

Towards a quantum test of the equivalence principle using atom interferometry

D. Schlippert, J. Hartwig, U. Velte, N. Winter, M. Zaiser,
V. Lebedev, W. Ertmer, and E. M. Rasel

Institut für Quantenoptik
Leibniz Universität Hannover
Welfengarten 1, 30167 Hannover, Germany
e-mail: schlippert@iqo.uni-hannover.de

March 30, 2010

Abstract

We present our experimental approach to realize a dual species atom interferometer performing a differential acceleration measurement with quantum objects, namely ^{87}Rb and ^{39}K atoms, to test the weak equivalence principle (universality of free fall) [1].

A compact and versatile laser system provides 5W for incoherent and coherent manipulation of both species allowing for trapping, cooling and driving stimulated Raman transitions with the same setup [2][3]. After dropping the atoms a detection cube below the MOT region allows for high NA state selective detection. Additionally the system provides an optical dipole trap at a wavelength of $1.96\mu\text{m}$ to enable very accurate initial position control of the two ensembles and leave options for evaporative and/or sympathetic cooling.

Keywords: ATOM INTERFEROMETRY, GRAVIMETRY, METROLOGY

References

- [1] G. Varoquaux et al., New Journal of Physics **11**, 113010 (2009)
- [2] Baillard et al., Opt. Comm. **266**, 609 (2006)
- [3] Gilowski et al., Opt. Comm. **280**, 443 (2007)