GR 6: Black Holes and other Black Objects

Zeit: Dienstag 16:45–19:05 Raum: VMP6 HS A

Hauptvortrag GR 6.1 Di 16:45 VMP6 HS A

A No-Hair Theorem for Astrophysically Relevant Black Holes — •Norman Gürlebeck — ZARM, University of Bremen, Germany

With the upcoming capabilities to observe black holes, it will be feasible to measure their properties with unprecedented detail. In particular, it will become possible to carry out so-called tests of the no-hair theorem. The no-hair theorem states that black holes are entirely characterized by their mass, angular momentum and charge alone. For this result to hold, the black hole must be isolated, i.e., there should be no additional sources of the gravitational field in their neighborhood like accretion disks. However, measurements of the angular momentum of the black hole rely heavily on the existence of such an accretion disk. Naturally, the question arises if the additional matter, say, an accretion disk impedes the suggested tests of the no-hair theorem. I will give a possible formulation of the no-hair theorem for such astrophysical black holes surrounded by matter alongside with a proof for static black holes. The proof employs the source integral formalism, which I review shortly. Perturbative approaches showed that deformations of black holes, which are immersed in an external gravitational field, measured by the second Love numbers vanish. But there was no consensus whether this result is still valid in case higher orders of the perturbation schemes are considered. The here presented no-hair theorem also implies that the second Love numbers of black holes vanish in full general relativity settling this debate also for the strong field regime. In the end of my talk, I will apply the developed formalism to existence and uniqueness questions in mathematical relativity.

GR 6.2 Di 17:25 VMP6 HS A

Lower-Dimensional Black Hole Chemistry — •antonia frassino[1,2], robert mann[2,3], and jonas mureika[4] — [1]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [2]Perimeter Institute, Waterloo, Ontario, Canada — [3]Department of Physics and Astronomy, University of Waterloo, Waterloo, Ontario, Canada — [4]Department of Physics, Loyola Marymount University, Los Angeles, California USA

We will address the issue of the phase structure for black holes in Anti-deSitter space, by treating the cosmological constant as a thermodynamic pressure within the black hole chemistry paradigm.

In particular, we will focus on the connection between black hole thermodynamics and chemistry in the lower-dimensional gravity regime by analysing rotating and charged BTZ metrics in the (2+1)-D and (1+1)-D limits of Einstein gravity.

GR 6.3 Di 17:45 VMP6 HS A

Constructing highly deformed non-uniform black string solutions — •Michael Kalisch and Marcus Ansorg — Theoretisch-Physikalisches Institut, Friedrich-Schiller-Universität Jena, Germany

We construct numerically static non-uniform black string solutions in five and six dimensions by using pseudo-spectral methods. An appropriately designed adaptation of the methods in regard of the specific behaviour of the field quantities in the vicinity of our numerical boundaries provides us with extremely accurate results, that allows us to get solutions with an unprecedented deformation of the black string horizon. Consequently, we are able to investigate in detail a critical regime within a suitable parameter diagram. In particular, we observe three clearly pronounced turning points in the curves of thermodynamic quantities, resulting in a spiral curve in the black string's phase diagram.

GR 6.4 Di 18:05 VMP6 HS A

Thermodynamics of a rotating black hole in minimal five-dimensional gauged supergravity — •Saskia Grunau and Hendrik Neumann — Carl von Ossietzky Universität Oldenburg

We study the thermodynamics of a general non-extremal rotating black hole in minimal five-dimensional gauged supergravity. Therefore we analyse the entropy-temperature diagram and the free energy. Additionally the thermodynamic stability is considered by calculating the specific heat, the isothermal moment of inertia tensor and the adiabatic compressibility.

GR 6.5 Di 18:25 VMP6 HS A

Analytic solutions of the geodesic equation for Einstein-Maxwell-dilaton-axion black holes — •Kai Flathmann and Saskia Grunau — Institut für Physik, Universität Oldenburg, D-26111 Oldenburg, Germany

In this talk we present the geodesic motion of test particles and light in the Einstein-Maxwell-dilaton-axion spacetime. This family of black hole solutions is characterized by 4 constants: mass, angular momentum, dilaton and axion charge. We only consider black holes with vanishing axion charge. The equations of motion are of elliptic type and their solutions are given in terms of the Weierstraß $\wp$, σ and ζ functions. With the help of parametric diagrams and effective potentials we analyze the geodesic motion and give a list of all possible orbit types.

GR 6.6 Di 18:45 VMP6 HS A

On gravity self-completeness on Anti-de Sitter background — •Sven Köppel[1,2], Antonioa Frassino[1,2], and Piero Nicolini[1,2] — [1]Institut für theoretische Physik, Goethe-Universität Frankfurt am Main, Deutschland — [2]Frankfurt Institute for Advanced Sciences, Frankfurt am Main, Deutschland

Recently Dvali proposed a new interpretation of the concept of a black hole, that turns out to be a condensate of gravitons. We present in this talk a metric model able to capture the properties of the graviton condensate beyond the semiclassical limit. We present also the effects of extra-dimension on the geometry and thermodynamics of such a new metric, as well as, the inclusion of an Anti-de Sitter cosmological term.