The Measurement of neutron capture cross section of ^{62}Ni and nucleosynthesis of heavy elements

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The overproduction of Ni isotopes has been a long standing problem in the calculations of s-process nucleosynthesis in massive stars[1], and the problems still remains in the recent nucleosynthesis calculation from the onset of central hydrogen burning through explosion as Type supernovae[2]. Among the Ni isotopes, ^{62}Ni has the largest overproduction factor. The origin of this problem is claimed to be due to nuclear physics inputs such as Maxwellian Averaged Cross Section (MACS) of the Ni isotopes[2]. The MACS of ^{62}Ni used in the calculation is 12.5±4 mb. It is not based on the experimental data but based on the extrapolation[3]. The extrapolation was made by subtracting the estimated narrow subthreshold resonance contribution at -0.077keV and assuming s-wave direct capture process. Hence, it is important to experimentally determine the keV neutron capture cross section of ^{62}Ni. In the present study, we used an anti-Compton NaI(Tl) spectrometer in order to detect a prompt γ-ray from the neutron capture reaction[4]. We could for the first time succeeded to detect a discrete γ-ray feeding from the neutron capture state of ^{62}Ni to ground state and obtain the neutron capture cross section of ^{62}Ni in the energy range from 5.5 to 90keV. We will discuss the results of the present experiment.

Reference

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