# GR 11: Alteranative Classical Theories of Gravitation

Time: Thursday 14:00–15:15 Location: H-HS V

GR 11.1 Thu 14:00 H-HS V

**Particle-like solutions in Einstein-scalar-Gauss-Bonnet theories** — •Burkhard Kleihaus[1], Jutta Kunz[1], and Panagiota Kanti[2] — [1]University of Oldenburg — [2]University of Ioannina

Einstein-scalar-Gauss-Bonnet (EsGB) theories are motivated from a quantum gravity perspective and include higher-curvature contributions in the form of the quadratic Gauss-Bonnet term coupled to a scalar field. Black holes and wormholes in EsGB theories have been extensively studied in the past. Here a new type of particle-like solutions is discussed. It represents globally regular spacetime manifolds and its effective stress-energy tensor is free from pathologies. We determine the domain of existence and compare with wormhole solutions, black holes and Janis-Newman-Winicourt-Wyman solutions. We show that the particle-like solutions are ultracompact objects possessing a lightring and featuring echoes in the gravitational-wave spectrum.

GR 11.2 Thu 14:15 H-HS V

**Gauge-invariant approach to the parametrized post-Newtonian formalism** — •Manuel Hohmann — University of Tartu, Tartu, Estonia

We present an approach to the parametrized post-Newtonian (PPN) formalism which is based on gauge-invariant higher order perturbation theory. This approach divides the components of the metric perturbations into gauge-invariant quantities, which carry information about the physical system under consideration, and pure gauge quantities, which describe the choice of the coordinate system. This separation generally leads to a simplification of the PPN procedure, since only the gauge-invariant quantities appear in the field equations and must be determined by solving them. Another simplification arises from the fact that the gauge-invariant approach supersedes the necessity to first choose a gauge for solving the gravitational field equations and later transforming the obtained solution into the standard PPN gauge. Both the metric and tetrad versions of the formalism are presented and applied to an example theory.

GR 11.3 Thu 14:30 H-HS V

**Post-Newtonian limit of general scalar-torsion theories of gravity** — •Kai Flathmann[1] and Manuel Hohmann[2] — [1]Institute for Physics, University of Oldenburg, 26129 Oldenburg, Germany — [2]Laboratory of Theoretical Physics, Institute of Physics, University of Tartu, 50411 Tartu, Estonia

In this talk we derive the post-Newtonian limit of a general class of teleparallel theories of gravity, where the action is a free function of the Torsion scalar and several quantities derived from a dynamical scalar field. In order to use the parameterized post-Newtonian (PPN) formalism without modifications, such as introducing an effective gravitational constant, we restrict the analysis to a massless scalar field. This class of theories is fully conservative, with only two non-vanishing PPN parameters. For a particular choice of the free function, the theory is even indistinguishable from General Relativity in its post-Newtonian approximation.

GR 11.4 Thu 14:45 H-HS V

**Tsallis holographic dark energy in the Brans-Dicke theory with logarithmic scalar field** — •Pradyumn Sahoo — Birla Institute of Technology and Science-Pilani, Hyderabda Campus, Hyderabad, India

In this paper, we investigate the dark energy phenomenon by studying the Tsallis holographic dark energy within the framework of Brans-Dicke (BD) scalar-tensor theory of gravity [Phys. Rev. **124**, 925 (1961)]. In this context, we choose the BD scalar field $\phi$ as a logarithmic function of the average scale factor $a(t)$ and Hubble horizon as the IR cutoff ($L = H^{-1}$). We reconstruct two cases of non-interacting and interacting fluid (dark sectors of cosmos) scenario. The physical behavior of the models are discussed with the help of graphical representation to explore the accelerated expansion of the universe. Moreover, the stability of the models are checked through squared sound speed $v_s^2$. The well-known cosmological plane i.e., $\omega_{de} - \omega'_{de}$ is constructed for our models. We also include comparison of our findings of these dynamical parameters with observational constraints. It is also quite interesting to mention here that the results of deceleration, equation of state parameters and $\omega_{de} - \omega'_{de}$ plane coincide with the modern observational data.

GR 11.5 Thu 15:00 H-HS V

**Gravitation as a physical interaction of subatomic particles instead of a geometrical space-time curvature.** — •Osvaldo Domann — Stephanstr. 42, 85077 Manching, Germany

General Relativity (GR) is the theory of gravitation of the SM. It is a mathematical approach from 1915, based on the representation of subatomic particles as isolated entities in space, arriving to the wondrous concept of space-time curvature. GR resists all intents of integration into a unified field theory and is not compatible with quantum mechanics. An approach is presented for a gravitation theory that is based on the representation of a subatomic particle (SP) as a focal point of rays of Fundamental Particles (FPs) that go from infinite to infinite, FPs where the energy of the subatomic particle is stored as rotations defining angular momenta. With this representation all SPs interact permanently through the angular momenta of their FPs, according to the Mach principle that postulates that physical laws are determined by the large-scale structure of the universe. The approach explains gravitation as the result of the physical reintegration of migrated electrons and positrons to their nuclei. Gravitation is so composed of a Newton and an Ampere component, with the Newton component dominant at sub galactic distances and the Ampere component at galactic distances. A positive Ampere component explains the dark matter and a negative Ampere component the dark energy. More at: www.odomann.com