GR 6: Relativistic Astrophysics

Time: Wednesday 11:00–12:30 Location: ZEU/0260

Invited Talk GR 6.1 Wed 11:00 ZEU/0260

Geodesic motion in relativistic astrophysics — •Eva Hackmann — ZARM, Universität Bremen

Astrophysical systems are usually composed of two major bodies. The throughout analysis of relativistic binary systems is therefore very important, but far from trivial due to the nonlinear nature of General Relativity. A limiting case, that can be handled analytically but is still informative for a wide range of systems, is the extreme mass ratio or one-body problem. In this presentation, we will first quickly review analytical solutions methods for this case, and then explore a range of applications in modern astrophysics, for example pulsar timing in extreme mass ratio systems.

Invited Talk GR 6.2 Wed 11:45 ZEU/0260

Modelling the multi-messenger signals of gravitational wave sources — •Stephan Rosswog — Sternwarte Hamburg, Gojenbergsweg 112, 21029 Hamburg

Compact binary systems that contain at least one neutron star are exiting sources of gravitational waves. Apart from relativistic gravity, their dynamics during a merger is governed by the microphysics of the neutron stars such as the nuclear matter equation of state or various neutrino processes. Observations of such mergers via gravitational and electromagnetic waves (and, ideally, also neutrinos) can provide many complementary facettes of the same event which can break degeneracies in the interpretation of observations.

While such multi-messenger approaches carry an enormous discovery potential, they come at the price of having to model very different physical processes (e.g. strong field gravity, nuclear matter, atomic opacities and radiative transfer) and very different length and time scales. These requirements also place high demands on the simulation methodology.

In my talk, I will review the physical and numerical challenges of such simulations, discuss a novel approach for relativistic hydrodynamics and show some first applications.