In the coming year, the existing electronics will be replaced by the GET digitized electronics so that the drift time for each particle of scattering events can be separated clearly. 256-channel readout pads will be employed for detailed information to enhance the discrimination. With these developments, it can be expected to identify the scattering and fusion events more effectively.

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2 - 16 Experimental Study of ^{13}N(α,p)^{16}O at the Stellar Energies*

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The presolar SiC grains[1] carry the original stellar nucleosynthesis signature. Their isotopic anomalies compared to the sun are the strong constrains in the supernovae (SN) model calculations. The ^{15}N-excess in some SiC-AB grains (^{12}C/^{13}C<10 and ^{14}N/^{15}N<272) is one of the challenges of core-collapse supernovae (CCSNe) models[2]. Recently, Pignatari pointed out that the entrainment of H-rich material into the He shell before the SN explosion allows the coproduction of ^{13}C, ^{15}N and ^{26}Al, which provides a new production scenario for SiC-AB grains[2]. In the He shell nucleosynthesis, the ^{13}C is produced through ^{12}C(p,γ)^{13}N($\beta^+\nu$)^{13}C reaction. The ^{14}N is synthesized through ^{13}N(n,γ) and ^{13}C(p,γ) reactions. In the SN He shell buring temperature (T ~0.4~0.8 GK), ^{13}N(α,p)^{16}O reaction is the main destruction of ^{13}N. Since there is no experimental reaction rate at the stellar low energy region (0.4~1.2 MeV), the reaction rate predicted by the statistic model exists large uncertainty[3,4], which affects the abundance of ^{13}C and ^{14}N significantly. Therefore, it is important to determine the reaction rate from experimental reaction cross section at the stellar low energy region.

The direct measurement of ^{13}N(α,p)^{16}O at $E_{\rm cm}$=0.4~1.2 MeV is still limited by the ^{13}N beam intensity (<10^5pps). Statistic model calculation predicts that the probability of ^{13}N(α,p)^{16}O* is four orders of magnitude less than ^{13}N(α,p)^{16}O. Thus, the inverse reaction measurement is a better choice. Here we propose to measure ^{16}O(p, α)^{13}N reaction cross section in the corresponding range, $E_{\rm cm}$=5.7~6.3 MeV, where the main contribution is from the resonance at $E_{\rm cm}$=5.96 MeV ($E_{\rm x}$=6.56 MeV, J^π=1/2$^+$) and deduce the ^{13}N(α,p)^{16}O reaction cross section using detail balance principle and R-Matrix calculation.

The experiment was performed at RIBLL1 in IMP. A 114 MeV ^{16}O beam, produced by SFC and improved by RIBLL1, was irradiated to a 6.7 mg/cm^2 thick $(CH_2)_n$target. One Single Si Detector (SSD) and a telescope, consisting of a SSD and a Double-sided Si Strip Detector (DSSD), were placed at the forward angles to measure ^{13}N and α partilces, respectively, as shown in Fig. 1(a). The energy correlation of ^{13}N and α is presented in Fig. 1(b). The band inside the area enclosed by the open circles in the figure is the strong correlation band of ^{13}N and α. Using the two particle energies and the emitting angle of α recorded by DSSD, the reaction kinematic was

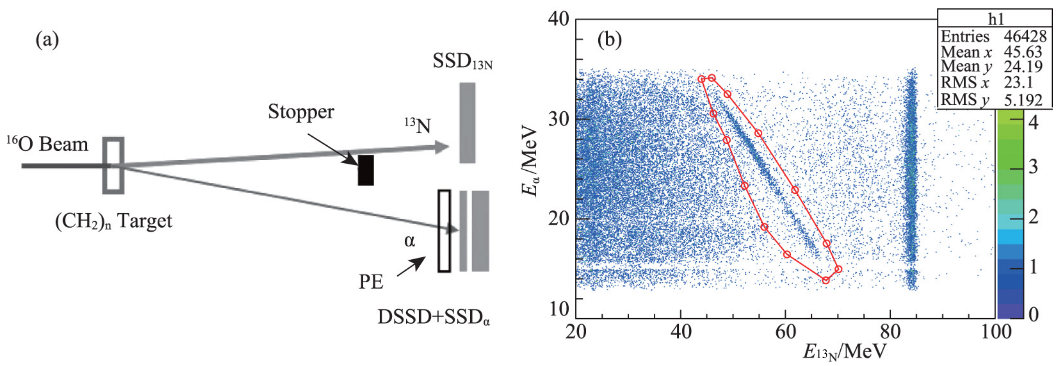

Fig. 1 (color online) (a) The experimental setup. (b) The energy correlation of α and ^{13}N.

reconstructed. After the geometry efficiency correction, the normalized center of mass cross section of $^{16}O(p, \alpha)^{13}N$ for E_{cm} <6.7 MeV is presented in Fig. 2. A very good agreement was found for our result and that of Nero[5]. For the lack of statistics, few events were observed around E_{cm}=5.96 MeV, corresponding to the ^{17}F (E_x=6.56 MeV). The $(CH_2)_n$ target used in the current experiment limited the beam intensity and introduced background due to the carbon in the target. To improve the statistics, we are developing a pure hydrogen target and hope to achieve more statistics at the resonance at E_{cm}=5.96 MeV.

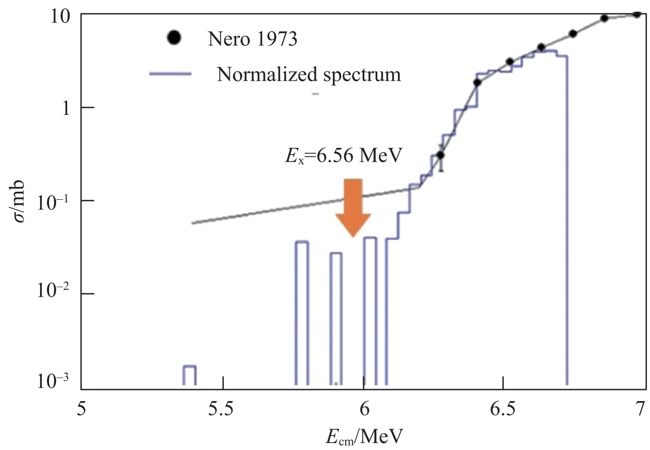

Fig. 2 (color online) The $^{16}O(p, \alpha)^{13}N$ reaction cross section as a function of center of mass energy. The solid circles are the experimental data from Nero[5]. The histogram is the normalized cross section from present experiment. The arrow indicates the expected resonance of E_x = 6.56 MeV of ^{17}F.

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* Foundation item: National Key Research and Development program (MOST 2016YFA0400501), National Natural Science Foundation of China (11490564)

2 - 17 Method for Determination of Deuterium Impurity in Helium Beam*

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JUNA (Jinping Underground laboratory for Nuclear Astrophysics) is planing to measure the $^{13}C(\alpha, n)^{16}O$ and some other important reactions at or close to stellar energies using intense helium beam out of an ECR driven accelerator in Jinping Underground laboratory[1]. Deuterium impurity in ion source will produces significant amount of neutrons, limiting the background level. To control the deterium impurity, we have developed a method to measure the deuterium impurity within Helium beam using the d(d,p)t reaction.

A test experiment has been done by using the 320 kV HV platform at IMP He^{2+} beam was produced by an ECR source and post-acclerated to 275 keV/q after it was filtered by a 90 ° magnet. The beam bombarded a deterium implantation target with a titanium substrate. The atom density of its effective layer is 1.98×10^{19} atoms/cm^2 and the ratio of D/Ti is 1.5. The protons produced by the d(d,p)T reaction was detected by a 300 μm thick silicon detector located at 135°. The distance between the detector and the target is 20 cm and a aluminium foil with thickness of 7 μm was placed before the silicon detector to stop the scattered He^{2+} particles. The reaction chamber was electrically isolated from the beam line and the incident total charge was recorded with a beam current integrator.