# Effects of the Metallicity on Li and B Production in Supernova Neutrino Process

Motohiko Kusakabe[1], Myung-Ki Cheoun[2], K. S. Kim[3], Masa-aki Hashimoto[4], Masaomi Ono[5], Ken'ichi Nomoto[6], Toshio Suzuki[7], Toshitaka Kajino[1,8,9], and Grant J. Mathews[10]

[1]School of Physics, and IRCBBC, Beihang University, Beijing 100083 China
[2]Department of Physics and OMEG Institute, Soongsil University, Seoul 156-743, Korea
[3]School of Liberal Arts and Science, Korea Aerospace University, Goyang 412-791, Korea
[4]Kyushu University, Hakozaki, Fukuoka 812-8581, Japan
[5]RIKEN, 2-1 Hirosawa, Wako-shi, Saitama 351-0198, Japan
[6]Kavli IPMU (WPI), The University of Tokyo, Chiba 277-8583, Japan
[7]Department of Physics, College of Humanities and Science, Nihon University, Tokyo 156-8550, Japan
[8]National Astronomical Observatory of Japan, Tokyo 181-8588, Japan
[9]Graduate School of Science, University of Tokyo, Tokyo 113-0033, Japan
[10]Center for Astrophysics, Department of Physics, University of Notre Dame, IN 46556, U.S.A.

The neutrino process for the production of $^7$Li and $^{11}$B in core-collapse supernovae (SNe) is extensively investigated [1]. Initial abundances of $s$-nuclei and other physical conditions are derived in an updated calculation of the SN 1987A progenitor. The nuclear reaction network including neutrino reactions is constructed with the variable order Bader-Deuflhard integration method. We find that yields of $^7$Li and $^{11}$B significantly depend on the stellar metallicity while they are independent of the weak $s$-process during the stellar evolution. When the metallicity is high, there are more neutron absorbers and the neutron abundance is small during the neutrino process. Since $^7$Be is predominantly destroyed via $^7$Be($n$, $p$)$^7$Li, a change in the neutron abundance results in different $^7$Be yields. Then, the calculated yield ratio $^7$Li/$^{11}$B=0.93 for the solar metallicity is larger than that for the SN1987 A $^7$Li/$^{11}$B=0.80 by 16 % in the inverted mass hierarchy case. We analyze contributions of respective reactions as well as the evolution of abundances, and clarify the neutrino process of $^7$Li and $^{11}$B.

In the Galactic chemical evolution of $^7$Li and $^{11}$B, the metallicity effect on the neutrino process must be taken into account. Also, yields for $^7$Li and $^{11}$B in SNe with near-solar metallicties, not that of SN1987 A progenitor, should be utilized when the calculated $^7$Li/$^{11}$B ratio is compared with meteoritic data for presolar grains [3].

[1] M. Kusakabe *et al.*, Astrophys. J. **872**, 164 (2019).
[2] G. J. Mathews *et al.*, Phys. Rev. D **85**, 105023 (2012).