GR 16: Black Holes I

Time: Wednesday 14:00–16:00 Location: SPA SR220

GR 16.1 Wed 14:00 SPA SR220

XMM-Newton's impact on Relativistic Astrophysics — •Norbert Schartel — XMM-Newton SOC, ESA, illanueva de la Cañada, Spain

With about 300 refereed papers published each year, XMM-Newton is one of the most successful scientific missions of ESA ever.

Observations of compact objects, where relativistic effects have to be accounted for, play a major role in XMM-Newton's observing program: Neutron stars and Galactic black holes as well as supermassive black holes in the centre of active and non-active galaxies. The main focus of the talk will be the discussion of scientific highlight results based on XMM-Newton observations of compact, relativistic objects during the last years. X-ray observations provide a unique opportunity to study the vicinity of compact objects, i.e. the region where the strong gravitational field acts and allows the determination of black hole spin.

GR 16.2 Wed 14:20 SPA SR220

Sequences of extremal radially excited rotating black holes — Jose Luis Blazquez-Salcedo[1], •Jutta Kunz[2], Francisco Navarro-Lerida[1], and Eugen Radu[2] — [1]Universidad Complutense de Madrid — [2]Universität Oldenburg

In 5-dimensional Einstein-Maxwell-Chern-Simons theory with Chern-Simons coefficient λ the solutions are only known in closed form, when $\lambda = 1$. For $\lambda \neq 1$ the charged rotating black hole solutions are obtained numerically. Beyond $\lambda = 1$ counterrotating black holes appear. Moreover, for $\lambda > 2$ uniqueness is lost. Here the extremal Reissner-Nordström solution is no longer the single extremal solution with vanishing angular momentum. Instead a whole sequence of rotating extremal $J = 0$ solutions arises, which can be labeled by the node number of the magnetic U(1) potential. These global black hole solutions thus represent a sequence of radially excited extremal solutions. They are associated with the same near horizon solution, and their mass converges to the mass of the extremal Reissner-Nordström solution. On the other hand, not all near horizon solutions are also realized as global solutions.

GR 16.3 Wed 14:40 SPA SR220

Balanced black holes with $S^2 \times S^{2k+1}$ horizon topology as higher dimensional counterparts of $d = 5$ black rings — Burkhard Kleihaus[1], Jutta Kunz[1], and •Eugen Radu[2] — [1]Institut für Physik, Universität Oldenburg, Postfach 2503 D-26111 Oldenburg, Germany — [2]Departamento de Fisica da Universidade de Aveiro and I3N, Campus de Santiago, 3810-183 Aveiro, Portugal

We present numerical evidence for the existence of a new type of black hole solutions with a nonspherical event horizon topology in $d > 5$ spacetime dimensions. These asymptotically flat configurations are found for a specific metric Ansatz by directly solving the Einstein equations with suitable boundary conditions. The new black holes are regular on and outside an event horizon of $S^2 \times S^{2k+1}$ horizon topology, being supported against collapse by rotation. Numerical solutions are constructed in a systematic way for $d = 7$. We point out that the basic properties of the new solutions are very similar to those of the $d = 5$ black rings. In particular, one finds two branches of solutions, which branch off from a cusp. Moreover, for a range of the parameters, there are three different solutions with the same global charges –two black holes with $S^2 \times S^{2k+1}$ horizon topology and one Myers-Perry black hole.

GR 16.4 Wed 15:00 SPA SR220

Black hole remnants due to Planck-length deformed QFT — •Alain Dirkes[1], Michael Maziashvili[2], and Zurab Silagadze[3] — [1]Frankfurt Institute for Advanced Studies (FIAS) & Goethe Universität, Frankfurt am Main, Germany — [2]Particle Physics & Cosmology Group, Ilia State University, Tiblisi, Georgia — [3]Budker Institute of Nuclear Physics SB RAS, Novosibirsk State University, Novosibirsk, Russia

It was shown in a number of papers that the gravitational potential calculated by using the propagator, that follows from the minimum-length deformed QFT, implies the existence of black hole remnants of the order of the Planck-mass.

Here we examine the behaviour of the potential that follows from Planck-length deformed QFT, which in general does not entail the concept of the minimum length.

We analyse whether the existence of black holes remnants is intimately related to the concept of the minimum length or not.

The key ideas of the above mentioned investigations are summarized in a preprint on the arXiv: 1309.7427v1 [gr-qc].

We intend to further generalize our analysis to a range of physically viable Non Local Field Theories.

GR 16.5 Wed 15:20 SPA SR220

Dynamical Black Holes in 2+1 Dimensions — •Mario Flory[1] and Ivo Sachs[2] — [1]Max-Planck-Institut für Physik, München — [2]Arnold Sommerfeld Center, Ludwig-Maximilians-Universität München

In this talk, the global structure of a recently discovered simple, exact, non-stationary solution of certain higher curvature theories in 2+1 dimensions will be discussed. We establish the existence of a time-like singularity in the causal structure of the spacetime as well as the presence of time dependent trapping and event horizons, making the spacetime at hand an exactly known dynamical vacuum black hole. We will in particular compare this dynamical black hole to the related stationary BTZ black holes.

GR 16.6 Wed 15:40 SPA SR220

Dynamics of test particles in the five-dimensional Myers-Perry-spacetime — Valeria Diemer[1], Jutta Kunz[1], Claus Lämmerzahl[1,2], and •Stephan Reimers[1] — [1]Carl von Ossietzky Universität Oldenburg — [2]ZARM, Universität Bremen

We present the complete set of analytical solutions of the geodesic equation in the five-dimensional Myers-Perry-spacetime with unequal rotation parameters. The solutions are given in terms of the Weierstrass $\wp$-, ζ- and σ-functions. We visualize the trajectories of test particles and discuss their properties. We show that observables can be presented in a closed form in terms of the periods of the Weierstrass functions.