GR 10 Gravitationswellen – Quellen

Zeit: Samstag 14:00–16:00 Raum: TU BH262

GR 10.1 Sa 14:00 TU BH262

Stationary Ring–Black Hole Systems — •David Petroff[1] and Marcus Ansorg[2] — [1]Theoretisch-Physikalisches Institut, FSU Jena — [2]Max-Planck-Institut für Gravitationsphysik (AEI), Golm

An axially symmetric, stationary spacetime containing a Black Hole surrounded by a ring of matter is constructed numerically. Because of the extremely high accuracy of the numerical solutions obtained, it is possible to solve for critical configurations and study subtle properties of these solutions that would otherwise be difficult to resolve. After a brief discussion of the numerical methods, these subtleties will be illuminated.

GR 10.2 Sa 14:15 TU BH262

Rotierende Ringe in der allgemeinen Relativitätstheorie — •Horatschek Stefan[1], Marcus Ansorg[2] und Thomas Fischer[3] — [1]Theoretisch-Physikalisches Institut, FSU Jena — [2]Max-Planck-Institut für Gravitationstheorie (AEI), Golm — [3]Institut für Angewandte Mathematik, FSU Jena

In diesem Vortrag werden selbstgravitierende, starr rotierende ideale Flüssigkeitskonfigurationen mit toroidaler Topologie (ohne Zentralkörper) im Rahmen der Einsteinschen Gravitationstheorie diskutiert. Neben polytropen Zustandsgleichungen mit verschiedenen Polytropenindizes wird das ideale vollständig entartete Neutronengas als Materiemodell betrachtet. Wie für die homogenen sogennanten „relativistischen Dyson-Ringe“ erhalten wir für eine vorgegebene maximale innere Energie-Massendichte Konfigurationen mit beliebig großen gravitativen und baryonischen Massen. Darüberhinaus weisen alle untersuchten Klassen toroidaler Flüssigkeitskörper einen kontinuierlichen Übergang zu einem extremen Kerr-black-hole auf.

GR 10.3 Sa 14:30 TU BH262

Kompakte Sterne als Quellen für Gravitationswellen — •Matthias Hanauske — Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Frankfurt am Main

Rotierende, quadrupoldeformierte kompakte Sterne, Kollisionen von kompakten Sternen oder kollabierende kompakte Sterne stellen mögliche Quellen für Gravitationswellen dar. Die meisten der nummerisch erzielten, theoretischen Vorhersagen der emittierten Gravitationswellen solcher Systeme benutzen ein realitätsfremdes Modell der Materie. Wenn man ernsthaft beabsichtigt eine Vorhersage einer möglicherweise in Zukunft detektierten Gravitationswelle zu machen, so sollte man keine einfachen polytropen Zustandsgleichungen bei nummerischen Berechnungen verwenden.

GR 10.4 Sa 14:45 TU BH262

Probing oscillations with spectral methods - Towards a 2D simulation for rapidly rotating neutron stars — •Erich Gaertig — Institut für Astronomie und Astrophysik der Universität Tübingen

In this talk I will give a brief overview about the current status of my work, which is part of the SFB/TR07. The final goal is to solve the linearized Einstein-equations for small perturbations on rotating neutron stars. In a very first step, all disturbances in the metric potentials are neglected which simplifies the problem significantly. As a consequence, only the relativistic hydrodynamic equations have to be considered and no gravitational waves are emitted.

A numerical code has been written that utilizes a highly accurate background model for polytropic equations of state and makes use of spectral methods for spatial differentiation. For time-evolution itself, an explicit Runge-Kutta 4th-order scheme is implemented.

GR 10.5 Sa 15:00 TU BH262

Eigenmodes of axisymmetric neutron stars in relativistic perturbation theory — •Stratos Boutloukos — Universität Tbingen

We perform perturbation theory on rapid-rotating neutron stars by use of the relativistic Cowling approximation and compute their eigenfrequencies. We are able to calculate for the first time the complete spectrum of axissymetric oscillations, including, the important for gravitational-wave detection, r-modes. The frequency window is determined and various eigenfunctions are shown. The results are compared with previous studies.

GR 10.6 Sa 15:15 TU BH262

Constructing ready to use search templates forcompact binaries moving in inspiralling eccentric orbits — •Gopakumar Achamveedu — Theoretisch-Physikalisches Institut,Friedrich-Schiller-University, Max-Wien-Platz 1, 07743 Jena, Germany

I describe a program, currently ongoing in Jena under SFB/TR7, *Gravitationswellenastronomie*, to construct highly accurate search templates for gravitational wave signals emitted by compact binaries moving in inspiralling eccentric orbits. These templates will be required to do astronomy with gravitational wave interferometrs and the square kilometre array.

GR 10.7 Sa 15:30 TU BH262

Post-Newtonian accurate parametric solution to the dynamics of spinning compact binaries in eccentric orbits: The leading order spin-orbit interaction — •Christian Königsdörffer and Achamveedu Gopakumar — Theoretisch-Physikalisches Institut, Friedrich-Schiller-Universität, Max-Wien-Platz 1, 07743 Jena, Germany

We derive Keplerian-type parametrization for the solution of post-Newtonian (PN) accurate conservative dynamics of spinning compact binaries moving in eccentric orbits. The PN accurate dynamics that we consider consists of the third PN accurate conservative orbital dynamics influenced by the leading order spin effects, namely the leading order spin-orbit interactions. The orbital elements of the representation are explicitly given in ADM-type coordinates. Our parametric solution is applicable in the following two distinct cases: (i) the binary consists of equal mass compact objects, having two arbitrary spins, and (ii) the binary consists of compact objects of arbitrary mass, where only one of them is spinning with an arbitrary spin. As an application of our parametrization, we present gravitational wave polarizations, whose amplitudes are restricted to the leading quadrupolar order, suitable to describe gravitational radiation from spinning compact binaries moving in eccentric orbits. The present parametrization will be required to construct ‘ready to use’ reference templates for gravitational waves from spinning compact binaries in inspiralling eccentric orbits. Finally, we note that our parametrization provides the first step in deriving a fully second PN accurate ‘timing formula’, that may be useful for the radio observations of relativistic binary pulsars like J0737-3039.

GR 10.8 Sa 15:45 TU BH262

Do we really need search templates for gravitational waves from compact binaries moving in inspiralling eccentric orbits ? — •Wen Linqing[1], Alessandra Buonanno[2], and Achamveedu Gopakumar[3] — [1]Max Planck Institut für Gravitationsphysik Albert-Einstein-InstitutAm Muehlenberg 1D-14476 Golm Germany — [2]groupe de Gravitation et Cosmologie (GReCO), IAP ,98bis Boulevard ARago, 75014 Paris, France — [3]Theoretisch-Physikalisches Institut, FSU, Max-Wien-Platz 1, 07743 Jena, Germany

Gravitational waves from compact binaries moving in inspiralling eccentric orbits are plausible sources of gravitational radiation for ground-based interferometric detectors, especially for detectors with good sensitivity at low frequency, such as VIRGO and Advanced LIGO. By using as target signals the current, most accurate post-Newtonian waveforms for inspiralling eccentric binaries, we evaluate the loss in signal-to-noise ratio if post-Newtonian templates for compact binaries in quasi-circular orbits were used. We explore how the loss in signal-to-noise depends on initial eccentricity, individual masses and post-Newtonian orders