PUSHing Core-Collapse Supernovae to Explosions in Spherical Symmetry: Nucleosynthesis Yields

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Core-collapse supernovae (CCSNe) are one of the most important sites of element synthesis in the universe. Not only do they drive the chemical evolution of galaxies, the nucleosynthesis yields of CCSNe are also imprinted on some of the oldest stars. However, our ability to predict nucleosynthesis yields is limited by the still unresolved question of the CCSN explosion mechanism. The PUSH method is a parametrized spherically symmetric explosion method that can reproduce many features of CCSNe for a wide range of pre-explosion models [1, 2]. This method also follows the evolution of the proto-neutron star and the electron fraction of the ejecta - features that are crucial for nucleosynthesis calculations. Here, we will discuss the nucleosynthesis yields of all successful explosion models from Ebinger et al. (2017). This includes two sets of pre-explosion models at solar metallicity, with combined masses between 10.8 and 120 $M_{\odot}$. We compare the predicted ^{56}Ni ejecta to observationally derived values for normal CCSNe. We highlight broad trends that appear as a function of pre-explosion model properties and explosion properties. We also predict iron-group yields that are in agreement with derived abundances for metal-poor star HD 84937. We provide detailed and complete isotopic yields for all our models [3, 4]. These yields will be extremely useful for modeling galactic chemical evolution to gain further insight into the nuclear history of our universe.

References

[1] A. Perego, M. Hempel, C. Fröhlich *et al.*, ApJ, **806, 275**, (2015).

[2] K. Ebinger, S. Curtis, C. Fröhlich *et al.*, (Submitted to ApJ, under revision).

[3] S. Curtis, K. Ebinger, C. Fröhlich *et al.*, (Submitted to ApJ, under revision).

[4] http://astro.physics.ncsu.edu/∼cfrohli/