GR 7: Modified Gravity and Applications

Zeit: Mittwoch 11:00–12:45 Raum: HS 5

GR 7.1 Mi 11:00 HS 5

Wormhole Solutions in Dilatonic Einstein-Gauss-Bonnet Theory — Panagiota Kanti[1], Burkhard Kleihaus[2], and •Jutta Kunz[2] — [1]University of Ioannina, Greece — [2]University of Oldenburg, Germany

Dilatonic Einstein-Gauss-Bonnet theory allows for wormhole solutions without the need for exotic matter. Here the presence of the higher-curvature term coupled to a dilaton, as suggested by string theory, leads to an effective stress-energy tensor, violating the energy conditions. The static wormhole solutions may possess a single throat or a double throat with an equator in between. The global charges of the wormhole solutions are analyzed as well as the properties of their throat(s). Linear stability of the static solutions is considered, and slowly rotating wormhole solutions are obtained perturbatively.

GR 7.2 Mi 11:15 HS 5

Quasinormal modes of neutron stars with scalar hair. — •Jose Luis Blázquez-Salcedo[1], Fech Scen Khoo[2], and Jutta Kunz[1] — [1]University of Oldenburg, Institute of Physics, Oldenburg, Germany — [2]Ruder Bošković Institute, Zagreb, Croatia

In this talk we will discuss the quasinormal modes of neutron stars in modified theories of gravity, where the system possesses a (massive) scalar degree of freedom, in addition to the space-time and fluid degrees of freedom that are present in General Relativity. Hence we will show that the spectrum of resonances of the ringdown phase of the gravitational waves emitted by these objects is richer. We will discuss different properties of this spectrum, such as the dependence with the mass of the scalar field, the equation of state and total mass of the neutron star.

GR 7.3 Mi 11:30 HS 5

The gravitational field of static p-branes in linearized ghost-free gravity — •Jens Boos[1], Valeri P. Frolov[1,2], and Andrei Zelnikov[1] — [1]Theoretical Physics Institute, University of Alberta, Edmonton, Alberta, Canada T6G 2E1 — [2]Yukawa Institute for Theoretical Physics, Kyoto University, 606-8502, Kyoto, Japan

We study the gravitational field of static p-branes in D-dimensional Minkowski space in the framework of linearized ghost-free (GF) gravity. We show that the singular behavior of the gravitational field of p-branes in General Relativity is cured by short-range modifications introduced by the non-locality, and we derive exact expressions of the regularized gravitational fields, whose geometry can be written as a warped metric. For large distances compared to the scale of non-locality our solutions approach those found in linearized General Relativity.

GR 7.4 Mi 11:45 HS 5

Principal Killing strings in higher-dimensional Kerr-NUT-(A)dS spacetimes — •Jens Boos and Valeri P. Frolov — Theoretical Physics Institute, University of Alberta, Edmonton, Alberta, Canada T6G 2E1

We construct special solutions of the Nambu-Goto equations for stationary strings in a general Kerr-NUT-(A)dS spacetime in any number of dimensions. This construction is based on the existence of explicit and hidden symmetries generated by the principal tensor which exists for these metrics. The characteristic property of these string configurations, which we call "principal Killing strings," is that they are stretched out from infinity to the horizon of the Kerr-NUT-(A)dS black hole and remain regular at the latter. We also demonstrate that principal Killing strings extract angular momentum from higher-dimensional rotating black holes and interpret this as the action of an asymptotic torque.

GR 7.5 Mi 12:00 HS 5

Black Hole Superradiance in Modified Gravity (MOG) — •Michael F. Wondrak[1,2], Piero Nicolini[1,2], and John W. Moffat[3] — [1]Frankfurt Institute for Advanced Studies (FIAS), Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität Frankfurt, Frankfurt am Main, Germany — [3]Perimeter Institute for Theoretical Physics, Waterloo, ON, Canada

When bosonic fields scatter off a black hole, the reflected radiation can gain a larger field amplitude than the incident one. This phenomenon, called superradiance, is typically sourced by the black hole electric charge or its angular momentum.

In this talk, we investigate superradiant scattering by black holes in Moffat's modified gravity (MOG). This theory replaces the need for dark matter in favor of an additional gravitational interaction. By comparison with Einstein's general relativity (GR), we find that the properties of superradiance crucially depend on the MOG parameter space: Even for small deviations from GR, there is a distinct reduction in the critical amplification frequency and in the overall brightness. Astronomical observation of superradiant scattering thus could provide an accurate test of MOG.

GR 7.6 Mi 12:15 HS 5

Axial quasi-normal modes of massive and massless scalarized neutron stars — •Zahra Altaha Motahar, Jose Luis Blázquez-Salcedo, Jutta Kunz, and Burkhard Kleihaus — University of Oldenburg, Institute of Physics, Oldenburg, Germany

The emission of gravitational waves as produced by colliding black holes and neutron stars in the observed events follows a typical sequence of phases, consisting of inspiral, merger and ringdown. The ringdown of the final compact object is dominated by its quasi-normal modes. We studied the axial quasi-normal modes of the massless and massive scalarized neutron stars with self interacting. In particular, we employed various realistic equations of state including nuclear, hyperonic and hybrid matter. Although the effect of spontaneous scalarization of neutron stars can be very large, binary pulsar observations and gravitational wave detections significantly constrain the massless scalar-tensor theories. If we consider a nonzero mass for the scalar field, the parameters of the massive case cannot be restricted by the observations, resulting in the large deviations of massive scalarized solutions from pure general relativity. In addition, we extended the universal relations for quasi-normal modes known in general relativity to the wide range of realistic EOS for massive and massless scalarized neutron stars.

GR 7.7 Mi 12:30 HS 5

The Ringdown of Wormholes — •Xiao Yan Chew, Jose Luis Blazquez-Salcedo, and Jutta Kunz — Carl von Ossietzky Universität Oldenburg Fakultät V - Mathematik und Naturwissenschaften Carl-von-Ossietzky-Str. 9-11 26129 Oldenburg

We calculate the quasinormal modes by WKB method and numerical direct integration for scalar, axial and radial perturbations of wormholes supported by a phantom scalar field. The spectrum of the quasi-normal modes is compared with the spectrum of Schwarzschild black holes. For fixed multipole number l and large mass M the wormhole modes approach their black hole counterparts as 1/M.