



Department of Physics and Astronomy
SPRING 2026 Colloquium Series

“Analysis of Relativistic Jets in Numerical Simulations”

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Sac State Physics Major Senior Project Talk

Relativistic jets launched by accreting black holes are some of the most energetic phenomena in the universe, but the physical mechanism behind their structure, acceleration, and prompt emissions remain only partially understood. Understanding jet collimation, magnetization, and energy extraction is crucial for interpreting the observations of gamma ray bursts, which can allow us to see billions of years in the past. GRBs are one of the only methods available to probe the earliest stages of the universe. We analyzed relativistic jets emitted by black holes in numerical simulations. We use a publicly available code called HARMPI to simulate the initial conditions of these astrophysical jets. We analyzed these jets by extracting their physical quantities, such as density, magnetization, and Lorentz factor. Numerical simulation of the GRB is far too computationally expensive, so we extrapolate the conditions that might be present during the prompt emission. We also used H-AMR to further understand the physical properties of relativistic jets. Our results show the jet structure, believed to be the reason jets are visible to off axis observers. Comparisons between HARMPI and H-ARM codes suggest that the higher resolution GPU code provides improved characterization of the jet structure.

Thursday, May 14, 2026

4:00 - 5:20PM

MND1015

Open & Free to all students, faculty and public