Fachverband Gravitation und Relativitätstheorie (GR)

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Übersicht der Hauptvorträge und Fachsitzungen

(Hörsaal KGI-HS 1010; Poster im Foyer KGI)

Plenar-, Preisträger- und Abendvorträge

PV I	Di	11:00–11:45	KGII-Audimax	**Observation of the highest energy cosmic rays by the Pierre Auger Observatory** — •James W. Cronin
PV II	Di	11:45–12:30	KGII-Audimax	**Numerical Relativity, Black Holes and Gravitational Waves** — •Bernd Brügmann
PV III	Mi	11:00–11:45	KGII-Audimax	**Der lange Weg zur Aufklärung der CP-Verletzung** — •Konrad Kleinknecht
PV IV	Mi	11:45–12:30	KGII-Audimax	**Fortschritte in der relativistischen Quantenfeldtheorie: Vom Verständnis der Grundlagen zu neuen Konstruktionsverfahren** — •Detlev Buchholz
PV V	Mi	20:00–21:00	KGI-Aula	**Neue Horizonte in der Teilchenphysik – Vom Higgs-Teilchen zur Dunklen Materie im Universum** — •Karl Jakobs
PV VI	Do	11:00–11:45	KGII-Audimax	**Unification and universality** — •Margaret Morrison

Hauptvorträge

GR 3.1	Di	9:00– 9:45	KGI-HS 1010	**Lunar Laser Ranging - A Testbed for General Relativity** — •Jürgen Müller
GR 3.2	Di	9:45–10:30	KGI-HS 1010	**New developments in the Hamiltonian treatment of spinning objects in general relativity** — •Gerhard Schäfer
GR 7.1	Mi	8:30– 9:15	KGI-HS 1010	**Experiments with cold atoms for gravitational physics** — •Hansjörg Dittus
GR 7.2	Mi	9:15–10:00	KGI-HS 1010	**Compact Stars as Sources for Gravitational Waves** — •Kostas Kokkotas
GR 10.1	Do	8:30– 9:00	KGI-HS 1010	**3D mapping-class groups in canonical General Relativity** — •Domenico Giulini
GR 10.2	Do	9:00– 9:45	KGI-HS 1010	**An isoperimetric concept for mass and energy of isolated systems** — •Gerhard Huisken
GR 10.3	Do	9:45–10:30	KGI-HS 1010	**Black Hole Production at the LHC** — •Matthew W. Choptuik

Fachsitzungen

GR 1.1–1.5	Mo	16:45–18:25	KGI-HS 1010	**Kosmologie**
GR 2.1–2.2	Mo	18:25–19:05	KGI-HS 1010	**Alternative klassische Gravitationstheorien**
GR 3.1–3.2	Di	9:00–10:30	KGI-HS 1010	**Hauptvorträge Dienstag**
GR 4.1–4.4	Di	14:00–15:20	KGI-HS 1010	**Klassische Allgemeine Relativitätstheorie**
GR 5.1–5.3	Di	15:20–16:20	KGI-HS 1010	**Schwarze Löcher**
GR 6.1–6.4	Di	16:45–18:05	KGI-HS 1010	**Numerische Relativitätstheorie**
GR 7.1–7.2	Mi	8:30–10:00	KGI-HS 1010	**Hauptvorträge Mittwoch**
GR 8.1–8.4	Mi	16:45–18:05	KGI-HS 1010	**Gravitationswellen**
GR 9.1–9.3	Mi	18:05–19:05	KGI-HS 1010	**Quantengravitation und Quantenkosmologie**
GR 10.1–10.3	Do	8:30–10:30	KGI-HS 1010	**Hauptvorträge Donnerstag**

GR 11.1–11.2	Do	11:50–12:30	KGI-HS 1010	**Experimente zur Gravitation I**
GR 12.1–12.6	Do	14:00–16:00	KGI-HS 1010	**Experimente zur Gravitation II**
GR 13.1–13.3	Do	16:30–17:30	KGI-HS 1010	**Alternative Ansätze**
GR 14.1–14.5	Mo–Do	0:00–24:00	Foyer KGI	**Poster**

Fachübergreifendes Symposium Emergent Time

Dieses Symposium wird veranstaltet vom Arbeitskreis AKPhil und von den Fachverbänden EP, GR, MP, T und findet am Montag von 11:00 bis 16:15 im Hörsaal KGI - HS 1199 statt. Das vollständige Programm dieses Symposiums ist unter SYET aufgeführt.

SYET 1.1	Mo	11:00–11:45	KGI-HS 1199	**Die Zeit der Physik und die Zeit der Philosophie** — •Manfred Stöckler
SYET 1.2	Mo	11:45–12:30	KGI-HS 1199	**Die Emergenz der Zeit in einen verallgemeinerten quantentheoretischen Rahmen** — •Hartmann Römer
SYET 2.1	Mo	14:00–14:45	KGI-HS 1199	**Emergence of Time from Quantum Gravity** — •Claus Kiefer
SYET 2.2	Mo	14:45–15:30	KGI-HS 1199	**Time in Emergent Gravity** — •Olaf Dreyer

Fachübergreifendes Symposium Raum – Zeit – Gravitation

Dieses Symposium wird veranstaltet von den Fachverbänden EP, GR, MP, T und findet am Mittwoch von 14:00 bis 16:15 im KGII - Audimax statt. Das vollständige Programm dieses Symposiums ist unter SYRZ aufgeführt.

SYRZ 1.1	Mi	14:00–14:45	KGII-Audimax	**Gravitationswellendetektoren auf der Erde und im Weltraum: Erste Daten und Flughardware** — •Karsten Danzmann
SYRZ 1.2	Mi	14:45–15:30	KGII-Audimax	**In search of dark matter with the strong gravitational lens effect** — •Joachim Wambsganss
SYRZ 1.3	Mi	15:30–16:15	KGII-Audimax	**Extradimensions and Gravity** — •Georgi Dvali

Begrüßungsabend

Am Dienstag ab 19:30 Uhr findet ein Begrüßungsabend mit warmen Buffet in der Mensa Rempartstraße statt.

Mitgliederversammlung des Fachverbandes Gravitation und Relativitätstheorie

Dienstag 18:10–19:30 Raum KGI – HS 1010

- Eröffnung und Festsetzung der endgültigen Tagesordnung
- Verlesen und Genehmigung des Protokolls der letzten Mitgliederversammlung
- Bericht des Vorsitzenden
- Wahl des Vorsitzenden des FV
- Wahl des Beirats des FV
- Neufassung der Satzung des FV
- Denkschrift ART
- Tagungen
- Büchertisch
- Verschiedenes

GR 1: Kosmologie

Zeit: Montag 16:45–18:25 Raum: KGI-HS 1010

GR 1.1 Mo 16:45 KGI-HS 1010

Visualization of the Gödel Universe — •Michael Buser[1], Endre Kajari[1], Wolfgang P. Schleich[1], Hanns Ruder[2], Frank Grave[3], and Günter Wunner[3] — [1]Universität Ulm — [2]Universität Tübingen — [3]Universität Stuttgart

An intriguing solution of Einstein's field equations was found by Kurt Gödel in 1949. The Gödel universe describes a homogeneous rotating space time in which closed time-like wordlines exist. Traveling along such a worldline allows an observer the paradoxal journey into his own past. This talk addresses some fundamentals in computer graphics and how they can be applied to Gödel's space time. We present a few scenarios and illustrate, how an observer, who is located in the Gödel Universe, would perceive the particular situations. In order to grasp the nature of the shown pictures we also discuss the propagation of light in conjunction with the existence of an optical horizon.

GR 1.2 Mo 17:05 KGI-HS 1010

Cosmic Topology and Cosmic Microwave Background (CMB) — •Sven Lustig — Universität Ulm, Institut für Theoretische Physik, Albert-Einstein-Allee 11, D-89069 Ulm

How well can the topology of our Universe be constrained by the WMAP data? This question shall be dicussed on the basis of the angular power spectrum of the CMB and the so-called "circle-in-the-sky" signature.

GR 1.3 Mo 17:25 KGI-HS 1010

An attempt to investigate the Local spacetime geometry — •Hans Joerg Fahr and Mark Siewert — Argelander Institut für Astronomie , Universität Bonn, Auf dem Huegel 71, 53121 Bonn

It is expected that the global Robertson-Walker metric describing cosmological expansion is not valid close to singular masses. The answer given by Einstein and Straus, how to connect the global Robertson-Walker metric with the local outer Schwarzschild metric, is not satisfying in view of astronomical facts. Here we shall give a new description of a local metric which is of the Robertson-Walker type, but connected with a local scale function. We look for solutions of this local scale function as function of time and predict photon frequency shifts for photons freely propagating in such local spacetime metrics, e.g. valid in the heliosphere.

GR 1.4 Mo 17:45 KGI-HS 1010

Einstein-Weyl Modelle der Kosmologie — •Erhard Scholz — Universität Wuppertal, Fb C, 42097 Wuppertal

Die integrable Weylgeometrie ermöglicht eine konservative Erweiterung der ART. Bei einer solchen Erweiterung werden Robertson-Walker (R-W) Kosmologien skalenkovariant analysierbar. Deren warp-Funktion $f(\tau)$ muss nicht notwendigerweise eine reale Expansion darstellen, sondern kann als Integral eines Weylschen Skalenzusammenhangs $\varphi = \varphi_i dx^i$ auftreten. Damit werden die beiden physikalischen Annahmen über den Grund der kosmologischen Rotverschiebung (RV), Raumexpansion bzw. feldtheoretischer Energieverlust der Photonen, ineinander übersetzbar (mathematisch gesehen äquivalent).

In diesem Theorierahmen erscheinen R-W Modelle, die üblicherweise aus physikalischen Gründen verworfen werden, durchaus erwägenswert; insbesondere solche mit linearer warp-Funktion $f(\tau) = H\tau$. Diese führen auf statische Raumgeometrien mit zeithomogenem Skalenzusammenhang $\varphi = Hdt$. Empirische Gründen zeichnen darunter diejenigen mit positiver konstanter Raumkrümmung aus. Bei einfachster Topologie führt dies auf das traditionelle Einstein-Universum, nun aber versehen mit einem Skalenzusammenhang $\varphi = Hdt$ (*Hubble Zusammenhang*), durch den die kosmologische RV modelliert wird.

Die auf diese Weise gebildeten *Einstein-Weyl Modelle* der Kosmologie werden in diesem Vortrag vorgestellt und die Frage diskutiert, ob bzw. unter welchen Annahmen diese als realistische Modelle der Kosmologie angesehen werden können.

GR 1.5 Mo 18:05 KGI-HS 1010

Warm dark matter with a non-zero chemical potential — •Tillmann Boeckel and Jürgen Schaffner-Bielich — Institut für Theoretische Physik / Astrophysik, J.W. Goethe Universität Max-von-Laue-Straße 1, D-60438 Frankfurt am Main, Germany

We explore a model for a fermionic dark matter particle family which decouples from the rest of the particles when at least all standard model particles are in equilibrium. We calculate the allowed ranges for mass and chemical potential to be compatible with big bang nucleosynthesis (BBN) calculations and WMAP-data for a flat universe with dark energy ($\Omega^0_\Lambda = 0.72$, $\Omega^0_M = 0.28$, $h = 0.7$). Futhermore we estimate the free streaming length for fermions and antifermions to allow comparison to large scale structure data (LSS). We find that for dark matter decoupling when all standard model particles are present even the least restrictive combined BBN calculation and WMAP results allow us to constrain the initial dark matter chemical potential to a highest value of 6.3 times the dark matter temperature. In this case the resulting mass range is at most 1.8 eV $\leq$ m $\leq$ 53 eV, where the upper bound scales linearly with $g^s_{eff}(T_{Dec})$. From LSS we find that similar to ordinary warm dark matter models the particle mass has to be larger than $\sim$ 500 eV (meaning $g^s_{eff}(T_{Dec}) > 10^3$) to be compatible with observations of the Ly α forest at high redshift, but still the dark matter chemical potential over temperature ratio can exceed unity.

GR 2: Alternative klassische Gravitationstheorien

Zeit: Montag 18:25–19:05 Raum: KGI-HS 1010

GR 2.1 Mo 18:25 KGI-HS 1010

A New Look at the Contributions to Cosmology of Dirac, Sciama and Dicke — •Alexander Unzicker — Pestalozzi-Gymnasium München

Though the separate contributions to cosmology of the above named researchers seem abandoned today, surprisingly their basic ideas can be encompassed into a consistent framework. We study Dirac's large number hypothesis (Proc.Roy.Soc. Lon. A 165, 199; 1938), Sciama's proposal of realizing Mach's principle (MNRAS 113, 34; 1953), and Dicke's considerations on an 'electromagnetic' theory of gravitation with a variable speed of light (Rev.Mod.Phys. 29, 363; 1957). Dicke's tentative theory can be formulated in a way which is compatible with Sciama's hypothesis on the gravitational constant G. Additionally, such a gravitational model satisfies Dirac's large number hypothesis without entailing a visible time dependence predicted by Dirac which indeed has never been verified. While Dicke's proposal, similarly to well-known flat space representations of general relativity (e.g. Dehnen et al., Ann.Phys. 6 (Folge 7),370; 1960) in first approximation agrees with the four classical tests, the cosmological redshift arises from a shortening of measuring rods rather than from an expansion of space.

GR 2.2 Mo 18:45 KGI-HS 1010

The Physical Fundament of General Relativity — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

General Relativity is governed by the paradigm of Einstein, that the speed of light c is a strict constant in all situations. Einstein has paid for his conviction by giving up the traditional understanding of space and time.

General Relativity is presently in a deadlock situation. The problems are the non-detectable gravitational waves, the Dark Matter phenomenon, and the Quantum Gravity question. Since 40 years the latter is an open issue, so a change of paradigm may be overdue.

The problems can have a solution if we follow a hint of Roman Sexl to understand gravity as a refraction process. As an example, the deflection of a photon beam at the sun, which once caused the breakthrough for Einstein's theory, can be quantitatively explained as a classical refraction process. If this refraction is applied to the internal oscillation of an elementary particle as it was found by E. Schrödinger ("Zitterbewegung"), then gravity for an object at rest can be quantitatively explained. Also the Schwarzschild formalism can be derived

using this ansatz.

In this view, gravity is not the "forth force", but a side effect of mainly the Strong Interaction. - And this solves easily the problem of Quantum Gravity, as the Strong Interaction is fully covered by QM.

For further information see www.ag-physics.org/gravity

GR 3: Hauptvorträge Dienstag

Zeit: Dienstag 9:00–10:30 Raum: KGI-HS 1010

Hauptvortrag GR 3.1 Di 9:00 KGI-HS 1010

Lunar Laser Ranging - A Testbed for General Relativity — •Jürgen Müller — Institut für Erdmessung, Leibniz Universität Hannover, Germany

Lunar Laser Ranging (LLR) has routinely provided observations for more than 37 years. A new site called APOLLO has just started with measurements reaching mm ranging accuracy. The main benefit of LLR is, e.g., to determine many parameters of the Earth-Moon dynamics (e.g. orbit and rotation of the Moon, a selenocentric reference frame or the secular increase of the Earth-Moon distance: 3.8 cm/year) and to test metric theories of gravity. LLR data analysis determines gravitational physics quantities such as the equivalence principle, any time variation of the gravitational constant, relativistic precessions, and several metric parameters. The gravitational physics parameters cause different spectral perturbations of the lunar orbit, which can be used to separate the various relativistic and Newtonian effects with high accuracy. We give an overview of the recent status of our LLR analysis procedure, present new results for the relativity parameters, and address potential capabilities of LLR in the near future.

Hauptvortrag GR 3.2 Di 9:45 KGI-HS 1010

New developments in the Hamiltonian treatment of spinning objects in general relativity — •Gerhard Schäfer — Theoretisch-Physikalisches Institut, Friedrich-Schiller-Universität Jena

The talk reviews recent achievements in the analytical treatmet of pole-dipole particles in general relativity based on canonical variables. Various higher order post-Newtonian Hamiltonians with spin are presented. The global Poincar'e algebra will be constructed on the post-Newtonian orders in question. The local stress-energy-tensor algebra will be given attention too.

GR 4: Klassische Allgemeine Relativitätstheorie

Zeit: Dienstag 14:00–15:20 Raum: KGI-HS 1010

GR 4.1 Di 14:00 KGI-HS 1010

Nonlinear effects of Einstein equations in the weak-field regime — •Nikodem Szpak — Albert-Einstein-Institut, Max-Planck-Institut für Gravitationsphysik, Golm

Einstein equations are essentially nonlinear. Even in the weak-field regime, like small perturbations of a static background, nonlinear effects show up. We discuss examples of such phenomena like late-time tails or distortion of travelling waves appearing solely due to the nonlinearity and being absent in the linear approximation.

GR 4.2 Di 14:20 KGI-HS 1010

On the initial value problem of the Maxwell-Lorentz equations — •Volker Perlick — Physics Department, Lancaster University, Lancaster LA1 4YB, United Kingdom

I am considering the coupled equations of motion for a charged dust and an electromagnetic field (Maxwell-Lorentz equations) on a general-relativistic spacetime. After decomposing the system of differential equations into evolution equations and constraints I am establishing a local existence and uniqueness theorem for the initial value problem. The Maxwell-Lorentz equations on a curved background are of relevance in astrophysics where they can be used to describe the electron component of a plasma; on a flat background, the Maxwell-Lorentz equations can be used, e.g., for modeling a particle beam in an accelerator.

GR 4.3 Di 14:40 KGI-HS 1010

Analytic solution of the geodesic equation in Schwarzschild–(anti) de Sitter space–time — •Eva Hackmann and Claus Lämmerzahl — ZARM - Universität Bremen, Am Fallturm, 28359 Bremen

The complete set of analytic solutions of the geodesic equation in a Schwarzschild-(anti)de Sitter space-time is presented. The solutions are derived from the Jacobi inversion problem restricted to the set of zeros of the theta function, called the theta divisor. In its final form the solutions can be expressed in terms of derivatives of Kleinian sigma functions. The different types of the resulting orbits are characterized in terms of the conserved energy and angular momentum as well as the cosmological constant. Using the analytical solution, the question whether the cosmological constant could be a cause of the Pioneer Anomaly is addressed.

GR 4.4 Di 15:00 KGI-HS 1010

Interferometry in Plebanski–Demianski space–times — •Valeria Kagramanova[1] and Claus Lämmerzahl[2] — [1]Institut für Physik, Universität Oldenburg, 26111 Oldenburg — [2]ZARM, Universität Bremen, Am Fallturm, 28359 Bremen

The Plebanski–Demianski solution is a very general axially symmetric analytical solution of Einsteins field equations generalizing the Kerr solution. This solution depends on seven parameters which include the mass, acceleration and cosmological constant. In this paper we present a general description of matter wave interferometry in this general space–time. We show that it is possible to have access to all parameters separately except a combination of electric and magnetic charge.

GR 5: Schwarze Löcher

Zeit: Dienstag 15:20–16:20 Raum: KGI-HS 1010

GR 5.1 Di 15:20 KGI-HS 1010

Quellterme für die approximativ in ADM-Koordinaten dargestellte Kerr-Geometrie und neue Wechselwirkungshamiltonians in höherer Spinordnung für Binärsysteme Schwarzer Löcher — •Steven Hergt[1] und Gerhard Schäfer[2] — [1]Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany — [2]Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany

Die Kerr-Metrik wird approximativ auf ADM-Koordinaten transformiert und zwar bis zur Ordnung $1/r^4$ bzw. a^2, wobei r die Radialkoordinate und a den Spinparameter bezeichnen. Als Ausgangspunkt hierfür dient die Kerr-Lösung dargestellt sowohl in quasi-isotropen als auch in harmonischen Koordinaten.

Die distributionellen Quellterme für die so gefundene Näherungslösung werden angegeben inklusive des Quellterms für den transversal-spurfreien Anteil der 3er-Metrik.

Damit wird in Verallgemeinerung auf Binärsysteme Schwarzer Löcher auf neue Wechselwirkungshamiltonians in höherer Spinordnung mit und ohne Linearimpuls geschlossen.

GR 5.2 Di 15:40 KGI-HS 1010

Higher Dimensional Charged Rotating Black Holes with Negative Cosmological Constant — •Jutta Kunz[1], Francisco Navarro-Lerida[2], and Eugen Radu[3] — [1]Universität Oldenburg, Germany — [2]Universidad Complutense de Madrid, Spain — [3]University of Maynooth, Ireland

We present charged rotating black holes with equal-magnitude angular momenta in an odd number of dimensions $D \geq 5$. These solutions possess a regular horizon of spherical topology and approach asymptotically the Anti-de Sitter spacetime background. We analyze their global charges, their gyromagnetic ratio and their horizon properties. We also address their thermodynamical properties.

GR 5.3 Di 16:00 KGI-HS 1010

Interior of Nonuniform Black Strings — •Burkhard Kleihaus and Jutta Kunz — Universität Oldenburg

In higher dimensional space-times with compact dimensions, caged black holes are localized in the compact dimensions, whereas the black strings wrap the compact dimensions completely. A topology changing transition between caged black holes and non-uniform black strings is expected. We consider nonuniform black strings inside their event horizon. We present numerical evidence, that the singularity touches the horizon as the horizon topology changing transition is reached.

GR 6: Numerische Relativitätstheorie

Zeit: Dienstag 16:45–18:05 Raum: KGI-HS 1010

GR 6.1 Di 16:45 KGI-HS 1010

Rotating Boson Stars and Q-Balls II: Negative Parity and Ergoregions — Burkhard Kleihaus[2], Jutta Kunz[1], Meike List[2], and •Isabell Schaffer[2] — [1]Institut für Physik, Universität Oldenburg, D-26111 Oldenburg — [2]ZARM, Universität Bremen, Am Fallturm, D-28359

We construct axially symmetric, rotating boson stars with positive and negative parity. Their flat space limits represent spinning Q-balls. Q-balls and boson stars exist only in a limited frequency range. The coupling to gravity gives rise to a spiral-like frequency dependence of the mass and charge of boson stars. We analyze the properties of these solutions, in particular, the presence of ergoregions in boson stars, and determine their domains of existence.

GR 6.2 Di 17:05 KGI-HS 1010

How to Slice a Black Hole Safely — Mark Hannam[1], Sascha Husa[2], •Frank Ohme[1], Bernd Brügmann[1], and Niall O Murchadha[3] — [1]Theoretical Physics Institute, University of Jena, Germany — [2]Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam, Germany — [3]Physics Department, University College Cork, Ireland

In Numerical Relativity, the freedom to choose appropriate coordinates that represent the spactime becomes of great importance. Recent success in numerical simulations suggest that particular gauge conditions, which fix the choice of coordinates, are well adapted to the physical properties of black hole systems. We investigate how such a set of gauge conditions (in particular the "1+log" lapse) works in the case of a single Schwarzschild black hole. Among other things, Carter-Penrose diagrams are presented that illustrate how the numerical grid avoids the physical singularity and approaches an analytically predicted stationary foliation.

GR 6.3 Di 17:25 KGI-HS 1010

Numerical simulations of high energy collisions of black holes — •Ulrich Sperhake — FSU Jena, Germany

We present numerical simulations of collisions of black holes with varying boost parameter. This study covers the range from vanishing initial boost to the regime where the total mass is dominated by the kinetic energy. The resulting horizon properties and gravitational wave emission are studied and compared with analytic predictions.

GR 6.4 Di 17:45 KGI-HS 1010

Computing the Event Horizon for Binary Black Hole Systems — •Marcus Thierfelder — Theoretical Physics Institute, University of Jena, Germany

I present results of an event horizon finder for full 3D numerical simulations in general relativity. The algorithm implements the method developed by Peter Diener. It works by evolving a complete null surface backwards in time, where the null surface is described as a level set of a scalar function. The code can handle numerical spacetimes which are created by the BAM code. So it is possible to calculate the event horizon for the case of two black holes that inspiral for several orbits and merge to one final black hole.

GR 7: Hauptvorträge Mittwoch

Zeit: Mittwoch 8:30–10:00 Raum: KGI-HS 1010

Hauptvortrag GR 7.1 Mi 8:30 KGI-HS 1010

Experiments with cold atoms for gravitational physics — •Hansjörg Dittus — ZARM, Universität Bremen, Am Fallturm, 28359 Bremen

Promising techniques for future gravitational physics experiments are matter-wave sensors based on cold atoms or atom lasers using atoms as low-noise microscopic test masses (wave packets) in order to measure inertial forces. In particular, weightlessness conditions allow attaining lower temperature regimes and longer evolution times. During drop tower or satellite experiments with ultra-cold quantum matter, like Bose-Einstein Condensates, the extension of an undisturbed free fall is possible and enable future quantum tests of the equivalence principle as well as experiments to verify possible effects induced by quantum gravity. I will report on recent experiments with Bose-Einstein Condensates in free fall at Drop Tower Bremen within the QUANTUS collaboration and on new activities to realize precision experiments for gravitational physics with atom sensors.

Hauptvortrag GR 7.2 Mi 9:15 KGI-HS 1010

Compact Stars as Sources for Gravitational Waves — •Kostas Kokkotas — Theoretische Astrophysik, Universität Tübingen

We will present the most recent results concerning the dynamics of neutron stars and their relation to the emission of gravitational waves. Special emphasis will be given to: 1) recent non-linear studies of vibrating neutron stars, 2) the studies related to the differential rotation of neutron stars and 3) the present understanding of the magnetar dynamics.

GR 8: Gravitationswellen

Zeit: Mittwoch 16:45–18:05 Raum: KGI-HS 1010

GR 8.1 Mi 16:45 KGI-HS 1010

Prediction of space distribution of young neutron stars as sources of gravitational waves — •Markus Hohle — AIU, Jena, Germany

In my talk I would like to introduce methods and ideas to find nearby young neutron stars and how to estimate a prediction for a distribution of these objects. This leads to constrains of certain areas in the sky where a neutron star excess could be expected. Dense objects like neutron stars and black holes, or the binary systems of them and supernova events are sources of gravitational waves.

The question of how many neutron stars could be detected depends strong on their physical behaviour, such as kick velocity and assumed cooling scenario.

The main interests are on young isolated neutron stars, which enable us in principle to constrain the equation of state.

Furthermore I would talk about a new estimation of the supernova rate for the solar vicinity compared with previous ones and other population synthesises and I will discuss how reliable are these predictions.

GR 8.2 Mi 17:05 KGI-HS 1010

Data analysis pipeline of the spherical gravitational wave detector MiniGRAIL — •Carlos Filipe Da Silva Costa[1], Stefano Foffa[2], Michele Maggiore[2], Martin Pohl[1], and Riccardo Sturani[2] — [1]DPNC, Université de Genève, CH-1211 Genève 4 — [2]DPT, Université de Genève, CH-1211 Genève 4

MiniGRAIL (GRavitational Antenna In Leiden) is a spherical resonant mass of 68cm diameter made of CuAl. First measurements have been obtained with three transducers (DROS) at a thermodynamic temperature of 5K. In the future, the detector will operate at 50mK with six transducers allowing a reconstruction of the gravitational wave direction. The GW sensitive spheroidal quadrupole modes have a frequency around 2980 Hz.

We are currently preparing the data analysis pipeline. We exploit the multi-mode capabilities of the sphere applying our knowledge of single-channel resonant detectors data analysis. First, we convert the current signal from the six transducers output into six quadrupolar modes h_m (including the scalar one). Then the modes are processed by means of the wavelet analysis and filtered via matched filtering. From the list of events generated for each mode, we look for coincidences and produce a list of candidate events. For each candidate event, we estimate the arrival direction and check if the event has the transverse geometry of a gravitational wave.

For compatibility, our pipeline is developed in C++ and results are saved in the frame format used by Ligo and Virgo.

GR 8.3 Mi 17:25 KGI-HS 1010

Gegenwart und Zukunft der Gravitationswellenforschung — •Peter Aufmuth — Albert-Einstein-Institut Hannover, Callinstr. 38, 30167 Hannover

Die interferometrischen Gravitationswellendetektoren haben die geplante Empfindlichkeit erreicht und sind zu Langzeitmessungen übergegangen. Die Reichweite der Detektoren beträgt etwa 10 bis 15 Mpc für den Nachweis von verschmelzenden Neutronensternen. Das reicht allerdings noch nicht aus, um täglich Signale erwarten zu können. Daher wird an der weiteren Absenkung des Detektorrauschens gearbeitet. LIGO und Virgo planen für 2009 eine Erhöhung der Detektionsrate um einen Faktor 10 durch Verwendung von Lasern mit höherer Leistung und Verbesserung der Optik (Enhanced LIGO und Virgo+). 2013 soll Advanced LIGO die Reichweite für verschmelzende Neutronensterne auf 175 Mpc und damit die Detektionsrate um einen weiteren Faktor 100 erhöhen. GEO600 wird die Ausbauphase von LIGO und Virgo mit Dauermessungen überbrücken; für später ist der Einsatz von gequetschtem Licht und die Erhöhung der Empfindlichkeit bei hohen Frequenzen vorgesehen (GEO-HF).

GR 8.4 Mi 17:45 KGI-HS 1010

Simulation des B.B.O. und seine Analyse — •Markus Otto, Christoph Mahrdt, Malte Priess, Jan Harms und Karsten Danzmann — Albert Einstein Institut Hannover

B.B.O. (Big Bang Observer) ist eine potentielle Folgemission vom Gravitationswellendetektor LISA. Das Ziel vom B.B.O. ist es, den kosmischen Gravitationswellenhintergrund (CGWB) zu messen. Hierbei bedient man sich einigen - in der Datenanalyse gängigen - Tricks, wie z.B. Rauschprojektion und Cross-Correlation.

Wir werden die Simulation des Detektors erläutern und speziell auf die Generierung des CGWB, Berechnung der Overlap-Reduction Function und Cross-Correlation der Datenströme nebst Sky Mapping eingehen.

GR 9: Quantengravitation und Quantenkosmologie

Zeit: Mittwoch 18:05–19:05 Raum: KGI-HS 1010

GR 9.1 Mi 18:05 KGI-HS 1010

Brechung der Lorentz-Invarianz in INTEGRAL gamma-ray bursts — •Raphael Lamon[1], Nicolas Produit[2] und Frank Steiner[1] — [1]Institut für Theoretische Physik, Universität Ulm, Deutschland — [2]INTEGRAL Science Data Center, Versoix, Schweiz

Wir suchen mögliche energieabhängige Zeitverzögerungen in den Ankunftszeiten der Photonen von gamma-ray bursts, die von INTEGRAL entdeckt wurden. Wir schlagen eine neue Methode vor, um Information aus ungebinnten Daten zu gewinnen und stützen diese mit Hilfe von Monte Carlo Simulationen. Die Analyse erlaubt uns, eine konservative untere Schranke für die Brechung der Lorentz-Invarianz anzugeben.

GR 9.2 Mi 18:25 KGI-HS 1010

Boundary Terms in Two-Dimensional Dilaton Gravity — •René Meyer[1], Luzi Bergamin[2], Daniel Grumiller[3], and Robert McNees[4] — [1]Max-Planck-Institut für Physik, München, Germany — [2]ESA Advanced Concepts Team, ESTEC, The Netherlands — [3]Massachusetts Institute of Technology, Cambridge, MA, USA — [4]Perimeter Institute for Theoretical Physics, Waterloo, Canada

We present recent results concerning the role of boundary terms in two-dimensional dilaton gravity (see hep-th/0703230, 0710.4140, 0711.3595). In the first part of this talk we construct the essentially unique Hamilton-Jacobi counterterm, which is necessary to ensure a well-defined semiclassical approximation and has applications in black hole thermodynamics as well as in holographic renormalization in the AdS/CFT correspondence. In the second part we outline the proof of quantum triviality of dilaton gravity models in two dimensions with a spacelike boundary, applying the path integral quantization method first developed by the "Vienna School" around Wolfgang Kummer.

GR 9.3 Mi 18:45 KGI-HS 1010

Metrical fluctuations and the Weak Equivalence Principle — •Ertan Göklü und Claus Lämmerzahl — ZARM - Universität Bremen, Am Fallturm, 28359 Bremen

We describe space-time fluctuations by means of small fluctuations of the metric on a given background metric. From a minimally coupled quantum field equation we obtain within a weak-field approximation up to second order and an averaging procedure over a finite space-time scale given by the quantum particle in the non-relativistic limit a modified Schrödinger equation. The dominant modification consists in an anomalous inertial mass tensor which depends on the type of particle and on the fluctuation scenario. This necessarily leads to a violation of the weak equivalence principle and, in general, to a violation of Lorentz invariance.

GR 10: Hauptvorträge Donnerstag

Zeit: Donnerstag 8:30–10:30 Raum: KGI-HS 1010

Hauptvortrag GR 10.1 Do 8:30 KGI-HS 1010

3D mapping-class groups in canonical General Relativity — •Domenico Giulini — Albert-Einstein-Institut, Am Mühlenberg 1, 14476 Golm

Mapping-Class-Groups of 3-dimensional manifolds (the Cauchy surfaces) act as discrete symmetries on the constraint-reduced spaces of states in classical as well as quantum gravity. These groups are generically infinite and non-abelian and therefore not easy to understand. I review some of the progress that has been made in understanding their structure and also comment on their relevance in current approaches to quantum gravity.

Hauptvortrag GR 10.2 Do 9:00 KGI-HS 1010

An isoperimetric concept for mass and energy of isolated systems — •Gerhard Huisken — Albert-Einstein-Institut, Am Mühlenberg 1, 14476 Golm

It is a basic problem of General Relativity to represent physical concepts like mass, center of mass, momentum or angular momentum of isolated gravitating systems by natural geometric structures in order to ensure invariance of these concepts under coordinate changes. The lecture explains how a 4-dimensional spacetime representing an isolated gravitating system can be decomposed in a narural way into 3-dimensional timeslices carrying 2-dimensional radial foliations that allow geometric definitions for mass and momentum. It is shown how the "total mass" of the system can then be interpreted in terms of the classical isoperimetric inequality relating volume and perimeter of regions in the 3-dimensional timeslice. The lecture also discusses how methods from geometric analysis justify these concepts and imply sharp lower bounds such as the Penrose inequality on the energy systems containing black holes.

Hauptvortrag GR 10.3 Do 9:45 KGI-HS 1010

Black Hole Production at the LHC — •Matthew W. Choptuik — Albert-Einstein-Institute, Golm — Dept of Physics & Astronomy, UBC, Vancouver, Canada

One of the most exciting and provocative claims arising from the possibilty that the Planck scale energy might lie near the TeV scale, is that the LHC may in fact turn out to be a mini-black-hole factory. In this talk I will briefly summarize the reasoning that underlies the claim, and discuss some possible weaknesses in the arguments. I will then report on numerical calculations aimed at determining to what extent some of the key assumptions used in the estimation of black-hole cross-sections in accelerator experiments can be expected to hold.

GR 11: Experimente zur Gravitation I

Zeit: Donnerstag 11:50–12:30 Raum: KGI-HS 1010

GR 11.1 Do 11:50 KGI-HS 1010

The dynamics of a quantum wave packet of a neutron and the question of extra dimensions of space-time — •Tobias Jenke[1], Hartmut Abele[1], Peter Geltenbort[2], and Christian Plonka[2] — [1]Physikalisches Institut der Universität Heidelberg — [2]Institut Laue-Langevin, Grenoble, France

The dynamics of a quantum mechanical wave packet bouncing off an insuperable potential wall in the gravitational field of the earth combines quantum theory with aspects of Newtonian mechanics at short distances.
We are performing an experiment to realize such a quantum bouncing ball with ultracold neutrons in a system, in which we have measured before the lowest stationary quantum states in the earth's gravitational field. This experiment is sensitive to gravity-like forces at a length scale below 10 μm, where we already place limits.
This work was funded by the German Federal Ministry for Research and Education under Contract No. 06HD187.

GR 11.2 Do 12:10 KGI-HS 1010

Test der Newtonschen Gravitation durch Quantenreflexion kalter Atome — •Maarten DeKieviet, Manuel Vedovelli, Felix Laux und Ulrich Schmidt — Physikalisches Institut der Universität Heidelberg, Philosophenweg 12, 69120 Heidelberg

Im Zuge der Lösung des Hierarchie-Problems und der Erschaffung einer Theory of Everything, wurden Ansätze im Rahmen der M-Theorie entwickelt, die große Extradimensionen postulieren. Die Folge wäre eine Änderung der Newtonschen Gravitation bei kleinen Abständen, die sich als ein Yukawa-Potential parametrisieren ließe. Bei der experimentellen Überprüfung dieses zusätzlichen Terms im mm- submm-Bereich, zeigt sich ein quantitatives Verständnis des Casimir-Effekts als unentbehrlich.

In unseren Atomstrahl-Spinecho-Messungen haben wir gezeigt, dass dies auf dem %-Niveau gegeben ist. In diesem Beitrag präsentieren wir eine Erweiterung dieser Methode, die zudem die maskierende Wirkung der Casimir-Kraft weitgehend systematisch unterdrückt. Hierbei wird ein Strahl kalter He-Atome von einer Oberfläche quantenreflektiert. Dies hängt stark von der Form des Wechselwirkungspotentials zwischen Atom und Oberfläche ab. Aus dem Vergleich der Reflektivitäten von ^{3}He und ^{4}He lässt sich auf Formänderungen des Gravitationspotentials, aufgrund eines zusätzlichen Neutrons, schließen. Dies erlaubt neue Limits auf die Yukawa-Parameter im Nanometer-Bereich.

GR 12: Experimente zur Gravitation II

Zeit: Donnerstag 14:00–16:00 Raum: KGI-HS 1010

GR 12.1 Do 14:00 KGI-HS 1010

Test der relativistischen Zeitdilatation mit schnellen optischen Uhren — •Sascha Reinhardt[1,3], Guido Saathoff[1,3], Henrik Buhr[1], Lars A. Carlson[1], Andreas Wolf[1], Dirk Schwalm[1], Sergei Karpuk[2], Christian Novotny[2], Gerhard Huber[2], Marcus Zimmermann[3], Ronald Holzwarth[3], Thomas Udem[3], Theodor W. Hänsch[3] und Gerald Gwinner[4] — [1]MPI für Kernphysik, 69029 Heidelberg, Germany — [2]Institut für Physik, Universität Mainz, 55099 Mainz, Germany — [3]MPI für Quantenoptik, 85478 Garching, Germany — [4]Dept. of Physics & Astronomy, University of Manitoba, Winnipeg R3T 2N2, Canada

Die relativistische Zeitdilatation, wie in der Speziellen Relativitätstheorie vorrausgesagt ist, wird mit schnellen optischen Uhren, die durch Lithium Ionen realisiert sind, gemessen und mit der Speziellen Relativitätstheorie verglichen.

Die Grundlage des Experiments ist der Testspeicherring am MPI für Kernphysik, der es ermöglicht Lithium Ionen bei 3% oder 6.4% der Lichtgeschwindigkeit zu speichern. An den gespeicherten Ionen wird eine Laserspektroskopie mit zwei gegenläufigen Laserstrahlen durchgeführt, so dass das Experiment nicht mehr durch die Dopplerverbreiterung limitiert wird.

Die Ergebnisse der Messungen geben eine neue obere Grenze für eine Abweichung zwischen Beobachtung und Theorie vor, die im Rahmen der Robertson-Mansouri-Sexl Testtheorie einen Wert von $\hat{\alpha} < 8.4 \times 10^{-8}$ ergibt (1).

(1) S. Reinhardt et al., Nature Physics,doi:10.1038/nphys778

GR 12.2 Do 14:20 KGI-HS 1010

Laboratory test of gravitational drag? — •Johan K. Fremerey

— Karl-Friedrich-Schinkel-Str. 14, D-53127 Bonn, Germany

In the early 1960s, J. C. Keith on the basis of both, Birkhoff's and Einstein's theories of gravitation proposed the existence of a rotational drag [1,2] besides the one caused by the generally accepted gravitational quadrupole radiation. A rotational drag as expected by Keith was experimentally observed in the early 1970s on a magnetically suspended, 2.5-mm steel ball spinning freely at rotational frequencies up to and beyond the elastic limit of the rotor material [3]. The laboratory observations have been disapproved by gravitational physicists as being incompatible with the observation of extraterrestrial objects [4,5]. The apparent discrepancy, however, can be resolved by simply assuming that the gravitational interaction postulated by Keith does not penetrate compact matter such as, in particular, the atomic nuclei contained in the experimental rotor. On grounds of this consideration, the Keith effect is expected to be observable only on small rotating bodies as these are widely transparent to the interaction.

[1] J.C. Keith, J. Math. Phys. 42, 248 (1963). [2] J.C. Keith, Rev. Mex. Fis. 12, 1 (1963). [3] J.K. Fremerey, Phys. Rev. Lett. 30, 753 (1973). [4] M. Reinhardt, A. Rosenblum, Lett. Nuovo Cimento 6, 189 (1973). [5] G.T. Gillies, Rev. Roum. Phys. 30, 805 (1985).

GR 12.3 Do 14:40 KGI-HS 1010

Numerische Modellierung der MICROSCOPE–Mission — •Meike List, Stefanie Bremer, Hanns Selig und Hansjörg Dittus — ZARM - Universität Bremen, Am Fallturm, 28359 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 Ende 2011 auf einer erdnahen Umlaufbahn an Bord eines Kleinsatelliten der CNES–μ–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 Missionsmodellierungen durchgeführt. Sowohl die verschiedenen Störeinflüsse als auch die verschiedenen Regelkreise zur Steuerung der Flugbahn des Satelliten und des Experiments sollen mit Hilfe dieses Modells simuliert werden.

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

GR 12.4 Do 15:00 KGI-HS 1010

Gravitational waves and rovibrational quantum interferometers — •Dennis Lorek[1], Andreas Wicht[2], Claus Lämmerzahl[1], and Hansjörg Dittus[1] — [1]ZARM, Universit\"at Bremen, Germany — [2]Institut für Experimentalphysik, Heinrich-Heine-Universität, Düsseldorf, Germany

We show that the application of atom interferometry techniques to the internal, i.e. rotational-vibrational states of molecules provides a new tool for ultra-high precision tests of fundamental physics. As an example we present how a molecular rovibrational quantum interferometer based on the HD+ molecule may be used to detect gravitational waves. The perturbation of the molecular Hamiltonian by a gravitational wave is derived, the quantum interferometric measurement principle is described, and the size of the effect is estimated. We will discuss whether a gravitational wave causes a frequency shift which may be detectable with the next generation atom interferometers.

GR 12.5 Do 15:20 KGI-HS 1010

Dynamics of a rigid body in an inhomogenous force field — •Andreas Resch, Claus Lämmerzahl, Dennis Lorek, Isabell Schaffer, and Hansjörg Dittus — ZARM, University of Bremen, Germany

Extended rigid bodies do not move on geodesics but couple to the space-time curvature. We discuss this effect at the Newtonian level where the deviation from the ordinary Keplerian orbits occurs in two ways: we obtain an additional force in the equation of motion for the center-of-mass and a torque acting on the rotational degrees of freedom. We give a survey of the dynamics for various initial conditions. We discuss whether these modifications of the equations of motion can explain the so-called flyby anomaly. In particular, the behavior of satellites during a flyby is studied and a comparison with the flyby anomaly of Galileo, NEAR, Cassini and Rosetta is made.

GR 12.6 Do 15:40 KGI-HS 1010

Report on the new analysis of tracking and house keeping data of the spacecraft Pioneer 10 and 11 — Stefanie Bremer, Hansjörg Dittus, Claus Lämmerzahl, Meike List, •Laura Mullin, and Benny Rievers — ZARM, Universität Bremen, Am Fallturm, D - 28359 Bremen

The Pioneer Anomaly denotes the anomalous constant blue shift of the Doppler tracking data of the spacecraft Pioneer 10 and Pioneer 11 at distances between 20 and 70 astronomical units. The phenomenon has been reported the first time by JPL in 1998 (Anderson et al.) and gave rise of various speculations about its origin since then. The blue shift can be interpreted as a constant acceleration towards the sun or the earth. Intensive investigations had been carried out in order to identify internal (on-board) or external sources for systematic errors. So far, none of the various effects investigated can explain the phenomenon. As part of an international collaboration (funded by DLR, CNES, NASA, and the International Space Science Institute), research at ZARM is being undertaken in a new effort to understand systematic modelling errors on the Pioneer spacecraft using housekeeping telemetry data corresponding to the mission period originally studied. These data will allow the verification of a finite element thermal model under construction as well as maneuver and gas leak modelling. We will report on recent results.

GR 13: Alternative Ansätze

Zeit: Donnerstag 16:30–17:30 Raum: KGI-HS 1010

GR 13.1 Do 16:30 KGI-HS 1010

Die E8-Symetrie-Gruppe, eine Repräsentation der Gravitation und des Makro- Mikrokosmoses. — •Norbert Sadler — Wasserburger Str. 25 a ; 85540 Haar

Die Gravitation, die Naturkonstanten, die Elementarteilchen, die Struktur des Universums sowie die Protein-Synthese können über die Algebren der Lie-Gruppe E8 vereinheitlicht dargestellt werden. Die Algebren der E8-Gruppe werden bestimmt zu E8 = (Univ.Rad.)/($\frac{5}{9}$ Lichtsec.) = $\frac{9}{5}$sinh$41,399 = 8,58 \cdot 10^{17}$. Es werden beispielhaft über die E8-Gruppe dargestellt: (i) Gravitationsfeldstärke des Universums: g(Univ.) = 1 kg c/(E8 π $\frac{5}{3}$ s). Die Gravitation ist die Beugung, Differentierung der Lichtgeschwindigkeit c an der E8-Repräsentation des Univ.-Alters. (ii) Naturkonstanten: G = (E8 c^3 $\frac{3}{4}$ s/(Masse d. Univ). Kopplungskonst.: κ = (6π E8 1 s)/(Masse d. Univ. c). $\hbar$ = $\frac{3}{4}$($|t_{\rm Pl}|$ Masse d. Univ. c $l_{\rm Pl}$)/(E8). (iii) Elementarteilchen: Quark(u,d) = ($\frac{4}{9}$ 1 kg)/(E8 π c). Higgs-Boson = $\sqrt{2}$(4π 1 kg)/(E8 0.25 $|c|$) = 156 $rmGeV/c^2$. (iv) Univ.-Struktur: Univ.-Radius = E8 $\frac{5}{9}$ Lichtsec.. Alter: E8 $\frac{5}{9}$ s. Masse d. Univ. = 4π(E8$\frac{5}{9}$ Lichtsec.)^2 1 kg/1 m^2 $= 2,57 \cdot 10^{53}$ kg. (v) Protein-Synthese: E8 = $2(2^{|37,57^\circ - \text{Zust.}|}2^{|21\text{ Aminosäuren}|})$. Die 21 natürlichen Aminosäuren sind über E8 im Universum kausal bestimmt.

GR 13.2 Do 16:50 KGI-HS 1010

Zusätzlicher Nachweis von Antigravitation — •Peter Kümmel — Amselweg 15 c; 21256 Handeloh

Künstlicher Schwerpunktversatz durch Rotations-AMG, ISBN:3-921-291-00-3, p. 36 ff., 1970, verursacht Torsionspendel-Rotation. Diese Bewegung wird von der 2-dimensionalen Kraftlinienkrümmung durch Massenrotation überlagert; vgl. Experiment mit Zweiebenenanordnung von 12 Staubsaugermotoren, 3-921-291-05-4, p. 291 f., 2001. Durch passende Beschaltung der Antriebsmotore lassen sich die Werte beider Torsionspendel-Rotationsantriebe trennen.

GR 13.3 Do 17:10 KGI-HS 1010

Zu Festquantenfeldern und inertialen Energien: Der Mond als Ursprung von Drehung und innerer Wärme der Erde — •Manfred Böhm — Telphykas, Solitudestr.389, 70499 Stuttgart

Die Energie des geostationären Quantengasfeldes beträgt an der Erdoberfläche 334 Joule pro Kubikmeter. Als inertiale Energie wird die

Energie bezeichnet, die sich ergibt,wenn von zwei sich linear mit v bewegenden Massen die eine um die andere im Abstand r mit einer anderen Geschwindigkeit kreist. Ausgehend von Festquantenkräften als EM-Kräften werden die Vortriebskräfte an Erde und Mond im Quantengasfeld der Sonne erläutert. Infolge seines Umlaufs übt der Mond auf die Erde ein Drehmoment aus, dass diese zu ihrer gegenläufigen Tagesdrehung veranlaßt und dem Mond dabei eine Winkelgeschwindigkeit verleiht, die ihn der Erde immer dieselbe Seite zuwenden läßt. Die Rotationsenergie des Mondes bezogen auf die Achse der Erde ist gleich deren Rotationsenergie und innerer thermischer Energie. Aus diesen Einsichten lassen sich Methoden zur Gewinnung praktisch unbegrenzter umweltneutraler Energie ohne Nutzung von Wasser und Wind im geostationären Quantengasfeld ableiten, als leistungsfähigere und wirtschaftlichere Miniatur-Analogien zu Gezeitenkraftwerken.

GR 14: Poster

Zeit: Montag–Donnerstag 0:00–24:00 Raum: Foyer KGI

GR 14.1 Mo–Do 0:00 Foyer KGI

Emission of massless spin-1/2 fermions by Kerr black holes — •Christian Röken, Ian Lerche, and Reinhard Schlickeiser — Institut für Theoretische Physik, Lehrstuhl IV: Weltraum und Astrophysik, Ruhr-Universität Bochum, Deutschland

Quantum theory predicts that a black hole is an emitter of various forms of radiation. Relativistic quantum theory anticipates that a Kerr black hole emits a spectrum of spin-1/2 fermions in its surrounding space-time region. As a consequence of this particle emission the black hole loses angular momentum and mass. Detection of the characteristic radiation can help to localize rotating, uncharged black holes.

Employing a dyadic Newman-Penrose spinor formalism on a Kerr manifold a generalized Dirac equation can, under the assumption of axial symmetry, be separated leading to two 1-dimensional wave equations for functions of the radial component and two differential equations for functions of the polar angle.

In this poster a new analytical approach is presented to solve the derived wave equations. Using an asymptotic substitution approach they can be transformed into Whittaker differential equations in an elementary way. Solutions are also obtained for the polar angle-dependent differential equations in the limits of small polar angles and negligible particle masses (e.g. neutrinos), so that asymptotic expressions for the fluxes of the number of fermions, energy and angular momentum in a solid angle element can be derived.

GR 14.2 Mo–Do 0:00 Foyer KGI

Special Relativity Derived from the Structure of Matter — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

Historically, the phenomena of relativity gave us a great chance for a better understanding of the structure of matter. Some of the founders of SR like H. Lorentz proceeded on this >physical< way.

This chance, however, was given away when Einstein presented a theory, which solved the relativity related problems with an abstract concept of structures, without any relation to matter. We can excuse Einstein by the fact that at his time there was only a limited knowledge about matter. Stimulated by the deadlock in present physics, we should re-develop the process of understanding relativity. We should use the contraction of fields (Lorentz) rather than the contraction of space; and as well the slow down of elementary oscillators (Ziegler, Schrödinger) rather than the dilation of time.

We arrive at the same mathematics like with Einstein (= Lorentz Transformation), but have based it on truly physical facts, and we have gained knowledge about other areas of physics (i.e. particle structure). We win a theory of relativity which is so easy to comprehend, that it can be taken into physics lessons at school.

And we find an easily understandable mechanism that explains the increase of mass at motion and the mass-energy-relation, without any use of abstract principles.

For further information refer to www.ag-physics.org/relat

GR 14.3 Mo–Do 0:00 Foyer KGI

Is the Speed of Light 'c' a True Constant? — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

Einstein has - in his structure-based theory of relativity - stated that the speed of light 'c' is a true constant under all circumstances. The physical community has accepted this up to now in spite of the problems arising from this paradigm; see the deadlock situation of present physics (Quantum Gravity).

The constancy of the speed of light has 3 aspects:

1.) Is 'c' the same for an observer in motion or at rest?

Einstein says: YES - Lorentz says NO; only the measured 'c' is constant resulting from the contraction of measuring rods and the desynchronization of clocks during motion.

2.) Is 'c' the same inside and outside a gravitational field?

Einstein says: YES - We can say: NO; 'c' is reduced in a grav. field, and not the space is curved but fields are; gravity is not force # 4 but a side effect of other forces

3.) Was 'c' a constant during the development of the universe?

Einstein says: YES - Magueijo says: NO; if we accept an (adapting) decrease of 'c', we can avoid the inflation in cosmology and the landscape of 10**100 universes.

The remarkable point of the alternative approaches mentioned above is that they yield the same mathematical results as the traditional version of Einstein, to the extent as they are confirmed by observations and experiments.

For further info see www.ag-physics.org/relat and /gravity

GR 14.4 Mo–Do 0:00 Foyer KGI

Ein Pseudo-Random Time-of-Flight Verfahren für das Atomstrahl-Spinecho Experiment — •Manuel Vedovelli, Felix Laux, Ulrich Schmidt und Maarten DeKieviet — Physikalisches Institut der Universität Heidelberg, Philosophenweg 12, 69120 Heidelberg

Bei der experimentellen Überprüfung des Gravitationspotentials im Submikrometer-Bereich auf einen nicht-Newtonischen Beitrag ist für Atome ein quantitatives Verständnis der Casimir-Kraft unentbehrlich. Mit unserer 3He-Atomstrahl-Spinecho-Methode haben wir gezeigt, dass dies auf einem Prozent-Niveau gegeben ist. Um Grenzen für Yukawa-Korrekturen zu setzen, vergleichen wir nun die Atom-Oberfläche-Wechselwirkungspotentiale von 3He und 4He auf diesem Niveau. Hierzu muss die Wellenlängenverteilung für jedes der beiden Isotope genauestens bekannt sein. Für 3He kann sie mit der Methode der Spin-Rotation präzise bestimmt werden. Für eine Messung der Wellenlängenverteilung von 4He wurde die Atomstrahl-Spinecho-Methode durch ein Pseudo-Random-Flugzeitmesssystem erweitert. Details des Experiments, seine Systematik und erste Resultate werden auf diesem Poster präsentiert.

GR 14.5 Mo–Do 0:00 Foyer KGI

How strong is the evidence for accelerated expansion? — •Marina Seikel and Dominik J. Schwarz — Universität Bielefeld

We test the present expansion of the universe using supernova type Ia data without making any assumptions about the matter and energy content of the universe or about the parameterization of the deceleration parameter. Using two different SN Ia data sets, two different fitting methods and two different calibrations, we observe large systematic effects. Nevertheless, the null hypothesis that the universe never expanded accelerated can be rejected at a high confidence level. The same test can be done in a calibration-free way, i.e. without assuming certain values for the Hubble constant and the absolute magnitude of the supernovae. But in this case the obtained evidence for acceleration is weaker than that obtained by the previous test.