APR17-2016-020162

Abstract for an Invited Paper
for the APR17 Meeting of
the American Physical Society

Modeling Core Collapse Supernovae

ANTHONY MEZZACAPPA, Department of Physics and Astronomy, University of Tennessee, Knoxville

Core collapse supernovae, or the death throes of massive stars, are general relativistic, neutrino-magneto-hydrodynamic events. The core collapse supernova mechanism is still not in hand, though key components have been illuminated, and the potential for multiple mechanisms for different progenitors exists. Core collapse supernovae are the single most important source of elements in the Universe, and serve other critical roles in galactic chemical and thermal evolution, the birth of neutron stars, pulsars, and stellar mass black holes, the production of a subclass of gamma-ray bursts, and as potential cosmic laboratories for fundamental nuclear and particle physics. Given this, the so called "supernova problem" is one of the most important unsolved problems in astrophysics. It has been fifty years since the first numerical simulations of core collapse supernovae were performed. Progress in the past decade, and especially within the past five years, has been exponential, yet much work remains. Spherically symmetric simulations over nearly four decades laid the foundation for this progress. Two-dimensional modeling that assumes axial symmetry is maturing. And three-dimensional modeling, while in its infancy, has begun in earnest. I will present some of the recent work from the "Oak Ridge" group, and will discuss this work in the context of the broader work by other researchers in the field. I will then point to future requirements and challenges. Connections with other experimental, observational, and theoretical efforts will be discussed, as well.