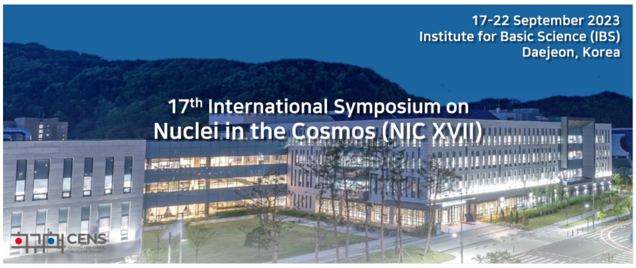

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Galactic chemical Evolution with short lived radioactive isotopes

Tuesday, 19 September 2023 18:20 (5 minutes)

Studying the galactic chemical evolution with short lived radioisotopes (SLRs) has a significant advantage over using stable elements: Due to their radioactive decay, SLRs carry additional timing information on astrophysical nucleosynthesis sites.

We can use meteoritic abundance data in conjunction with a chemical evolution model to constrain the physical conditions in the last rapid neutron capture process event that polluted the early Solar system prior to its formation [1].

Further, with the help of detections of live SLRs of cosmic origin in the deep sea crust [2], we can use these data in a 3-dimensional chemical evolution code to explain why different classes of radioisotopes should often arrive conjointly on Earth, even if they were produced in different sites (e.g., neutron star mergers, core-collapse/thermonuclear supernovae) [3].

Finally, we included radioisotope production into a cosmological zoom-in simulation to create a map of Al-26 decay gamma-rays indicating areas of ongoing star formation in the Galaxy, consistent with the observations by the SPI/INTEGRAL instrument [4]. We provide predictions for future gamma-ray detection instruments.

[1] Côté et al., 2021 Science 371, 945
[2] Wallner et al., 2021 Science 372, 742W
[3] Wehmeyer et al., 2023 ApJ 944, 121
[4] Kretschmer et al., 2013 A&A 559, A99

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