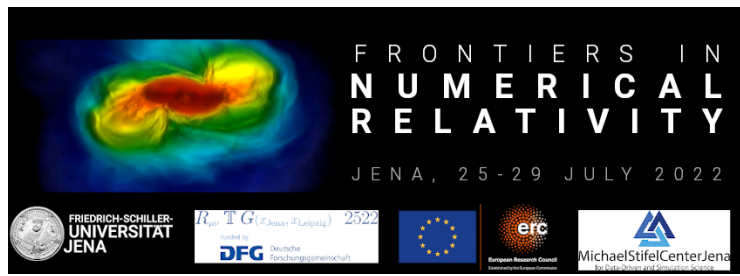


Frontiers in Numerical Relativity 2022 (FNR2022)



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‘GR-Athena++’: puncture evolutions on vertex-centered oct-tree AMR

Wednesday, 27 July 2022 17:15 (15 minutes)

GR-Athena++ is a general-relativistic, high-order, vertex-centered solver that extends the oct-tree, adaptive mesh refinement capabilities of the astrophysical (radiation) magnetohydrodynamics code Athena++. To simulate dynamical spacetimes GR-Athena++ uses the Z4c evolution scheme of numerical relativity coupled to the moving puncture gauge. Stable and accurate binary black hole merger evolutions are demonstrated in convergence testing, cross-code validation, and verification against state-of-the-art effective-one-body waveforms. GR-Athena++ leverages the task-based parallelism paradigm of Athena++ to achieve excellent scalability. Strong scaling efficiencies above 95% for up to 1.2×10^4 CPUs and excellent weak scaling up to 10^5 CPUs in a production binary black hole setup with adaptive mesh refinement are measured. GR-Athena++ thus allows for the robust simulation of compact binary coalescences and offers a viable path towards numerical relativity at exascale.

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Session Classification: Short talks