DEPARTMENT OF
PHYSICS &
ASTRONOMY

Fall 2026 Colloquium



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3:30 - 4:30 p.m. | Tuesday, November 10
Science Building 234

What is the origin of stellar-mass black holes and neutron stars? Explosions, progenitors, and binaries

The most compact objects in the Universe form in core-collapse supernovae (CCSNe) marking the death of massive stars. After decades of efforts, a theoretical consensus on the explosion mechanism is emerging: the gravitational potential released by the collapse of the core produces neutrinos which can drive convection behind the CCSN shock. Aided by asymmetries, neutrino-driven convection can produce successful (albeit possibly weak) explosions. Unfortunately, this mechanism is extremely sensitive to the detailed structure of the star at the onset of collapse: the progenitor evolution determines the initial conditions for the collapse and explosion. Maybe even more importantly, astrophysically, CCSN progenitors evolve in interacting binary systems, which can and do modify the interior structure of the stars in ways that can impact the explosion and the remnants. However, the theoretical consensus on the explosion mechanism rests entirely on numerical simulations of single massive stars evolved with closed-source tools. I will discuss the binary interaction physics relevant to CCSNe, and how the community is addressing the computational bottlenecks of late core burning presently limiting the progenitors used so far to single stars. Exploring a more realistic landscape of interacting binaries is necessary to capitalize on the theoretical consensus and produce predictive models of the compact object masses, highly needed to interpret already available datasets (from gravitational-wave mergers, Gaia astrometry) and upcoming (Roman microlensing).

Refreshments at 3 p.m. | SC 103