GR 15: Numerical Relativity

Zeit: Donnerstag 17:45–19:05 Raum: VMP6 HS C

GR 15.1 Do 17:45 VMP6 HS C

Binary Neutron Stars with Generic Spin and Mass ratio — •Tim Dietrich[1,2], Niclas Moldenhauer[2], Nathan Johnson-McDaniel[3], Sebastiano Bernuzzi[4,5], Charalampos Markakis[6], Bernd Brügmann[2], and Wolfgang Tichy[7] — [1]Max-Planck-Institut for Gravitational Physics, Albert-Einstein-Institut, D-14476 Golm, Germany — [2]Theoretical Physics Institute, University of Jena, 07743 Jena, Germany — [3]International Centre for Theoretical Sciences, Tata Institute of Fundamental Research, Bengaluru 560012, India — [4]DiFeST, University of Parma, and INFN Parma, I-43124 Parma, Italy — [5]Theoretical Astrophysics, California Institute of Technology, 1200 E California Blvd, Pasadena, California 91125, USA — [6]Mathematical Sciences, University of Southampton, Southampton SO17 1BJ, United Kingdom — [7]Department of Physics, Florida Atlantic University, Boca Raton, FL 33431 USA

Binary neutron star mergers are associated with a variety of observable phenomena in the gravitational and electromagnetic spectra. We investigate such systems in the last milliseconds before and after their merger with full 3D numerical simulations. We focus on previously inaccessible regions of the binary neutron star parameter space and discuss as exemplary cases results for the highest mass ratio simulation in full general relativity and the first precessing binary neutron star merger. We find that both setups show interesting new physics, e.g, mass transfer during the inspiral or precession induced oscillations in subdominant modes of the gravitational wave signal.

GR 15.2 Do 18:05 VMP6 HS C

Discontinous Galerkin methods in dynamical neutron star simulations — •Marcus Bugner, David Hilditch, Hannes Rüter, and Bernd Brügmann — Theoretical Physics Institute, University of Jena, 07743 Jena, Germany

After the successful application of Discontinous Galerkin (DG) methods to a single isolated 3D neutron star in the Cowling approximation, we present further extensions of the method. In order to exploit more general physical setups, we added the full support of DG on 3D curvilinear grids, as well as the inclusion of system symmetries. Having this hybrid pseudo-spectral + DG tool at hand, we target the fully relativistic simulation of more complex neutron star systems.

GR 15.3 Do 18:25 VMP6 HS C

Novel Efficient ADER-DG Scheme for General Relativistic Hydrodynamics — •Matthias Pilz[1], Marcus Bugner[1], Tim Dietrich[1,2], and Bernd Brügmann[1] — [1]Theoretisch-Physikalisches Institut, Jena — [2]Albert-Einstein-Institut, Potsdam-Golm

We study a discontinuous Galerkin (DG) finite element method applying an a posteriori finite volume subcell limiter technique for solving the equations of general relativistic hydrodynamics. A key part of the algorithm is the calculation of a space-time predictor solution, which enables us to obtain a high order approximation of the numerical fluxes in the one-step DG scheme. A novel alternative to the existing iterative procedure using an element-local continuous extension of Runge-Kutta methods is proposed. We aim at simulating the TOV star to show convergence and efficiency of our implementation.

GR 15.4 Do 18:45 VMP6 HS C

Simulations for the critical collapse of the scalar field — •Hannes Rüter and Bernd Brügmann — Theoretical Physics Institute, University of Jena, 07743 Jena, Germany

We present simulations of a massless salar field obtained from our pseudo-spectral evolution code, BAMPS. In particular we are looking for critical phenomena of the scalar fields gravitational collapse. To study the features in non-spherically symmetric collapses, we look into evolutions of perturbations of spherically symmetric initial data.