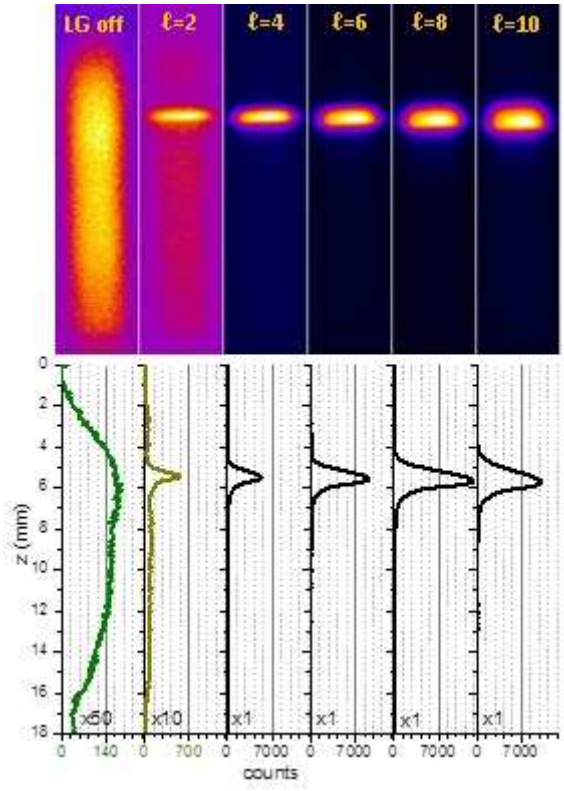
Using a blue-detuned laser shaped in a Laguerre-Gaussian donut mode we highly collimate the output of a 2–dimensional magneto-optical trap. The resulting atomic beam has a 1 mm diameter, its divergence is reduced from 40 down to 3 mrad and the atomic density is increased by a factor of 200. The collimation effect has been studied versus the order ℓ of the Laguerre-Gaussian mode (up to 10) and the laser detuning (0-120 GHz). The "2D-colli-MOT" study allows us to determine the best conditions which minimize the atom heating due to residual light absorption and optimize the collimation effect.

We will describe the experimental setup, the procedure, the obtained results and will show how the 2D-colli-MOT could provide a new tool to load a 3D-MOT using lasers with millimeter range diameters and thus sparing the laser power.



Collimation effect observed via atom imaging for LG modes with ℓ= 2, 4, 6, 8, 10, and no LG case (on the left). Top : atom images. Bottom: the corresponding profiles.