Contribution ID: **51** Type: **Oral Presentation**

Cosmic radioactivity probing the epoch of SN or merger nucleosynthesis and neutrino interactions

There is a growing consensus in recent multi-messenger astronomy that the neutron-star merger (NSM) could be a possible site for the production of heavy elements including long-lived radioactive nuclei. We will first discuss that the collapsar, which is very massive single star collapsing to a black hole, and core-collapse supernovae (CCSNe) such as magneto-hydrodynamically driven-jets and neutrino-driven winds dominate the nucleosynthesis of heavy r-elements [1] and p-isotopes like 92,94Mo and 96,98Ru [2] over the entire history of cosmic evolution. We also find that the NSM contribution delays in cosmological timescale until recent epoch due to very slow GW radiation in our Galactic chemical evolution model [1]. Since collapsars and CCSNe eject extremely large flux of energetic neutrinos, the neutrino-process nucleosynthesis (including neutrino-proton process) is strongly affected by both collective and MSW flavor oscillation effects at high density environment. Long-lived radioactive isotopes such as 92Nb (halflife 34.7My), 98Tc (4.20My), 53Mn (3.74My), etc. are produced there abundantly and serve as ideal chronometers to estimate the epoch of SN explosions. Comparing our theoretical calculations and observed isotopic anomalies of these neutrino-isotopes found in meteorites, we will estimate the epoch of SN event which affected strongly the solar-system formation. These nucleosynthetic products could be the most sensitive probe of neutrino interactions in high-density matter and constrain the still unknown mass hierarchy. We will propose how to constrain the mass hierarchy in our nucleosynthetic method in terms of the neutrino-isotopes 180Ta, 138La, 98Tc, 92Nb, 11B, 7Li, etc. [3]. We will also discuss the critical roles of the both primary neutrino-nucleus reactions and secondary radioactive nuclear reactions to respectively produce and destroy these neutrino-isotopes [4] whose experiments are being planned.

[1] Y. Yamazaki, Z. He, T. Kajino, et al., submitted to ApJ (2022), arXiv:2102.05891.
[2] H. Sasaki, Y. Yamazaki, T. Kajino, et al., ApJ 924 (2022), Issue 1, id.29, 7pp.
[3] H. Ko, M.-K. Cheoun, E. Ha, et al., ApJ 891 (2020), Issue 1, id.L24, 6 pp.
[4] X. Yao, M. Kusakabe, T. Kajino, S. Cherubini, S. Hayakawa, H. Yamaguchi,
in preparation (2022); Web of Conf. (EDP Sci.) Proc. NIC-XVI, in press (2022).

Length of presentation requested

Oral presentation: 25 min + 5 min questions (Review-type talk)

Please select between one and three keywords related to your abstract

Nucleosynthesis

2nd keyword (optional)

Cosmic Radioactive Deposits in Solar-System Samples

3rd keyword (optional)

Nuclear physics - theory

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