Black Holes, Neutron Stars, and Gravitational Waves @ Black Sea



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binary black hole grmhd with einstein toolkit

This paper presents a comprehensive study of binary black hole systems using general relativistic magnetohydrodynamics (GRMHD) simulations within the Einstein Toolkit framework. We investigate the complex interactions and accretion dynamics of merging black holes, highlighting the role of magnetic fields in shaping the gravitational wave signals and electromagnetic counterparts associated with these events. Our analysis focuses on the evolution of binary black holes from inspiral to merger, employing advanced numerical techniques to capture the intricate physics involved.

Key Contributions:

GRMHD Framework: We utilize the Einstein Toolkit to implement GRMHD simulations, allowing for a detailed examination of the magnetized plasma surrounding the black holes and its influence on the dynamics of the system.

Magnetic Field Effects: The study emphasizes how magnetic fields can alter the accretion processes and the resulting gravitational waveforms, providing a deeper understanding of the electromagnetic signals that accompany black hole mergers.

Comparative Analysis: We compare our simulation results with observational data from gravitational wave detectors, aiming to identify signatures that could indicate the presence of magnetic fields in binary black hole systems.

Implications for Astrophysics: The findings have significant implications for the understanding of black hole formation, the role of magnetic fields in astrophysical processes, and the interpretation of multi-messenger astronomy.

Future Work: We outline potential avenues for future research, including the exploration of different initial conditions and the impact of varying magnetic field strengths on the merger dynamics and associated emissions.

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