2025 North American Einstein Toolkit Workshop



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(virtual) Dendro-GR: Scalable wavelet-based AMR for numerical relativity

Friday 13 June 2025 09:00 (1 hour)

Simulations to calculate a single gravitational waveform (GW) can take several weeks. Yet, thousands of such simulations are needed to detect and interpret gravitational waves. Future detectors will require even more accurate waveforms than those currently used. Here, we discuss the Dendro-GR framework, a large-scale, wavelet-driven octree-based adaptive mesh refinement with support for multi-GPU acceleration with performance analysis and benchmarking. We achieve 800 GFlops/s on a single NVIDIA A100 GPU with an overall 2.5x speedup over a two-socket, 128-core AMD EPYC 7763 CPU node with an equivalent CPU implementation. We present detailed performance analyses, parallel scalability results, and accuracy assessments for GWs computed for mass ratios q=1,2,4. We also present strong scalability up to 16 A100s and weak scaling up to 229,376 x86 cores on the Texas Advanced Computing Center's Frontera system.

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