Z402a Supernova neutrinos and multi-messenger strategies

Shunsaku Horiuchi (Virginia Tech)

Neutrinos open new windows to unraveling the mysteries of some of the most violent astrophysical phenomena in the Universe, from the mechanism of supernovae to the origins of cosmic rays. Current and upcoming neutrino detectors are well positioned to realize the promise of neutrino astronomy. This talk will focus on the particular case of core collapse of massive stars and their subsequent supernovae. These explosive transients are ubiquitous, yet timely information on how the core of a massive star collapses is lost when photon messengers are initially obscured by several solar masses of opaque stellar plasma. Consequently, neutrinos offer a unique opportunity to reveal the physical conditions deep in the interiors of core-collapse supernovae in realtime. I will summarize the current theoretical understanding of the supernova explosion mechanism, explore the landscape of neutrino emission predictions, and discuss the importance of neutrinos in the context of multi-messenger astronomy including photons and gravitational waves. In particular, I will focus on recent developments in multi-dimensional simulations of core collapse and multi-progenitor studies, which have allowed multi-messenger signals to be studied across a broad range of realistic systems.