Contribution ID : **17** Type : **not specified**

Recovery schemes in numerical GR MHD simulation of the post-merger system with a composition-dependent equation of state

Tuesday, 20 September 2022 14:00 (30)

The code HARM_COOL, a conservative scheme for relativistic magnetohydrodynamics, is being developed in our group and works with a tabulated equation of state of dense matter. This EOS can be chosen and used during dynamical simulation, instead of the simple ideal gas one. In this case, the inversion scheme between the conserved and primitive variables is not a trivial task. In principle, the code needs to solve numerically five coupled non-linear equations at every time-step. The 5-D recovery schemes were originally implemented in HARM and worked accurately for a simple polytropic EOS which has an analytic form. Our current simulations support the composition-dependent EOS, formulated in terms of rest-mass density, temperature and electron fraction. I will discuss and compare several recovery schemes that have been included in our code. I will present and discuss their convergence tests. I will also show some preliminary results of a numerical simulation, addressed to the post-merger system formed after the coalescence of binary neutron stars.

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