Title: Turbulent Frontiers in Massive Stellar Death

Abstract:
Core-collapse supernovae are the luminous explosions that herald the death of massive stars. Neutron stars, pulsars, magnetars, and black holes are all born in these explosions. Supernovae are the drivers of galactic chemical evolution, being responsible for the synthesis of most of the heavy elements throughout the universe. Additionally, a Galactic supernova should be detectable by neutrino and gravitational wave detectors, opening entirely new windows on the observable universe. Despite the importance of CCSNe to our understanding of many aspects of astrophysics, the mechanism that reverses stellar core collapse and drives these explosions is not fully understood. I will discuss the revolution underway in supernova theory made possible by high-fidelity 3D simulations. In particular, I will focus on my work revealing the paradigm-shifting importance of turbulence in aiding neutrino-driven supernova explosions, and how this turbulence is influenced by realistic 3D progenitor structure as well as magnetic fields. These new developments at the frontier of core-collapse supernova theory may lead to a solution for the long-standing problem of how massive stars explode.