GR 13: Numerical Relativity

Time: Thursday 15:15–16:00 Location: H-HS V

GR 13.1 Thu 15:15 H-HS V

Hyperbolic-like Encounters of Binary Black Holes — •Hannes Rüter — Albert-Einstein-Institut, Potsdam

Using fully general-reativistic simulations, we are investigating the encounter of two black holes that are initially on a hyperbolic-like orbit. Due to emission of gravitational waves the black holes can eventually become bound and merge. We are particularly interested in the physics near the region between this capture and escape to inifinity.

GR 13.2 Thu 15:30 H-HS V

Application of numerical relativity to the prediction of thermal noise in interferometric gravitational wave detectors — •Tom Wlodarczyk, Nils Fischer, and Harald Pfeiffer — Albert-Einstein-Institut Potsdam

One factor limiting the sensitivity of interferometric ground-based gravitational wave (GW) detectors such as Advanced LIGO and Virgo is thermal noise originating in the coatings of the mirrors which form the interferometer. An improved understanding of the properties of this thermal noise may lead to a reduction of this noise-source, with an attendant improvement in the GW detector's sensitivity. The fluctuation-dissipation theorem relates thermal noise properties to elastic deformations of the mirrors when certain external forces are applied. The resulting partial differential equations are similar to those that arise in solutions of the Einstein constraint equations for merging black holes, and therefore opens the possibility to utilise modern numerical relativity codes to improve the design of future GW detectors. This talk reports on the status of this project. Our goal is to make statements about thermal noise with regard to the geometry and structure of the mirror coatings and potential beam shapes.

GR 13.3 Thu 15:45 H-HS V

Initial data for neutron-star binaries with the new SpECTRE code — •Nils L. Fischer — Max-Planck-Institut für Gravitationsphysik (Albert-Einstein-Institut) Potsdam, Deutschland

I report on progress on the next-generation pseudo-spectral numerical relativity code SpECTRE, currently in development by the SXS collaboration. It combines nodal discontinuous Galerkin methods and task-based parallelism to achieve more accurate solutions for challenging relativistic astrophysics problems such as core-collapse supernovae and binary neutron star mergers. In particular, I present the first results solving for initial data for neutron-star binaries using our new numerical technology and I demonstrate the code's ability to scale to the capacity of the Minerva supercomputer at AEI Potsdam.