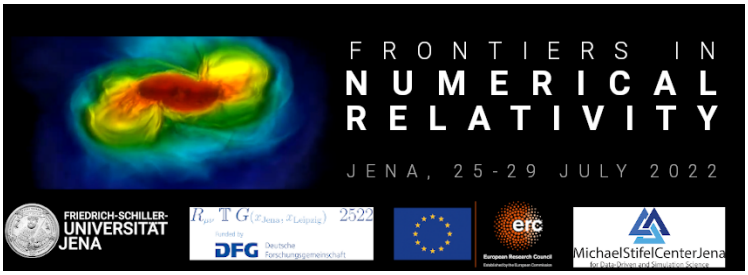

Contribution ID: **56** Type: **not specified**

FUKA: A public code for initial data of unequal-mass, spinning compact-object binaries

Wednesday, 27 July 2022 12:15 (15 minutes)

The construction of constraint-satisfying initial data is an essential element for the numerical exploration of the dynamics of compact-object binaries. While several codes have been developed over the years to compute generic quasi-equilibrium configurations of binaries comprising either two black holes, or two neutron stars, or a black hole and a neutron star, these codes are often not publicly available or they provide only a limited capability in terms of mass ratios and spins of the components in the binary. We here present a new open-source collection of spectral elliptic solvers that are capable of exploring the major parameter space of binary black holes (BBHs), binary neutron stars (BNSs), and mixed binaries of black holes and neutron stars (BHNSs). Particularly important is the ability of the spectral-solver library to handle neutron stars that are either irrotational or with an intrinsic spin angular momentum that is parallel to the orbital one. By supporting both analytic and tabulated equations of state at zero or finite temperature, the new infrastructure is particularly geared towards allowing for the construction of BHNS and BNS binaries. For the latter, we show that the new solvers are able to reach the most extreme corners in the physically plausible space of parameters, including extreme mass ratios and spin asymmetries, thus representing the most extreme BNS computed to date. Through a systematic series of examples, we demonstrate that the solvers are able to construct quasi-equilibrium and eccentricity-reduced initial data for BBHs, BNSs, and BHNSs, achieving spectral convergence in all cases. Furthermore, using such initial data, we have carried out evolutions of these systems from the inspiral to after the merger, obtaining evolutions with eccentricities 10−4−10−3, and accurate gravitational waveforms.

Presenter: TOOTLE, Samuel (Goethe University)

Session Classification: Short talks