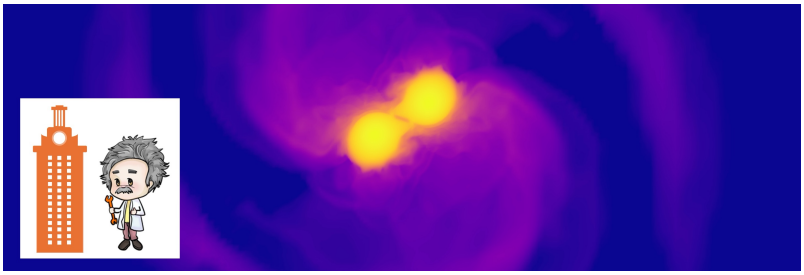

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GRHayL —An Open-Source, Modular, and Extensible Library for GRMHD Simulations

Tuesday 10 June 2025 16:30 (1 hour)

The advent of gravitational-wave (GW) astronomy has revolutionized our understanding of the universe and expanded the frontiers of multi-messenger astrophysics. Accurately interpreting these signals, particularly from phenomena such as binary neutron star mergers, requires detailed numerical simulations that solve the coupled Einstein and general relativistic magnetohydrodynamics (GRMHD) equations. These simulations must incorporate complex physics, including state-of-the-art nuclear equations of state, magnetic fields, and neutrino transport, to capture the interplay between strong gravity, dense matter, and radiation.

However, developing and maintaining comprehensive GRMHD codes is a formidable task, demanding significant computational and software engineering effort. In this talk, I will introduce GRHayL —a new, open-source, infrastructure-agnostic library designed to address these challenges. GRHayL delivers modular, extensible implementations of core GRMHD algorithms, optimized for modern heterogeneous architectures with GPU-friendly kernels. By providing a flexible and efficient foundation, GRHayL aims to accelerate the development of next-generation GRMHD codes, reduce computational costs, and facilitate broader access to cutting-edge simulation capabilities within the astrophysics community.

Presenter: WERNECK, Leonardo (University of Idaho)