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Towards the nano g with a colds atoms absolute gravimeter

The acceleration of gravity is of great interest in different subjects, from geology to the redefinition of the kilogram. The atomic interferometry is a mature technology used to build inertial sensors able to measure that value in an absolute and accurate way. An atomic cloud of colds rubidium atoms is prepared into a vacumm chamber. One can then use contra propagating Raman light pulses to separate them during their free fall. An Mach-Zehnder interferometer can be made with a sequence of three pulses :a first one to split the atomic clouds in two, a second one to redirect them, and a last one to recombine them. The gravity value can finally be extract from the phase diffrerence between the two clouds of atoms.

In LNE-SYRTE, an absolute gravimeter using this technic has been developped since 2005, achieving an accuracy of 2 10ˆ-9 g and a stability at 1 s of 6 10ˆ-8 g. The limits of those results are linked to the temperature of the atoms, in the order of the µK, and more specifically to their ballistic expansion in the inhomogeneous intensity and phase of the light pulses. In order to reduce this expansion effect, a dipolar trap will be implemented to cool the atoms below the µK. New colimator and optics will also be used in order two increase the optical quality of the beam. We hope with those implementations to reach an accuracy below 10ˆ-9 g.

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