GR 2: Experimental Tests

Time: Monday 15:00–15:40 Location: H 2013

GR 2.1 Mon 15:00 H 2013

Free fall mass determination — •Martin Thalhammer[1,2], Gunther Cronenberg[1], Hanno Filter[1], Peter Geltenbort[2], Jörg Herzinger[1], Tobias Jenke[1], Tobias Rechberger[1], and Hartmut Abele[1] — [1]Atominstitut, Technische Universität Wien, Stadionallee 2, 1020 Wien, Austria — [2]Institut Laue-Langevin, 71 avenue des Martyrs, 38000 Grenoble, France

With the qBounce Experiment we are able to derive both the inertial and the gravitational mass, from the free fall of single neutrons. The spatial modulation of the corresponding Schrödinger wave function scales with z_0, which is determined by the third root of the product of the two masses. The discrete energy spectrum of the gravitational bound states depends on the inertial as well as the gravitational mass with two different fractional powers. Knowing the local acceleration of the earth g and measuring two observables energy and spatial modulations, this information allows us for the first time to determine the inertial mass and the gravitational mass of a single particle, the neutron independently.

GR 2.2 Mon 15:20 H 2013

Measurement of the isotropy of the speed of light to 10^{-18} — •Moritz Nagel[1], Stephen R. Parker[2], Klaus Döringshoff[1], Sylvia Schikora[1], Paul L. Stanwix[1], John G. Hartnett[2,3], Eugene N. Ivanov[2], Evgeny V. Kovalchuk[1], Michael E. Tobar[2], and Achim Peters[1] — [1]Humboldt-Universität zu Berlin, Institut für Physik, AG Optische Metrologie, Newtonstr. 15, 12489 Berlin — [2]School of Physics, The University Of Western Australia, Crawley 6009, Western Australia, Australia — [3]Institut for Photonics and Advanced Sensing, The University of Adelaide, Adelaide, Australia

We present details on the data analysis of a Michelson-Morley-type experiment that utilizes two orthogonally aligned cryogenic sapphire microwave oscillators which have a fractional frequency stability in the 10^{-16} regime for integration times from 1 - 100 seconds. After more than one year of continuous rotation using a high-precision air-bearing turntable, we can set an upper limit for the isotropy of the speed of light of 10^{-18}, representing a ten-fold improvement over previous such experiments and also the first limit in the Planck suppressed electroweak unification energy regime set by a direct terrestrial measurement. We will also give detailed results on our bounds for the coefficients of the minimal Standard Model Extension.