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First Results from Spritz: A GRMHD Code for Binary Neutron Star Mergers with Microphysical Equation of State

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We present first results from Spritz, a general-relativistic magnetohydrodynamics (GRMHD) code developed for high-precision simulations of binary neutron star (BNS) mergers using nuclear equations of state. Spritz is designed with a focus on robustness and accuracy, incorporating high-order shock-capturing schemes and support for tabulated equations of state, allowing for the inclusion of neutrino radiation. The code is built on the Einstein Toolkit infrastructure, which provides adaptive mesh refinement (AMR) and optimized parallel performance for large-scale simulations.

In this study, we assess the accuracy of Spritz in evolving both magnetized and non-magnetized equal-mass BNS systems with realistic microphysical input. The simulations reliably capture the inspiral, merger, and early post-merger phases, producing consistent gravitational waveforms and detailed remnant structures.

These initial results demonstrate the code's capability as a foundation for more comprehensive studies. We conclude by outlining planned investigations, including ejecta characterization and the conditions for the formation of relativistic jets—key to understanding high-energy transients such as short gamma-ray bursts and kilonovae.

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