GR 6: Relativistic astrophysics II

Zeit: Mittwoch 14:00–16:00 Raum: NW-Bau - HS3

GR 6.1 Mi 14:00 NW-Bau - HS3

Accretion disks around compact objects with mass quadrupole — •Claus Lämmerzahl — ZARM, University of Bremen, Am Fallturm, 28359 Bremen

Compact massive objects like rotating neutron stars possess axially symmetric mass multipoles. We describe thick accretion disks in such axially symmetric space-times and discuss the modifications compared to accretion disks around Black Holes.

GR 6.2 Mi 14:20 NW-Bau - HS3

Geometrically thick fluid tori parametrisations — •Pavel Jefremov and Vojtěch Witzany — ZARM, Universität Bremen

In this talk I investigate various new solution for the geometrically thick toroidal perfect fluid configurations orbiting a stationary and axisymmetric black hole. These solutions are constructed by demanding that the velocity field of the orbiting fluid be expressed analytically through the parameter(s) of the resulting configuration. The well-known analytical solutions such as Polish Doughnuts with constant angular momentum and the Fishbone-Moncrief tori are then recovered as special cases of the resulting more general family of solutions.

GR 6.3 Mi 14:40 NW-Bau - HS3

The exact propagation delay in pulsar timing — Arnab Dhani[1,2,3] and •Eva Hackmann[3] — [1]Pennsylvania State University — [2]Indian Institute of Technology Roorkee — [3]ZARM, Universität Bremen

Pulsar timing offers the possibility to test the theory of gravity in the strong field regime. Particularly promising laboratories for such tests are pulsar–black hole binaries. In such a system it is therefore of paramount importance to accurately model the effects of General Relativity. Here we present an exact analytical calculation for the relativistic propagation delay of the signal of a pulsar orbiting a supermassive black hole. We use this result to test the accuracy of the usually employed post–Newtonian approximation methods.

GR 6.4 Mi 15:00 NW-Bau - HS3

Equilibrium of a charged perfect fluid around a Kerr black hole in a dipole magnetic test field: Role of the spin — •Kris Schroven, Audrey Trova, Eva Hackmann, and Claus Lämmerzahl — University of Bremen, Center of Applied Space Technology and Microgravity (ZARM), 28359 Bremen, Germany

Analytical descriptions of accretion discs - such as the thick disc model-can help to deepen the understanding of the physics involved in this structures. Here, we will analytically discuss the structures formed by a charged ideal fluid, surroundling a rotating black hole (BH) with a magnetic dipole test-field. These formed structures are then influenced by the balance between the gravitational and magnetic forces. The test field will be oriented along the spin-axis. Furthermore rigid rotation of the fluid around the BH is assumed. We will focus on how the black hole spin influences the structure and position of the equilibrium configurations of the fluid. We will see, that the black hole spin plays a crucial role in the existence of equilibrium configurations of the fluid along the spin axis.

GR 6.5 Mi 15:20 NW-Bau - HS3

Equilibrium of charged perfect fluid around a Kerr black hole: role of the spin — •Audrey Trova[1], Kris Schroven[1], Jiří Kovář[2], Petr Slaný[2], Vladimir Karas[3], and Eva Hackmann[1] — [1]University of Bremen, Center of Applied Space Technology and Microgravity (ZARM), 28359 Bremen, Germany — [2]Institute of Physics, Faculty of Philosophy and Science, Silesian University in Opava Bezručovo nám. 13, CZ-746 01 Opava, Czech Republic — [3]Astronomical Institute, Academy of Sciences, Boční II, CZ-141 31 Prague, Czech Republic

Studies of equilibrium of toroidal structures of a perfect fluid are important to understand the physics of accretion disks. Here, we are presenting an analytical approach for the equilibrium of charged-perfect fluid surrounding a rotating black hole, embedded in an asymptotically large scale uniform magnetic field. The vertical and radial structure of the torus are influenced by the balance between the gravitational and the magnetic force. Following our previous study of rotating charged test fluid around a non rotating black hole, this time, we show that according to the spin of the black hole the area of existence of such structures change. In this work, we focus our attention on orbiting structures in permanent rigid rotation. We prove, in this rotating case also, the existence of equilibrium configurations in the equatorial plane and on the polar axis such as charged polar clouds. Moreover, we show that the rotation of the black hole has a crucial role in the existence of such structures.

GR 6.6 Mi 15:40 NW-Bau - HS3

Fermi LAT limit on evaporation of individual primordial black holes — •Dmitry Malyshev[1], Christian Johnson[2], Steven Ritz[2], and Stefan Funk[1] — [1]ECAP, Erlangen, Germany — [2]Santa Cruz University, USA

Primordial black holes (PBH) with masses below approximately 10^{15} g are expected to emit gamma rays with energies above a few tens of MeV, which can be detected by the Fermi Large Area Telescope (LAT). Previous searches for PBHs have focused on either short timescale bursts or the contribution of PBHs to the isotropic gamma-ray emission. We show that, in case of individual PBHs, the Fermi LAT is most sensitive to PBHs with temperatures near 16 GeV, which it can detect out to a distance of about 0.03 pc. These PBHs would appear as potentially moving point sources. We develop a new algorithm to detect the proper motion of a gamma-ray PS, and apply it to unassociated PS in the third Fermi-LAT source catalog (3FGL). None of unassociated PS with spectra consistent with PBH evaporation show significant proper motion. The derived 99% confidence limit on PBH evaporation rate in the vicinity of the Earth is similar to the limits obtained with ground-based gamma-ray observatories.