Supernova neutrino process and sensitivity to neutrino temperatures

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Some rare isotopes are produced by neutrino-induced reactions in supernova (SN) explosions (neutrino-process). This neutrino-process is important for i) understanding the origin of some isotopes, ii) evaluation of the temperatures for 6 neutrinos emitted from the proto-neutron star in SN, and iii) estimation of the duration time from the last SN which occurred around the solar system to the time of the solar system formation (SSF). These neutrino-isotopes can be produced by the charged current reactions with electron neutrino and anti-electron neutrino and by the neutral current reactions with all neutrinos. ^{6}Li, ^{11}B, ^{19}F, ^{138}La, and ^{180}Ta, have been considered to be major neutrino-isotopes. Among them ^{19}F, ^{138}La, and ^{180}Ta are produced in relatively inner layers, O/Ne layers, and thus these isotopes are relatively sensitive to the temperatures of the 6 neutrinos from the proto-neutron star. Progress in meteorite science has provided the abundance of a radioactivity ^{92}Nb ($T_{1/2}$=3.5 Myr) at SSF but the origin of ^{92}Nb has been an open question. We have proposed the neutrino-process origin for ^{92}Nb and reproduced the ^{92}Nb abundance by SN models with assumed neutrino temperatures. Since the neutrino-nucleus interactions are one of key physics, we have calculated them by using QRPA models. We also suggest the possibility that ^{98}Tc ($T_{1/2}$=4.2 Myr) can be produced by the neutrino process. When the ^{98}Tc abundance at SSF will be measured, we can constrain strongly neutrino temperatures. We discuss neutrino-nucleus interactions involved, neutrino temperatures, nucleosyntheses in SNe, and the time from the last SN to the solar system formation.