GR 9: Experimentelle Tests 2

Zeit: Mittwoch 16:30–17:30 Raum: SFG 0140

GR 9.1 Mi 16:30 SFG 0140

Updates on the Drift Mode Experiment on LISA Pathfinder — •Sarah Paczkowski on behalf of the LPF collaboration — Albert-Einstein-Institut, Max-Planck-Institut für Gravitationsphysik und Universität Hannover, 30167 Hannover, Germany

The LISA Pathfinder (LPF) satellite mission is a technology demonstrator for a gravitational wave observatory in space, called LISA. LPF was launched on December 3rd 2015 and is expected to operate until May 31st 2017.

The aim of LPF is to show that the required level of free-fall needed for gravitational wave observation with LISA, is achievable. The acceleration of a drag-free test mass (TM) is measured with respect to a reference TM which is on the same axis, and therefore has to be constantly actuated. This is slightly different from the LISA case, so the drift mode, or free-flight, experiment allows us to mimic the LISA scenario on LPF by replacing the constant actuation with periodic force impulses and times without actuation. The drift mode experiment is also an important cross-check for our standard measurements with constant actuation. However, this comes at the cost of introducing quasi-parabolic motion of the reference mass and periodic data gaps into the data analysis.

Here, we report on the analysis and the results of the drift mode experiment on LPF.

GR 9.2 Mi 16:50 SFG 0140

A laser actuated cantilever to search for deviations from gravity in the nanometre length scale — •Helena Schmidt, Lars Andresen, Helmut Wolff, and Ludger Koenders — Physikalisch-Technische Bundesanstalt, Bundesallee 100, 38116 Braunschweig

Although gravity has been well tested on several length scales, some unified theories predict deviations for the region below 1 mm. Some of the newer theories are the *Domestic Axion* hypothesis by Dvali and Funcke and a ghost-free quantum gravity by Edholm et al. (2016).

We present a method to search for such deviations in the nanometre length scale. Below 1 μm, the electrostatic and the Casimir force are by some magnitudes stronger than the gravitational force. To distinguish these forces, we designed a new cantilever made of fused silica. Utilizing the cantilever with the frequency modulation AFM technique it is feasible to measure these forces with sufficient accuracy to set new constraints for possible deviations of gravity. We are going to present first experimental results.

GR 9.3 Mi 17:10 SFG 0140

BOOST: A Test of Special Relativity — •Lisa Wörner[1], Thilo Schuldt[2], Norman Gürlebeck[1], Arne Grenzebach[1], Markus Krutzik[3], Thijs Wendrich[4], Nadan Jha[4], Domenico Geradi[5], Ulrich Johann[5], Claus Braxmaier[1,2], and the BOOST collaboration[1,2,3,4,5] — [1]ZARM, University of Bremen — [2]DLR — [3]Humboldt University Berlin — [4]Leibniz University Hanover — [5]Airbus Defense and Space

BOOST is a mission that aims at testing the foundations of Special Relativity. The centre piece of BOOST is a Kennedy-Thorndike experiment [1] mounted on a satellite. It is dedicated to detect a potential boost dependence of the speed of light by comparing a length reference (i.e. a highly stable optical resonator) with a molecular frequency reference. Likewise experiments have been performed on Earth. The current best Earth-bound test has been performed by Tobar et al. [2] in 2010, being able to determine the Kennedy-Thorndike coefficient with an accuracy of $4\ 10^{-8}$. By operating a state-of-the-art experimental setup in space for a duration of two years that accuracy could theoretically be improvement to $1\ 10^{-10}$. With the restrictions induced by the choice of orbit and the achievable stability of the in-build clocks an improvement of the accuracy in the order of two orders of magnitude seems realistic.

[1] R.J. Kennedy, E.M. Thorndike, Physical Review, 42 (1932) 400-418. [2] M.E. Tobar, et al., Physical Review D, 81 (2010) 022003.