Multi-d core collapse supernovae and nucleosynthesis

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The explosion of massive stars as core-collapse supernovae represents one of the outstanding problems in modern astrophysics. Core-collapse supernovae figure prominently in the chemical evolution of galaxies as the dominant producers of elements between oxygen and the iron group, and they play an important role in the production of elements heavier than Fe. They represent a key ingredient in understanding the history of chemical enrichment of the Universe.
We present in this work a detailed analysis of nucleosynthesis calculations of a 15 Msun neutrino-driven supernova explosions in 3D (explosions, approximative neutrino treatment, progenitors are presented by Wongwathanarat et al. 2017). Nucleosynthesis calculations are performed in a post-process using tracer particles method (TONiC code, Travaglio et al. 2011). The nucleosynthesis network used is based on 1500 isotopes, and for the first time about 500.000 tracer particles cover the star up to the explosive C-burning shell. We also discuss a the consequences for using different nuclear reaction networks (Basel 2009 as well as JINA 2012). The nuclear processes included are electron captures, neutron captures, alpha captures and photodisintegrations.
A detailed comparison of the nucleosynthesis calculation between 3D and 1D models (where also the 1D model includes neutrino-driven explosion) will be presented providing interesting information on
1. overproduction of neutron-rich material
2. elemental and isotopic abundances information of elements like Mn, Cr, Sc, Cu Zn to better understand the observations in metal-poor stars in our Galaxy as well as in external objects
3. radiogenic material
4. potential source of p-process nuclei.