GR 22: Numerical Relativity I

Time: Thursday 15:45–16:05 Location: SPA SR220

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Initial data for eccentric neutron star binaries — •Niclas Moldenhauer[1], Charalampos Markakis[1], Nathan Johnson-McDaniel[1], Wolfgang Tichy[2], and Bernd Brügmann[1] — [1]Friedrich-Schiller Universität Jena, 07743 Jena, Deutschland — [2]Florida Atlantic University, Boca Raton, FL 33431 USA

Various groups have been recently evolving neutron-star binaries on eccentric orbits, but either in Newtonian gravity or with constraint violating initial data. On circular orbits, which are stationary in a rotating frame, helical symmetry can be exploited for constructing equilibrium solutions. However, due to lack of helical symmetry, no such method exists for eccentric orbits. Thus, the numerical relativity community has often resorted to unsolved initial data based on superimposed spherical stars. Because such configurations lack tidal deformation and are not stationary in the correct frame, they give rise to unphysically large oscillations in the subsequent evolution. We consider configurations which are approximately stationary in physically relevant frame. We utilize the resulting approximate first integral of the Euler equation in a self-consistent iteration of the Einstein constraints in the extended conformal thin-sandwich approach, to construct initial data for eccentric binaries. We compare the constraint violations and stellar oscillations in simulations based on various data sets, and find that simulations based on the new data compare favorably to earlier ones in the eccentric case.