GR 8: Poster session (permanent)

Zeit: Mittwoch 18:00–19:30 Raum: Phys-SR-SE2

GR 8.1 Mi 18:00 Phys-SR-SE2

Frequency Spectrum of an Optical Resonator in Curved Spacetime — Dennis Rätzel[1], •Fabienne Schneiter[2], Daniel Braun[2], Tupac Bravo[1], Richard Howl[1], Maximilian P. E. Lock[3,1], and Ivette Fuentes[4,1] — [1]Faculty of Physics, University of Vienna, Boltzmanngasse 5, 1090 Vienna, Austria — [2]Institut für Theoretische Physik, Eberhard-Karls-Universität Tübingen, 72076 Tübingen, Germany — [3]Imperial College, Department of Physics, SW7 2AZ London, United Kingdom — [4]School of Mathematical Sciences, University of Nottingham, University Park, Nottingham NG7 2RD, UK

We study the effect of a gravitational field and proper acceleration on the frequency spectrum of an optical resonator, both when the resonator is considered to be rigid or deformable. The resonator is modeled as a rod of matter with two attached mirrors at its ends, or as a dielectric rod whose ends function as mirrors. We derive expressions for the frequency spectrum, which is defined through the runtime of light pulses sent back and forth between the mirrors by an observer. For a deformable resonator, the frequency spectrum depends on the speed of sound in the rod supporting the mirrors. The speed of sound approaching infinity corresponds to the assumption of Born rigidity, and the speed of sound approaching the speed of light corresponds to the assumption of a relativistic concept of rigidity. The results may be used for measuring gravitational fields or accelerations based on frequency shifts, and are not limited to weak gravitational fields.

GR 8.2 Mi 18:00 Phys-SR-SE2

Relativistic Interactive Flight Simulation — •Stephan Preiss — Institut für Physik, Universität Hildesheim

First-person visualizations can be used as virtual laboratories where relativistic scenes are explored and relativistic phenomena like length contraction, time dilation and aberration of light are directly observable. We developed an interactive relativistic flight simulation to show these effects. Next to static objects, the simulation also includes objects that move at constant speed, accelerate uniformly or rotate constantly. With this tool, we are able to address the common difficulties in the understanding of the special theory of relativity by creating scenes treating twin and ladder paradoxa.

GR 8.3 Mi 18:00 Phys-SR-SE2

partially massless and self duality in three dimensions — •daniel galviz[1] and adel khoudeir[2] — [1]Universität Bonn, Nussallee 12, D-53115 Bonn, Germany — [2]Centro de Física Fundamental, Departamento de Física, Facultad de Ciencias, Universidad de Los Andes, Merida 5101, Venezuela

Partially massless in three dimensions is revisited and its relationship with the self-dual massive gravity is considered. The only mode of the partially massless is shown explicitly through of an action for a scalar field on (A)dS background. This fact can be generalized to higher dimensions. This degree of freedom is altered when a triadic Chern-Simons is introduced, giving rise to the self dual massive gravity on (A)dS background. We present another physical system with partially massless symmetry and its connection with topologically massive gravity is discussed.

GR 8.4 Mi 18:00 Phys-SR-SE2

Scalarization of neutron stars with realistic equations of state — •Zahra Altaha Motahar, Jose Luis Blazquez-Salcedo, Burkhard Kleihaus, and Jutta Kunz — Oldenburg University

Neutron stars are one of the most mysterious but interesting objects in the universe. Due to their compactness and high ensity, we can take them as an ideal laboratory to test alternative theories of gravity. In addition, studying neutron stars can improve our limited knowledge of properties and the physics of nuclear matter in such a high density inside these compact objects.

We demonstrate the effect of scalarization on static and slowly rotating neutron stars implementing various realistic Equations Of State (EOSs). Beside polytropic EOS and some EOSs considering pure nuclear matter, and pure quark matter, particularly we include several EOSs describing nuclear matter with hyperons and hybrid matter for the first time in this context.

We investigate the onset of scalarization, for these different EOSs presenting a universal relation for the critical coupling parameter versus the compactness. We then recognize that the most significant universal (independent of the EOS) feature of the onset and the magnitude of the scalarization, is the correlation with the value of the the gravitational potential at the center of the star. We also analyze the moment-of-inertia–compactness relations and confirm universality for the nuclear matter, hyperon and hybrid equations of state.

GR 8.5 Mi 18:00 Phys-SR-SE2

Flying through a Kerr black hole – Visualizations — •Thomas Reiber — Universität Hildesheim

We use a maximal analytic extension of Kerr spacetime, which offers an interesting topology. An observer in it can pass through event horizons to reach distant asymptotically flat parts of the spacetime. To illustrate what an observer moving through a Kerr black hole would observe, a general relativistic ray tracer is used to calculate videos of the observers view for different geodesic movements of the observer.

GR 8.6 Mi 18:00 Phys-SR-SE2

Sektormodelle gekrümmter Raumzeiten — •Corvin Zahn und Ute Kraus — Universität Hildesheim

Die Allgemeine Relativitätstheorie beschreibt die Welt als vierdimensionale Lorentz-Mannigfaltigkeit. Um die Bewegung von Teilchen oder die Ausbreitung von Licht zu untersuchen ist es oft ausreichend, einen zweidimensionalen Unterraum bestehend aus der Zeit- und einer Raumkoordinate zu betrachten.

Zur anschaulichen Darstellung solcher Unterräume, deren Geometrie i. A. nicht die Minkowski-Geometrie ist, haben wir Anschauungsmodelle entwickelt. Sie basieren auf der im Regge-Kalkül verwendeten koordinatenfreien, nur auf messbaren Abständen beruhenden Beschreibung der Raumzeit.

In diesem Beitrag werden Beispiele solcher Sektormodelle vorgestellt: Raumzeiten von Schwarzen Löchern, Neutronensternen, Gravitationswellen und dem expandierenden Universum.

GR 8.7 Mi 18:00 Phys-SR-SE2

Satellite Dynamics and Formation Flight Simulator: Design, Analysis, and Optimization of future geodesy missions — Takahiro Kato, Wöske Florian, Rievers Benny, and •List Meike — ZARM, Universität Bremen, Am Fallturm 2, 28359 Bremen

Observations in satellite gravimetry depend on accurate modeling techniques for (I) an interpretation of measured data and the characterization of perturbations, (II) mission analysis, design and optimization and (III) tests of data evaluation procedures.

The need for an improvement of the modeling of system and environment in particular for satellite gravimetry is motivated by a range of complex questions and tasks.

The focus of the development lies on the implementation of an accurate dynamics model of the satellite under external perturbations, as well as the internal coupling effects (noises) on the measurement.

GR 8.8 Mi 18:00 Phys-SR-SE2

MICROSCOPE: A space mission to test the Weak Equivalence Principle — Stefanie Bremer, Meike List, •Benny Rievers, and Hanns Selig — ZARM, Universität Bremen, Am Fallturm 2, 28359 Bremen

On the 25th of April the French space mission MICROSCOPE was launched. After the successful commissioning phase, scientific measurements started in December 2016 and are planned to be continued at least until January 2018. The goal of the MICROSCOPE mission is ambitious: The Weak Equivalence Principle is being tested with a precision never achieved before yielding the determination of the Eötvös parameter η with an accuracy of 10-15. Here we show details on the orbit and system modeling as well as on some aspects of data analysis.

GR 8.9 Mi 18:00 Phys-SR-SE2

Circular motion in NUT space-time — •Pavel Jefremov and Volker Perlick — ZARM, Universität Bremen

We investigate characteristic imprints of the gravitomagnetic charge and the Manko-Ruiz constant on circular geodesics and perfect fluid tori motion in NUT (Newman-Unti-Tamburino) metric. For the perfect fluid case we consider the Polish Doughnuts model which is widely used in modelling of accretion flows. We find that the shape of the rotational configurations is qualitatively changed due to the presence of the gravitomagnetic charge and compare thermodynamical parameters of the tori for different values of the parameters of the metric.

GR 8.10 Mi 18:00 Phys-SR-SE2

Relativistic accretion of charged dust in Kerr-Newman spacetime — •Kris Schroven, Eva Hackmann, and Claus Lämmerzahl — University of Bremen, Center of Applied Space Technology and Microgravity (ZARM), 28359 Bremen, Germany

We use an analytical model to describe the accretion of a dilute collisionless plasma onto a rotating and charged black hole (BH). By assuming continuous injection of particles at the spherical shell, and by treating the BH and accretion disk as passive sinks of particles, the dicsussed model becomes stationary. The model may serve as a toy model for plasma feeding an accretion disk around a charged and rotating BH. Our main focus lies on the discussion of the influence of a very small BH net charge on the plasma accretion. We can demonstrate that, within our model, already a vanishingly small BH charge may in general have a non-negligible effect on the plasma's motion. Furthermore, we argue that the inner and outer edges of the forming accretion disk strongly depend on the charge of the accreted plasma. The resulting possible configurations of accretion disks are analyzed in detail.

GR 8.11 Mi 18:00 Phys-SR-SE2

Relativistic geodesy: the geoid and leveling — •Dennis Philipp — ZARM, Universiät Bremen

We give a definition of the relativistic geoid in terms of the redshift potential, which exists for any isometric congruence of observers. Our definition yields the well known (post-)Newtonian notions in the respective limit, and it applies to any celestial object no matter how strong the gravitational field is. Mathematically, the definition of the geoid in terms of a redshift potential is equivalent to a definition in terms of an acceleration potential, and we use this equality to explore the field of relativistic leveling. The definitions are visualized by specific examples for analytically known simple spacetimes, and we show the influence of certain properties of the gravitational field, such as the gravitomagnetic parameter, on the results.

GR 8.12 Mi 18:00 Phys-SR-SE2

Galilean relativity with the relativistic gamma factor. — •Osvaldo Domann — Stephanstr. 42, D- 85077 Manching

SR as derived by Einstein is the product of an approach of 1905 when the interactions between light and the measuring instruments were still not well understood. SR is a rough undifferentiating heuristic mathematical approach which ignores the origin of the constancy of light speed in inertial frames, arriving to wondrous results about time and space. With the findings made during the last 100 years by experimentalists, a critical revision of Einstein's theoretical approach is more than overdue. Based on these findings, a theoretical approach is presented which takes into consideration the interactions between light and optical lenses and electric antennas of the measuring instruments, explaining why always 'c' is measured in the frame of the instruments. The approach treats relativity as a speed problem with absolute time and space variables, resulting equations of Galilean relativity multiplied with the gamma factor. More at www.odomann.com

GR 8.13 Mi 18:00 Phys-SR-SE2

The Question of Dark Energy — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

Dark energy is considered to be one of the great mysteries of present-day physics. From measurements of the motion of type Ia supernovae, it has been concluded that the universe is undergoing accelerated expansion. To explain this acceleration, the universe is assumed to be filled with some type of ("dark") energy.

However, there is a very unspectacular explanation for these measurements if we follow the Lorentzian relativity rather than the relativity of Einstein.

In the Lorentzian relativity space is not expanding but always fixed and the stars and the galaxies are moving physically through this stable space. Inflation is in this view not a change of the space but a change of the speed of light c. And instead of a slowly expanding space one has to assume a slow decrease of the speed of light.

If in this view the speed of light was higher in the past there is a simple solution. Because if this higher c of the early times is inserted into the Doppler equation to determine the speed of the stars from their red shift, this will yield higher speeds for early stars. So there is no acceleration.

GR 8.14 Mi 18:00 Phys-SR-SE2

Possible experimental proof of Lorentz interpretation (LI) of GRT — •Jürgen Brandes — Karlsruhe, Germany

LI of GRT is a rational variation of classical GRT. Nobel Prize winner Kip S. Thorne accepts both, the curved spacetime paradigm of classical GRT and the flat spacetime paradigm of LI of GRT. "Is spacetime really curved? Isn't it conceivable that spacetime is actually flat, but the clocks and rulers with which we measure it ... are actually rubbery?" and his answer is: "Yes." [2]. Normally, there is no difference in the predictions of relativistic experiments of both interpretations. The great exception: within LI of GRT "black holes" have no event horizon and they are degenerate objects of arbitrary mass from which light waves can escape. The poster shows details of the calculations of these supermassive objects using the Tolman Oppenheimer Volkoff (TOV) equation. The differences to classical GRT shall become observable by the "Event Horizon Telescope" and "Black Hole Cam" project within 2018.

[1] J. Brandes, J. Czerniawski: *Spezielle und Allgemeine Relativitätstheorie für Physiker und Philosophen - Einstein- und Lorentz-Interpretation, Paradoxien, Raum und Zeit, Experimente*, 4. Aufl. 2010, [2] Website www.grt-li.de.

GR 8.15 Mi 18:00 Phys-SR-SE2

Dark Matter Problem solved by Modified Gravitation — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

Dark matter is one of the great mysteries in physics today.

There are fundamentally two possible solutions: (1) types of particle may exist which are presently undetected and which provide the missing contribution to the gravitational field; (2) the theory of gravity put forward by Newton and Einstein, which relates gravitation to mass and energy, may be at fault.

For the second alternative, a working ansatz is available. If the Lorentzian interpretation of relativity is extended to the field of general relativity, i.e. to gravitation, this results in a different causality for gravity. Gravity is no longer caused by mass but is instead a side effect of other forces. So every elementary particle contributes to the field independently of its mass. In this case, photons and neutrinos play a prominent role.

Taking the thoroughly investigated rotating galaxy NGC 3198 as an example of this approach, it can be shown that the result for the value of the field as well as its spatial distribution fits the measurements quite precisely.

On the other hand, the search for specific particles as an explanation for this phenomenon has not yielded any hint of their existence up to now.