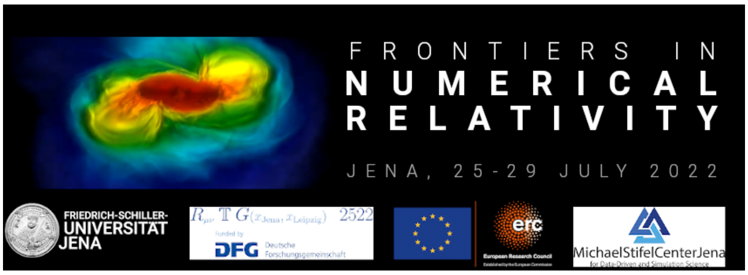

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Numerical relativity and the propagation of gravitational waves through matter

Wednesday, 27 July 2022 09:00 (15 minutes)

Authors: Nigel T. Bishop, Monos Naidoo, and Petrus J. van der Walt. Using linearized perturbations within the Bondi-Sachs formalism, we have considered the problem of a gravitational wave (GW) source surrounded by a spherical dust shell. It was shown that the shell causes the GWs to be modified both in magnitude and phase; and that if the shell is viscous, then the shear induced in the velocity field results in an energy transfer so damping the magnitude of the GWs. Both effects can be significant if the shell radius r is much smaller than the GW wavelength λ, and there are astrophysical scenarios for which the modification to the GW signal is large enough to be measurable. These scenarios include core collapse supernovae (CCSNe), quasinormal mode emission from the remnant of a binary neutron star (BNS) merger, and primordial GWs. In particular, there are feasible values of the CCSNe parameters for which viscous damping of the GW signal would be almost complete. In numerical relativity, an evolution of the full Einstein and matter field equations with GW extraction far from the source will properly include all effects described above. However, in situations such as CCSNe and BNS the complexity of the matter physics may necessitate an approximate treatment of the gravitational field or of the GW extraction. Results obtained in these cases may need to be corrected. The presentation builds on our previous work: 1. N.T. Bishop, M. Naidoo, and P.J. van der Walt (2020), Gen. Rel. Grav. 52:92, https://doi.org/10.1007/s10714-020-02740-9 arXiv:1912.08289 2. M. Naidoo, N.T. Bishop, and P.J. van der Walt (2021), Gen. Rel. Grav. 53:97, https://doi.org/10.1007/s10714-021-02841-z arXiv:2102.00060

Presenter: Prof. BISHOP, Nigel (Rhodes University)

Session Classification: Short talks