Contribution ID: **17** Type: **not specified**

The unknown site of actinide nucleosynthesis –clues from extraterrestrial Pu-244 in deep-sea archives

Thursday, 4 July 2019 11:00 (35 minutes)

Half of the heavy elements are produced in r-process nucleosynthesis, which is exclusively responsible for actinide production. The abundance of long-lived actinides in today's interstellar medium (ISM) results from the interplay between production and decay. Their presence would establish that their production was recent. The solar system moves through the ISM and collects ISM dust particles. Direct detection of freshly produced radionuclides 'live'on Earth, i.e. before decaying, provides thus direct insight into recent and nearby nucleosynthetic activity. In particular ^{244}Pu ($t_{1/2}$=81 Myr) can place strong constraints on r-process frequency and production yields over the last few 100 Myr [1,2]. In our work, we searched for such ISM radionuclides incorporated into terrestrial archives.
Detection of ISM-^{244}Pu in deep-sea archives complements the positive detection of interstellar and supernova-produced ^{60}Fe ($t_{1/2}$=2.6 Myr) [3-6]. However, the low concentrations measured previously suggest a low abundance of interstellar Pu [7]. It signals actinide r-process nucleosynthesis is rare, which is incompatible with the rate and expected yield of supernovae as the predominant actinide-producing sites, but compatible with high yield - low rate scenarios, such as e.g. neutron-star mergers.
Here we present new results for ^{244}Pu measured with a new facility at ANSTO (Sydney) with unprecedented sensitivity and background-free detection of Pu. We will report on the first time detection of a quantitative influx of the r-process nuclide ^{244}Pu onto Earth and link this to a concomitant influx of ^{60}Fe and supernova-activity. These data provide also new insights into their ISM concentrations [8].
[1] M. Paul et al. ApJL 558 (2001)
[2] C. Wallner et al. New Astr. Rev. 48 (2004)
[3] K. Knie et al., PRL 83 (1999); PRL 93 (2004)
[4] A. Wallner et al., Nature 532 (2016)
[5] L. Fimiani et al., PRL 116 (2016)
[6] P. Ludwig et al., PNAS 113 (2016)
[7] A. Wallner et al., Nature Comm. 6 '(2015)
[8] A. Wallner et al., submitted, in review (2019)

Presenters: WALLNER, Anton (The Australian National University); FROEHLICH, Michaela (ANU); KINOSHITA, Norikaru; HOTCHKIS, Michael; PAVETICH, Stefan; TIMS, Stephan

Session Classification: Session