Numerical Relativity 2022-2023

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Homework 3
(May 15 2023)

1 Sod Shock Tube Problem [max 2 pages]

Use the Einstein Toolkit to solve the Sod Riemann problem using three different resolutions. Compare with the exact solution (at least for the rest-mass density ρ) and discuss your results.

2 TOV Evolution [max 2 pages]

Use the Einstein Toolkit to study the evolution of the maximum of the rest-mass density ρ of a stable TOV solution. You can do one of the following studies:

1. use 3 different resolutions;
2. introduce a perturbation in pressure and then evolve the system with 3 different resolutions;
3. change the grid setup (domain size and/or number of refinement levels).

In all cases discuss your results, focusing in particular on the evolution of the maximum of the rest-mass density.

Figures do not count toward the maximum number of page limit. Use an A4 page format and a font size of at least 11.

Note: in order to get admitted to the oral exam you are requested to submit the answers to all these questions as a single pdf document via email at least two weeks before the oral exam. Include the parameter files used to solve the exercises at the end of the pdf document.