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(virtual) AsterX: a new open-source GPU-accelerated GRMHD code for dynamical spacetimes

Tuesday 10 June 2025 11:30 (1 hour)

With the ongoing transition toward exascale computing to tackle a range of open questions via numerical simulations, the development of GPU-optimized codes has become essential. In this talk, I will highlight the key features of AsterX, a novel open-source, modular, GPU-accelerated general relativistic magnetohydrodynamic (GRMHD) code for fully dynamical spacetimes in 3D Cartesian coordinates. Built for exascale applications, AsterX integrates with CarpetX, the new driver for the Einstein Toolkit, leveraging AMReX for block-structured adaptive mesh refinement (AMR). The code employs the flux-conservative Valencia formulation for GRMHD, and uses high-resolution shock capturing schemes to ensure accurate hydrodynamic modeling. Alongside discussions on the ongoing code development, I will also present the results of comprehensive 1D, 2D, and 3D GRMHD tests conducted on OLCF's Frontier supercomputer, highlighting AsterX's performance gains through subcycling in time and demonstrating its scaling efficiency across thousands of nodes.

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