GR 20: Relativistische Astrophysik

Zeit: Freitag 12:30–13:30 Raum: ZHG 002

GR 20.1 Fr 12:30 ZHG 002

Observables for bound orbital motion in axially symmetric space-times — •Eva Hackmann[1] and Claus Lämmerzahl[1,2] — [1]ZARM, Universität Bremen — [2]Institut für Physik, Universität Oldenburg

The periastron shift and the Lense-Thirring effect of bound orbital motion in a general axially symmetric space-time given by Plebański and Demiański are analyzed. We also define a measure for the conicity of the orbit and give analytic expressions for the observables in terms of hyperelliptic integrals and Lauricella's F_D function. For an interpretation of these analytical expressions, we perform a post-Schwarzschild and a post-Newton expansion of these quantities. This clearly shows the influence of the different space-time parameters on the considered observables and allows to characterize Kerr, Taub-NUT, Schwarzschild-de Sitter, or other space-times.

GR 20.2 Fr 12:50 ZHG 002

Analytical timing formula for a pulsar orbiting a Schwarzschild black hole — Eva Hackmann[1], Claus Lämmerzahl[1,2], •Viktoriya Morozova[1,3,4], and Volker Perlick[1] — [1]ZARM, University Bremen, Am Fallturm, 28359 Bremen, Germany — [2]Institute for Physics, University Oldenburg, 26111 Oldenburg, Germany — [3]Institute of Nuclear Physics, Ulughbek, 100214,Tashkent, Uzbekistan — [4]Albert-Einstein-Institute, Golm

The analytical formula describing the arrival of periodic signals coming from a pulsar orbiting a Schwarzschild black hole is presented. The novelty of our approach consists in using general relativistic solutions in terms of Weierstrass elliptic functions for exact description of the pulsar motion as well as light ray propagation in the vicinity of Schwarzschild black hole in application to the pulsar timing problem. From the obtained formula any order of relativistic approximation can be derived.

GR 20.3 Fr 13:10 ZHG 002

On spherical lightlike geodesics in the Kerr spacetime — •Volker Perlick — ZARM, Universität Bremen, 28359 Bremen

It is known that the Kerr spacetime admits spherical lightlike geodesics, i.e., lightlike geodesics that stay on a sphere $r =$ constant in standard Boyer-Lindquist coordinates. In this talk I will present pictures that show the region filled by these spherical lightlike geodesics, for the black-hole case ($a^2 \leq m^2$) and for the naked-singularity case ($a^2 > m^2$), and I will discuss the relevance of this "photon region" for gravitational lensing. In the second part of the talk I will investigate the behaviour of the photon region under perturbations of the Kerr spacetime and I will discuss, thereupon, the question of how to distinguish strongly naked singularities from weakly naked singularities; this distinction was introduced by Shwetketu Virbhadra for spherically-symmetric and static spacetimes and is generalised here.