# GR 22: Experimentelle Tests

Zeit: Freitag 15:20–16:20 Raum: ZHG 002

GR 22.1 Fr 15:20 ZHG 002

**Spectroscopy of Gravity** — Hartmut Abele[1], Thomas Bittner[1], Gunther Cronenberg[1], Hanno Filter[1], Peter Geltenbort[2], •Tobias Jenke[1], Hartmut Lemmel[1], and Martin Thalhammer[1] — [1]Atominstitut TU Wien, Wien, Österreich — [2]Institut Laue-Langevin, Grenoble, Frankreich

This talk is about a test of the Newtons Inverse Square Law of Gravity at micron distances by quantum interference with ultra-cold neutrons deep into the theoretically interesting regime.

The method is based on a new resonance spectroscopy technique related to Rabi spectroscopy, but it has been adapted to gravitationally bound quantum systems. By coupling such a quantum system to mechanical vibrations, we observe resonant transitions, devoid of electromagnetic interaction.

As Newtonian gravity and hypothetical Fifth Forces evolve with different phase information, the experiment has the potential to test the equivalence principle and Newtons gravity law at the micron scale. This experiment can therefore test speculations on large extra dimensions of sub-millimetre size of space-time or the origin of the cosmological constant in the universe, where effects are predicted in the interesting range of this experiment and might give a signal in an improved setup.

GR 22.2 Fr 15:40 ZHG 002

**Thermal recoil analysis of the Pioneer 10 spacecraft** — •Benny Rievers and Claus Lämmerzahl — Centre of Applied Space Technology and Microgravity (ZARM), University of Bremen

Since the upcoming of investigations of the so called Pioneer Anomaly (PA), a constant unexplained residual Doppler shift of the deep space probes Pioneer 10 and Pioneer 11, many theories on the origin of the effect have been proposed and tested without success. It has soon be suggested to investigate the thermal effects, since only a small fraction of the available thermal energy is sufficient to cause a recoil in the magnitude of the anomaly. However, the constancy of the effect and simple model calculations seemed to contradict a thermal source. At the Centre of Applied Space Technology and Microgravity (ZARM) new high precision modeling methods for the assessment of thermal recoils acting on spacecraft have now been developed and utilized for a detailed thermal analysis of the complete Pioneer 10 mission. The analysis, which includes the detailed interior and exterior configuration of the craft as well as the available telemetry data shows that the observed residual effect can completely be reconstructed as a thermal recoil resulting from anisotropic heat radiation. For one part of the mission this result has already been confirmed independently and new analysis of longer Doppler data sets by NASA also favour a thermal explanation of the PA. In the talk, the modelling methods based on Finite Elements and raytracing as well as the robustness of the results will be discussed in detail.

GR 22.3 Fr 16:00 ZHG 002

**Störkraftanalyse für die MICROSCOPE-Mission** — •Meike List, Stefanie Bremer, Benny Rievers und Claus Lämmerzahl — ZARM, Universität Bremen

Das Ziel des französischen Raumfahrtprojektes MICROSCOPE ist die experimentelle Überprüfung des schwachen Äquivalenzprinzips mit einer Genauigkeit von $\eta = 10^{-15}$. Das Experiment wird voraussichtlich 2016 auf einer erdnahen Umlaufbahn an Bord eines Kleinsatelliten der CNES-$\mu$-Sat-Line durchgeführt. Das französische Institut ONERA entwickelt und baut die hochgenauen Differential-Accelerometer, mit deren Hilfe die angestrebte Messgenauigkeit erreicht werden soll.

Das ZARM verfügt über das Erstzugriffsrecht auf die Missionsdaten. Für die Datenanalyse sowie die In-Orbit-Kalibrierungsphasen des Satelliten werden am ZARM umfangreiche Simulationen der verschiedenen Störeinflüsse durchgeführt. Hierzu wird die Simulationssoftware HPS verwendet, welche in Kooperation mit dem DLR Institut für Raumfahrtsysteme entwickelt wird.

Über den aktuellen Stand des Projekts wird im Rahmen des Vortrags berichtet.