GR 18: Poster

Time: Thursday 17:15–18:45 Location: HBR 14: Foyer

GR 18.1 Thu 17:15 HBR 14: Foyer

Questionable predictions by EHT image of Sgr A*; observational evidence for Sgr A* being no BH; de Laval nozzle and its application to astrophysical jets. — •Jürgen Brandes — Karlsbad, Germany

I. The famous EHT image of Sgr A* predicts BH features in contradiction with observation: a* = 0.9375 against a* $\leq$ 0.15; spin direction face-on against edge-on; accretion light variability arising with accretion disks against variability of accretion wind. And there is a theoretical shortcut by Broderick et al.: The missing UV bump agrees with degenerate supermassive objects being no BH [1], [2]. II. Furthermore, [3] proves: If Sgr A* is a BH then its spin must be a* = 0.90. But [1] proves that the spin of Sgr A* $\leq$ 0.15. The purely logical conclusion: Sgr A* cannot be a BH (contrary to [3], its spin would be too low). **These observations of Fragione, Loeb, Daly et al. together are an obvious experimental confirmation for Sgr A* not being a BH** [1], [3]. III. Jets of supermassive objects being no BH are quite natural explained by astronomical application of a de Laval nozzle [4]. Since this does not work for BHs it should lead to observable differences between BHs and no BH stellar objects.

[1] Talk-DPG-2023 www.grt-li.de.
[2] J. Brandes, J. Czerniawski, L. Neidhart: *Special and general relativity...* VRI: 2023
[3] R. A. Daly et al., MNRAS 2024, 428 - 436
[4] P. Subramanian, *Fluid Dynamics for Astrophysics*, 2021, lec. 31

GR 18.2 Thu 17:15 HBR 14: Foyer

Lorentz-invariant quantum gravity by elimination of spacetime — •René Friedrich — Strasbourg

Spacetime is more and more often suspected of being at the origin of the problem of quantum gravity. However, it will be shown that general relativity may not only be described within a spacetime manifold, but also in Lorentz-invariant terms. In particular, gravity may not only be represented in the form of curved spacetime, but also equivalently as gravitational time dilation in flat, uncurved space.

Quantum mechanics and general relativity are harmonizing because - fundamentally speaking - they are both Lorentz-invariant. Lorentz-covariant spacetime is only the way how the universe of general relativity is perceived and measured by observers, it is a sort of "observational interface", half-way between the observer and the underlying reality. The Lorentz-invariant universe of quantum gravity is not observable, it must be retrieved from observation by calculation, exactly in the same way as the proper time of a particle is retrieved from the coordinate time measured by an observer. Further information: R. Friedrich: Quantengravitation ohne Mühe

GR 18.3 Thu 17:15 HBR 14: Foyer

Curvature of four-dimensional space due to electrical charges — •Michael Zauner[1] and Günther Hendorfer[2] — [1]University of Applied Sciences Upper Austria — [2]Buchenweg 3, 4081 Hartkirchen

The inadequacy of accurately describing phenomena in the near field of large masses led to the further development of Newton's theory into the general theory of relativity. Newton's law and Coulomb's law are both subject to the Poisson equation, so the question arises as to whether a similar theory can be developed for electrical charges.

In this thesis, the assumption that forces between charges can be traced back to curved spaces will be investigated and a Schwarzschild-like solution will be analyzed. The following postulates are to be established from the previous considerations: (1) Electric charges bend space. (2) The space curvature of opposite charges is also opposite. For example, a negative charge curves space "concavely" and a positive charge curves space "convexly". (3) Several charges move in such a way that the space merges into Minkowski space. This means that two different charges move towards each other, which cancels out the curvature of space, or two charges of the same name move away from each other, to create a minimum in the curvature of space.

The results of this work can be converted back into a Coulomb approximation, and the following results were also found: (1) The spatial extent of the space curvature depends not only on the charge, but also on the mass of the respective particle. More massive, charged particles have a smaller spatial expansion. (2) In close range is an asymmetry in the repulsive and attractive force.

GR 18.4 Thu 17:15 HBR 14: Foyer

Scalar Field on Fuzzy de Sitter Space — •Bojana Brkic[1], Ilija Buric[2], Maja Buric[1], and Dusko Latas[1] — [1]Faculty of Physics, University of Belgrade, Studentski trg 12 SR-11001 Belgrade, Serbia — [2]Department of Physics, University of Pisa and INFN, Largo Pontecorvo 3, I-56127 Pisa, Italy

First, we introduce (commutative) d-dimensional de Sitter space and write down orthonormal bases of solutions to the Klein-Gordon equation in two sets of coordinates - the usual Poincaré coordinates (η, x^i) and another coordinate system (η, y^i) that is inspired by noncommutative geometry. It is shown that the natural choice of vacuum in the (η, y^i) coordinates is invariant under the de Sitter group and the choice of positive frequency modes that gives rise to the Bunch-Davies vacuum is identified. We compute overlaps between field modes in (η, x^i) and (η, y^i) coordinates [1]. After that, we give the definition of fuzzy de Sitter space, in particular, its differential geometry and the Laplacian [2]. Our main objective is to find the eigenfunctions of the fuzzy Laplacian. We show that eigenfunctions of the Laplacian on commutative de Sitter space in four dimensions, separated in the (η, y^i) coordinates, may be directly 'quantised' to give eigenfunctions of the fuzzy Laplacian. The special choice of coordinates ensures that no issues due to operator ordering arise in the quantisation process. Also, we consider fuzzy de Sitter space in two dimensions.

[1] B. Allen, Phys. Rev. D **32**, 3136 (1985)
[2] B. Brkić *et al*, Class. Quant. Grav. **39**, 115001 (2022)

GR 18.5 Thu 17:15 HBR 14: Foyer

Visualizing the geometry of spacetime of General Relativity with sector models — •Vassilios Marakis — Universität Hildesheim

Understanding the trajectories of free-falling particles and the path of light in curved spacetime can be challenging, particularly for beginners or those with a casual interest, due to complex mathematics. The sector model simplifies this visualization by dividing the coordinate space into blocks with intuitive Euclidean geometry. Our application enhances this approach by creating sectors based on various metrics, such as the spacetime of the equatorial plane of a massive celestial body, allowing users to explore geodesics and understand phenomena like redshift, light deflection, and perihelion rotation.

GR 18.6 Thu 17:15 HBR 14: Foyer

Time transfer in stationary and general frames — •Bennet Grützner — ZARM, Bremen

Time transfer, a form of synchronization, is a necessary tool for many experiments and observations. In Special Relativity Einstein synchronization is widely accepted as the standard method of time transfer. It works just as well in static frames in General Relativity, like non-rotating frames in the Schwarzschild metric. However, in stationary or general frames, Einstein synchronization is not transitive due to effects such as the Sagnac effect.

We discuss different methods of time transfer, with particular emphasis on globally transitive methods. The concept of hyperspheres of simultaneity is introduced, and applications to time transfer on Earth and in space are discussed.