Precision measurements in gravitational physics with cold atom interferometry

G. M. Tino[1]

[1] *Dipartimento di Fisica e Astronomia and LENS - Università di Firenze, INFN - Sezione di Firenze, Via Sansone 1, 50019 Sesto Fiorentino, Italy*

Presenting Author: guglielmo.tino@fi.infn.it

I will describe experiments we are conducting for precision tests of gravitational physics using cold atom interferometry. In particular, I will report on the measurement of the Newtonian gravitational constant [1] and of the gravity-field curvature [2] with a Rb Raman interferometer, and on experiments based on Bloch oscillations of Sr atoms in optical lattices for gravity measurements at small spatial scales [3] and for testing the Einstein equivalence principle [4]. Future prospects for experiments in space will be also discussed [5].

References

[1] G. Rosi, F. Sorrentino, L. Cacciapuoti, M. Prevedelli, G. M. Tino, Precision Measurement of the Newtonian Gravitational Constant Using Cold Atoms, Nature 510, 518 (2014).
[2] G. Rosi, L. Cacciapuoti, F. Sorrentino, M. Menchetti, M. Prevedelli, G. M. Tino, Measurement of the gravity-field curvature by atom interferometry, Phys. Rev. Lett. 114, 013001 (2015).
[3] F. Sorrentino, A. Alberti, G. Ferrari, V. V. Ivanov, N. Poli, M. Schioppo, G. M. Tino, Quantum sensor for atom-surface interactions below $10\mu m$, Phys. Rev. A 79, 013409 (2009).
[4] M.G. Tarallo, T. Mazzoni, N. Poli, D.V. Sutyrin, X. Zhang, G. M. Tino, Test of Einstein Equivalence Principle for 0-Spin and Half-Integer-Spin Atoms: Search for Spin-Gravity Coupling Effects, Phys. Rev. Lett. 113, 023005 (2014).
[5] G. M. Tino et al., Precision Gravity Tests with Atom Interferometry in Space, Nuclear Physics B (Proc. Suppl.) 243–244, 203 (2013).