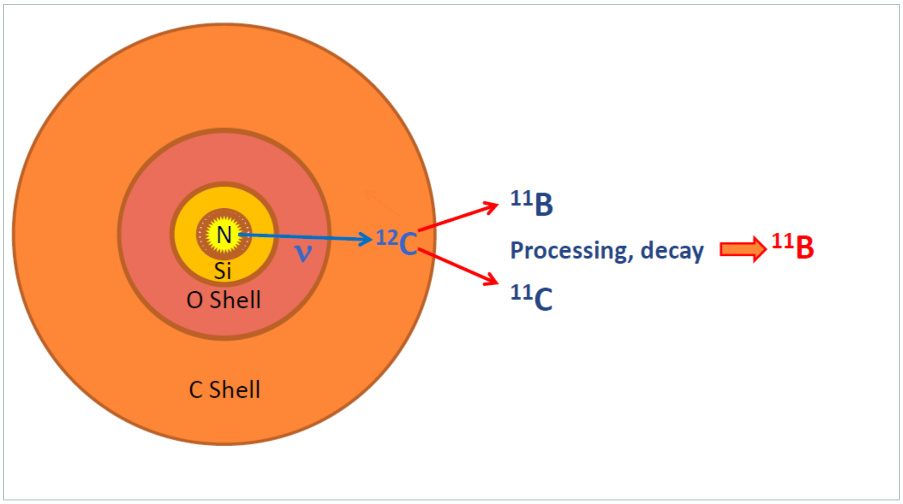
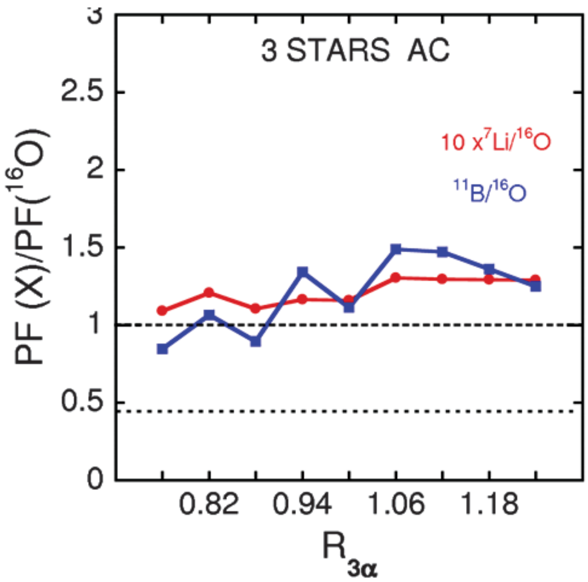
11B Made in the Neutrino Process Constrains the Neutrino Spectra from Core Collapse Supernovae



Schematic of the neutrino process. The proto neutron star formed in a core collapse supernova emits neutrinos which dissociate 12C leading to 11C and 11B. After processing in the hot environment and the decay of 11C, some 11B will be returned to the interstellar medium.



Production of 11B by the neutrino process for various values of the triple alpha rate. A production factor(PF) of 0.42 means that the solar system abundance of 11B is reproduced.

We have used KEPLER calculations to estimate the production of the light elements 7Li, 11B, and 19F in supernova explosions. We find that they are produced in the neutrino process outlined above. The results are shown as production factors (PF), the ratios of the SN production to the observed abundance. Straightforward arguments indicate that about 42% of 11B is made by the neutrino process, the rest by the galactic cosmic rays (GCR). Thus a production factor of 0.42 would, in combination with the GCR, reproduce the observed abundance.

We see that the neutrino process production of 11B is a factor of 2-3 larger than observed. This may mean that SN produce fewer neutrinos than we have assumed (3 x 1053 ergs) or that the neutrinos are less energetic than assumed (4-6 MeV Fermi-Dirac distributions. Or that the nuclear processes involved in processes are not well enough understood. These processes must be further studied to improve the constraints.

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