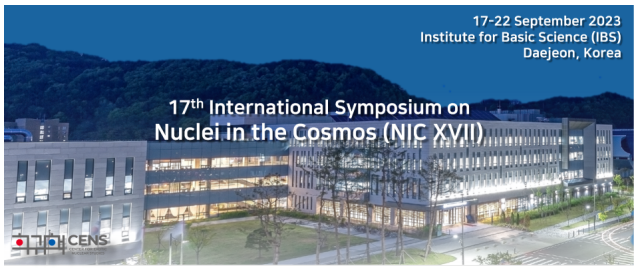

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Development of a low-background neutron detector array

Tuesday, 19 September 2023 18:15 (5 minutes)

$^{13}C(\alpha,n)^{16}O$ is the dominant neutron source of the s- and i-processes. The cross section of this reaction is extremely low at stellar energies(~10^{-14} Barn), which brings large errors of the measurements and makes it difficult to constrain the theoretical extrapolation.

To precisely measure the cross section of the $^{13}C(\alpha,n)^{16}O$ reaction, we designed a detector array comprising 24 ^{3}He proportional counters. The counters were embedded in a polyethylene cube, which was shielded with 7% borated polyethylene layer. The neutron background measured at China Jinping Underground Laboratory(CJPL) was as low as 4.5(2) counts/h, 265 times lower than the result of the ground measurement.

The detection efficiency of the array for neutrons was determined in the range of 0.1MeV to 4.5 MeV, which was carried out with the 3 MV tandem accelerator at Sichuan University and Monte Carlo simulations. Future studies are expected to focus on further improvement of the efficiency and accuracy by measuring the angular distribution of the $^{13}C(\alpha,n)^{16}O$ reaction.

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