GR 13: Klassische Allgemeine Relativitätstheorie 1

Zeit: Donnerstag 9:10–10:30   Raum: JUR K

GR 13.1 Do 9:10 JUR K
Analytic solution of the geodesic equations in the Plebański-Demiański spacetimes of generalized Black Holes — Eva Hackmann[2], Valeria Kagramanova[1], Jutta Kunz[1], and •Claus Lämmerzahl[2] — [1]Universität Oldenburg — [2]ZARM, Universität Bremen

The Plebański–Demiański metric represents the complete family of Petrov type D solutions of the Einstein-Maxwell equations in 4 dimensions with an aligned electromagnetic field and non-zero cosmological constant. It includes e.g. Kerr-de Sitter, NUT-de Sitter and Kerr–NUT–de Sitter spacetimes. These spacetimes are characterized by 7 parameters: mass, nut parameter, rotation parameter, electric and magnetic charges, cosmological constant and the acceleration. We show that the separable Hamilton–Jacobi equations in the spacetimes without acceleration are analytically integrable and present the complete sets of analytic solutions of the equation of motion for a charged particle. The solutions are given in terms of the Kleinian sigma functions and are based on the theory of hyperelliptic integrals and functions.

GR 13.2 Do 9:30 JUR K
Discussion of geodesics in Kerr-de Sitter space-time — •Eva Hackmann and Claus Lämmerzahl — ZARM, Universität Bremen

Recently, the geodesic equation in Kerr-de Sitter space-time has been solved analytically (arXiv:0911.1634v1). Using this solution, we discuss chosen geodesics in this space-time. This includes orbits which highlight the influence of the cosmological constant as well as the last stable spherical orbit and the innermost stable circular orbit. In addition, the analytical expressions for the perihelion shift and the Lense-Thirring effect will be discussed and corresponding orbits will be shown.

GR 13.3 Do 9:50 JUR K
Analytical solution of the geodesic equations in the NUT–(de Sitter) spacetime. — •Valeria Kagramanova[1], Jutta Kunz[1], Eva Hackmann[2], and Claus Lämmerzahl[2] — [1]Universität Oldenburg — [2]ZARM, Universität Bremen

We analytically solve the geodesic equations in the NUT–de Sitter spacetime which belongs to the Petrov type D spacetimes of generalized Black Holes and is characterized by the (gravielectric) mass and the gravimagnetic mass. The analytical solution of the geodesic equations, given in terms of Weierstrass elliptic functions (NUT) and hyperelliptic theta and sigma functions (NUT–de Sitter), allows us to systematically study the motion of test particles and to derive analytic expressions for the observables. In particular, we discuss the incomplete geodesics in these spacetimes.

GR 13.4 Do 10:10 JUR K
Analytische Berechnung der Bahnen und deren Observablen in der Kerr-Raumzeit — •Claus Gebhardt, Eva Hackmann und Claus Lämmerzahl — ZARM, Uni Bremen

Die analytische Lösung der Geodätengleichung in der Kerr-Raumzeit lässt sich mit Hilfe elliptischer Funktionen finden. Dieser Formalismus führt weiterhin auf die analytische Darstellung von Observablen in dieser Raumzeit. In unserem Vortrag werden wir die analytische Lösung darlegen und anschließend Phänomene wie die Lichtablenkung, den fly-by von Teilchen, die Periheldrehung sowie den Lense-Thirring-Effekt diskutieren. Außerdem geben wir einen Ausblick auf spezielle Orbits, wie z. B. die innerste stabile Kreisbahn.