Neutron experiment for the study of Re/Os cosmochronometer

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The age determination of the universe has been an interesting subject. It has been considered that the Re-Os pair can be one of good cosmochronometers, since it has unique features as discussed below [1]. Namely, ^{187}Re is produced by only r-process and the half life of ^{187}Re is quite long 42.3±1.3 Gyr. However, there are following interesting problems to use the Re-Os pair as a precise cosmochronometer. It is known that ^{186}Os is the s-only isotope, and therefore ^{187}Os is produced not only by the decay of ^{187}Re but also by the slow neutron capture process of ^{186}Os. Hence, principally if we know the production rate of ^{187}Os by the s-process neutron capture and the loss rate of ^{187}Os, we could obtain the amount of the decay product of ^{187}Re. Moreover, there exists the excited state at 10 keV in ^{187}Os. The state could be significantly populated at the stellar temperature of about 10^8K, and therefore ^{187}Os is depleted by the neutron capture process through the excited state [2]. Hence it is very important to find a proper way to correct for the loss rate of ^{187}Os through the excited state in deducing the age of the Galaxy [3]. In order to correct for the effect, the measurements for neutron capture cross section of ^{186}Os ,^{187}Os and ^{189}Os were made [4] [5]. It is unfortunate that there is a large discrepancy between different data sets. In the present study, we measured the neutron capture cross section of ^{186}Os, ^{187}Os and ^{189}Os for neutrons between 10 and 90 keV by detecting a prompt gamma ray from these reactions using an anti-Compton NaI(Tl) spectrometer. We report preliminary results of these measurements. We have for the first time succeeded to detect discrete gamma ray from the neutron capture reaction of ^{186}Os, ^{187}Os and ^{189}Os at a stellar energy by detection a prompt discrete gamma rays from these reactions (Fig. 1). Data anaylsis to determine the neutron capture cross section of these Os isotopes is in progress. Using newly obtained data, we hope that we could determine the age of the universe within an uncertainty of one billion year.

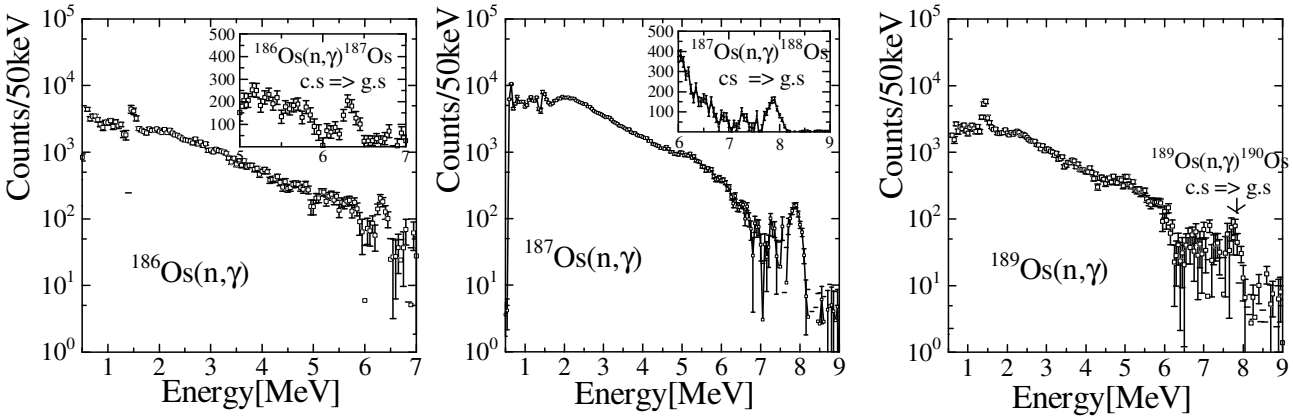

Figure 1: Net gamma ray pulse height spectra of ^{186}Os, ^{187}Os, ^{189}Os for 10-90keV neutrons.

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