MULTIDIMENSIONAL SIMULATIONS OF CORE-COLLAPSE SUPERNOVAE AND THE IMPLICATIONS FOR NUCLEOSYNTHESIS

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Core-collapse supernovae (CCSNe), the culmination of massive stellar evolution, are the principle actors in the story of our elemental origins. Our developing paradigm for the initiation of a CCSN reveals a supernova shock that stalls for hundreds of milliseconds before reviving. Though brought back to life by neutrino heating, the development of the supernova is inextricably linked to three-dimensional fluid flows, with large scale hydrodynamic instabilities allowing successful explosions that spherical symmetry would prevent. Unfortunately, our understanding of the nucleosynthesis that occurs in these explosions, and their impact on galactic chemical evolution, is often based on spherically symmetric simulations with parameterized explosions, ignoring much that we have learned about the central engine of these supernovae over the past two decades. I will present recent results from two-dimensional CCSN simulations using our CHIMERA code[1], as well as ongoing three-dimensional simulations, and discuss how the multidimensional character of the explosions directly impacts the nucleosynthesis and other observables of core-collapse supernovae.

[1] S. W. Bruenn et al., ApJL 767, L6 (2013)