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Studying the sensitivities of multi-messenger signals from populations of core-collapse supernovae

Tuesday, 20 November 2018 • 3:30 pm

MSI Conference Room • 3550 University

We have developed a new method for artificially driving core-collapse supernova explosions in 1D simulations. Turbulence is important for understanding the CCSN explosion mechanism, since turbulence may add a >20% correction to the total pressure behind the shock and thus aid in the explosion. Including turbulence results in successful explosions in spherical symmetry without altering the neutrino luminosities or interactions, as is commonly done to produce explosions in spherical symmetry. This better replicates the physical explosion mechanism and more reliably produces the thermodynamics and composition, which is vital for accurately predicting the nucleosynthesis that occurs in the supernova environment. We have applied this model to explore the multi-messenger observable signals - light curves, neutrino emission, and GW emission - for the landscape of supernova progenitors from 9 - 120 $M_\odot$. We have explored correlations between the underlying stellar structure and physics of the CCSNe mechanism with observable quantities..