GR 403: Experimente zur Gravitation

Zeit: Donnerstag 14:00–15:15 Raum: KIP Kl. HS

GR 403.1 Do 14:00 KIP Kl. HS

Zum aktuellen Stand der Gravitationswellenforschung — •Peter Aufmuth — Albert-Einstein-Institut Hannover, Callinstr. 38, 30167 Hannover

Die großen interferometrischen Gravitationswellendetektoren haben die für die erste Ausbaustufe geplante Empfindlichkeit erreicht bzw. fast erreicht und sind zu Dauermessungen übergegangen. Die Reichweite der Anlagen beträgt etwa 20 Mpc für Binärsysteme aus Neutronensternen. Alle Anlagen arbeiten im Rahmen der LSC (LIGO Scientific Collaboration) zusammen. Die nächste Generation von Detektoren mit einer zehnfach größeren Reichweite wird vorbereitet, ebenso ein Probelauf (LISA Pathfinder) für die Weltraummission LISA. – Die Resonanzantennen arbeiten im Rahmen der IGEC (International Gravitational Event Collaboration) zusammen. Die Empfindlichkeit der Zylinderantennen für Millisekundenpulse erreicht noch nicht die der Interferometer, aber die Bandbreite konnte beträchtlich verbessert werden. Die Zukunft liegt hier im Bau von kugelförmigen Antennen, die sowohl omnidirektional arbeiten als auch die Richtung der Quelle bestimmen können.

GR 403.2 Do 14:15 KIP Kl. HS

Space Missions to Verify Fundamental Physics — •Claus Braxmaier[1,2], Dennis Weise[2], Christian Jentsch[2], and Ulrich Johann[2] — [1]University of Applied Sciences Konstanz, Brauneggestr. 55, 78462 Konstanz — [2]EADS Astrium GmbH, An der B31, 88039 Friedrichshafen

EADS Astrium is Europe's largest space system company, especially as prime for science and earth observation missions. Space industry is involved at the very beginning of the mission developments, especially to garantuee their technical feasibility. This talk reports on the current development status of selected ESA scientific space missions from the industrial point of view, such as LISA and HYPER. The two basic theories of physics, general relativity and Quantum Theory, have to be tested in foundations and predicted effects. The physical fundaments to be verified are e.g. Special Relativity, EEP, LPI or the universality of redshift. High precision measurements will be used to determine the predicted signature of the Lense-Thirring-effect and to detect gravitational waves. Also to be tested are the time dependency of the finestructure constant or h/m in the field of Quantum Theory. Main ESA projects beside LISA and HYPER are the Space MOT, Optical Clocks in Space and other conceivable missions for the Cosmic Vision program. The scientific payloads of such missions are challenging and highly sophisticated individual metrology systems. We will give an overview on missions, the derived requirements to the instrument to meet the mission goals, the status of relevant currently available space techniques and the technical road map to meet these challenges.

GR 403.3 Do 14:30 KIP Kl. HS

New analysis of an extended Pioneer 10 and 11 data set — •Meike List, Laura Mullin, Eva Hackmann, Claus Lämmerzahl, Stephan Theil, and Hansjörg Dittus — ZARM, University of Bremen, Am Fallturm, 28359 Bremen

A previous analysis of Doppler tracking data from Pioneer 10 and 11 has detected an anomalous, constant, acceleration of magnitude $\sim 8 \times 10^{-8}$cm s^{-2} directed toward the sun [1]. The studied period corresponded to a heliocentric distance interval of 40.0 to 70.5 AU in the case of Pioneer 10 and of 22.4 to 31.7 AU for Pioneer 11. The anomaly has been independently confirmed, but despite a study of the spacecraft systematics and influential forces being performed no satisfactory cause of the acceleration has yet been found.

An extended data set is now available that includes housekeeping telemetry as well as Doppler data and covers the majority of the mission lifetimes (that is, corresponding to 4.6 to 80.2 AU for Pioneer 10 and 1.0 to 41.7 AU for Pioneer 11). These extended data allow a rigorous search to be made for the cause of the anomalous acceleration using conventional physics. The ZARM project is performing an analysis of the entire Doppler data in an attempt to determine the magnitude and direction of the anomaly over the mission lifetimes. Telemetry data is used to investigate in detail maneuvers and fly-by events. Additionally, a FE thermal model is being constructed to examine the contribution of thermal radiation on the spacecraft acceleration. The status of the project will be discussed.

[1] Anderson et al., Phys.Rev. D 65, 082004, 2002

GR 403.4 Do 14:45 KIP Kl. HS

On the observation of the time dilatation effect in ternary fission. — Genevieve Mouze and •Christian Ythier — Faculte des Sciences, Universite de Nice, France

This relativistic effect can explain the energy-shift of minus 6 keV reported by Ramayya et al.[1] for the gamma ray de-exciting the first 2+ state, at 3368.03 keV, of the 10Be cluster emitted together with the fragments 146Ba and 96Sr in the ternary fission of 252Cf. A velocity of 0.060c can be justified for the gamma-emitting 10Be cluster. It leads to an energy-shift of minus 6.14 (0.16) keV [2]. This result confirms that the low-energy orthogonal particle emission is caused by the double giant dipole resonance accompanying binary fission, as suggested by G. Mouze [3] and by H.Y. Han et al. [4]. The conditions of observation of this second-order Doppler effect are discussed. 1. A.V. Ramayya et al. Phys.Rev.Lett. 81 (1998) 947; 2. G.Mouze and R.A. Ricci, EPJA 21 (2004) 179; 3. G. Mouze Proceedings of the 1996 D.A.N.F. Conference, Casta Papiernicka, Slovakia,Dubna 1996, p.338; 4. H.Y. Han et al., Chin.Phys. Lett.18 (2001) 1454.

GR 403.5 Do 15:00 KIP Kl. HS

Messung der Newtonschen Gravitationskonstanten — •Sven Schubert[1], H. Meyer[2] und W. Bartel[3] — [1]Institut für Experimentalphysik, Universität Hamburg — [2]Universität Wuppertal — [3]DESY, Hamburg

Am DESY in Hamburg wird zur Zeit ein Experiment zur genauen Bestimmung der Gravitationskonstanten G aufgebaut. Es ist die Neuauflage der Wuppertaler Messung aus dem Jahre 2002: zwei Pendel formen zusammen einen Mikrowellen-Resonator. Dadurch ist es möglich, gravitativ bedingte Abstandsänderungen bis herab zu 0.01 nm zu messen. Aufgrund geringerer Bodenunruhen und Temperaturschwankungen als in Wuppertal und verbesserter Elektronik erwarten wir eine genauere Messung von G.