GR 3: Relativistic Astrophysics

Time: Monday 16:30–17:15 Location: H-HS IX

GR 3.1 Mon 16:30 H-HS IX

Quadrupole distortion of a mass with quadrupole — •Shokoufe Faraji — Bremen

In this paper the space-time of a mass with quadrupole in the presence of an external distribution of matter up to quadrupole is constructed. This space-time explains the exterior of a static and axially symmetric object locally, by its definition. The main goal of this work is to study this space-time and the effects of quadrupole moments via the geodesics motion, especially circular orbits on the equatorial plane. If the effects due to the rotation are negligible, this metric can describe the exterior of any axially symmetric astrophysical model up to quadrupole in a more realistic way in the sense that mostly astrophysical objects, are not isolated.

GR 3.2 Mon 16:45 H-HS IX

Hypermassive hybrid stars within the phase diagram of QCD — •Matthias Hanauske[1,2], Horst Stöcker[1,2], and Luciano Rezzolla[1,2] — [1]Frankfurt Institute for Advanced Studies — [2]Institut für Theoretische Physik, Frankfurt, Germany

Hypermassive hybrid stars (HMHS) are extreme astrophysical objects. In contrast to hypermassive neutron stars (HMNS) these highly differentially rotating objects contain deconfined strange quark matter in their slowly rotating inner region. HMHS and HMNS are formed in a binary neutron star merger event and can survive only a view seconds. During the inspiral, merger and post-merger evolution of the system, gravitational waves (GW) are emitted and the measured GW GW170817 has verified this picture impressively for the late inspiral phase. GWs, emitted from merging neutron star binaries, will be observed frequently within the coming years and it is therefore needful to understand the main characteristics of the underlying merging system in order to predict the expected GW signals. The appearance of a QCD-phase transition in the interior region of the HMHS and its conjunction with the spectral properties of the emitted GW will be addressed during this talk.

GR 3.3 Mon 17:00 H-HS IX

Propagation time delay in Kerr black hole — •Bilel Ben Salem[1,2] and Eva Hackmann[2] — [1]University of Bielefeld — [2]ZARM, University of Bremen

Finding a pulsar closely orbiting the super massive black hole in the galactic center would open the window to a new era of testing General Relativity and other alternative theories of gravity in the strong gravity regime as well as some aspects like the cosmic censorship conjecture and the no-hair theorem. The pulsar timing model which predicts the arrival time of the pulses should include all relativistic effects for a such binary system, in particular the propagation delay of the pulses in the gravitational field of the black hole. In [E. Hackmann, A. Dhan The propagation delay in the timing of a pulsar orbiting a supermassive black hole. General Relativity and Gravitation], an exact analytical formula for the propagation time delay was derived for the Schwarzschild black hole where the pulsar is treated as a test particle due to the extreme mass ratio. We generalize the formula to the Kerr black hole case where we investigate the effect of the frame-dragging on the propagation time delay and compare our result to the post-Newtonian approximation.