Laser cooling in 3-D isotropic light

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Laser cooling and trapping of neutral atoms has opened up new exciting possibilities in the field of ultra-stable atomic frequency standards. The cooling using isotropic laser light is an interesting manner to obtained cold atoms for cesium atomic clocks.

Laser cooling in two dimensions in isotropic light have been demonstrated by Pritchard et al. in 1992 [1]. We have proposed a three dimensional scheme a few years ago in our laboratory [2].

The cesium atoms are contained in a glass cell surrounded by a diffusive (Spectralon) or reflective material (copper). The cooling laser light is injected in the glass cell using four optical fibers. A probe beam, situated 225 mm below the center of the cell allows us to detect the cold atoms by Time of Flight (TOF) technique. We will present the new results obtained for different geometrical configurations (sphere, cylinder). The number of cold atoms measured by TOF is very high (about 10^7 to 10^9). The estimated temperatures can reach a few μK [3]. In order to precisely measure temperatures, we plan to select a slice of cold atoms in the molasses.

The atomic source we can obtain is suitable for a use in an atomic clock.

[1] W. Ketterle, A. Marin, M. A. Joffe and D. E. Pritchard *Phys. Rev. Lett.* **69** 2483 (1992).
[2] C. Valentin, E. Aucouturier, P. Petit, S. Weyers, G. Granger Ch. Guillemot and N. Dimarcq, *Proceedings of ICAP XV, 5-9 August 1996, Amsterdam (The Netherlands).*
[3] E. Guillot *Ph.D. thesis, Orsay* (2000).