

Tuguldur Sukhbold – Astronomy Seminar 4/11/2018

Title - "Islands of explodability" in a sea of implosions

Abstract - How a massive star ends its life depends upon how that life has been lived - the rotation, mass and composition it was born with, mass loss and exchange, and the complex convective and nuclear burning episodes it experienced along the way. In the end, the presupernova stellar core has a density structure that can be characterized by its “compactness” - essentially how fast the density declines outside the iron core. The likelihood that a massive star explodes, by any means, is sensitive to this compactness. It turns out, perhaps surprisingly, that the compactness is not a monotonic function of the star’s birth mass, and, in some mass regions, whether the star explodes or not is almost random. In this talk, I will review the underlying stellar physics for the development of presupernova core compactness, and will present 1D explosion results from a fine grid of masses by assuming neutrino-powered mechanism. Unlike all of the prior explorations, in this survey we give up the “luxury” of exploding a star in any way we want, instead, the explosion energies, nucleosynthesis yields, light curves and remnant masses are all uniquely tied to the progenitor core structure. While some challenges remain especially in the context of nucleosynthesis, overall the results are in good agreement with wide range of observational constraints.