ASTROPHYSICS SEMINAR SERIES

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12:30 pm - Rm 184 NSH

Islands of explodability in a sea of implosions

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 recent results on surveying the final fates of massive stars assuming neutrino-powered mechanism. Unlike the prior explorations, in this survey we gave 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 final progenitor core structure. The results are in good agreement with wide range of observational constraints, including solar abundances, compact object mass distributions, light curves and other diagnostics of core-collapse supernova explosions.

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