The cross section of the formation of quasi-deuteron was calculated as discussed above, and the analytic expression is obtained by fitting the n-p scattering data. The width of quasi-deuteron virtual state of a 0^+ resonance was about $\Gamma_2(E_1) = 9\times10^{-8}$ MeV derived from the n-p scattering curve. The loosely bounded quasi-deuteron might have a bigger radius than a real deuteron, and this possibly results in a larger (α, γ) cross section as well. The detail effect is now under evaluation. For simplicity, here we can take the cross section of $^2H(\alpha,\gamma)^6Li$ as that of quasi-deuteron capture on ^4He, which gives the lower limit of $^4He(np,\gamma)^6Li$ rate. The calculation of the $^4He(np,\gamma)^6Li$ rate is still in progress.

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2 - 20 Investigation for Resonant Scattering of $^{17}F+p$

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X-ray bursts[1] are probably an important source for the production of proton-rich nuclei via the high temperature rp-process[2], and the $^{14}O(\alpha, p)^{17}F$ reaction is thought to be one of the crucial stellar reactions during the ignition phase. By far, its reaction rate is still uncertain. Therefore, the studies of this waiting-point reaction are of great nuclear astrophysical importance to understand the energy generation and nucleosynthesis in the explosive stellar environments.

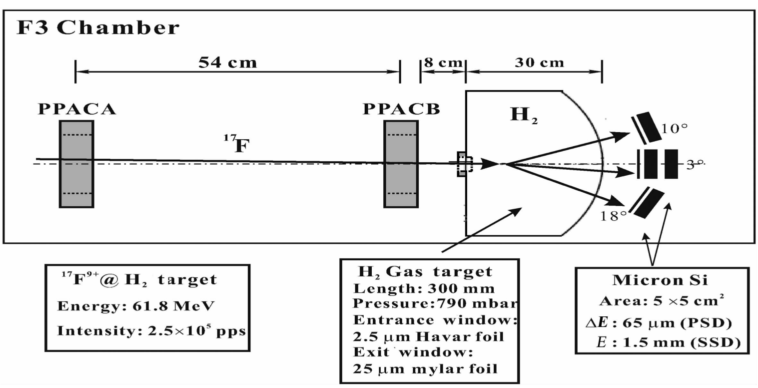

Fig. 1 Schematic diagram of experimental setup at F3 chamber.

The reaction $^{14}O(\alpha, p)^{17}F$ is mainly resonant[3, 4], and its reaction rate depends on the resonant properties of those excited states above the α threshold in the compound nucleus ^{18}Ne. In this work, the proton resonant properties in ^{18}Ne have been studied by the resonant elastic and inelastic scattering of $^{17}F+p$ with a ^{17}F beam bombarding a thick H_2 gas target. The experimental goal was to determine the spin-parities and

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proton partial widths for those states above the proton threshold in ^{18}Ne.

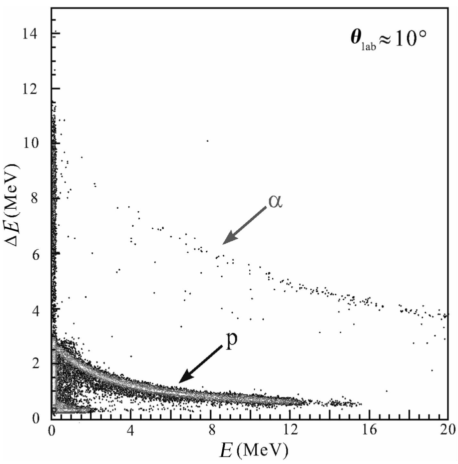

Fig. 2 Identification plot for the recoiled light particles at $\theta_{lab} \approx 10°$.

The experiment was performed at the low-energy RI beam facility CRIB (CNS Radioactive Ion Beam separator) of Center for Nuclear Study (CNS), the University of Tokyo[5]. A 6.64 *A*MeV $^{16}O^{6+}$ primary beam from AVF cyclotron with an average intensity of 560 enA, bombarded a liquid-nitrogen-cooled D_2 gas target (90 K, 158 mbar) where a secondary beam of ^{17}F was produced via the ^{16}O(d, n)^{17}F reaction. The D_2 gas was confined in a cell with a length of 80 mm. The cell was sealed by two Havar foils of 2.5 μm as entrance and exit window. The ^{17}F beam was separated by the CRIB separator using the in-flight method. By using Wien Filter, the average purity of ^{17}F beams can achieve about 90 % finally. The ^{17}F beam, with a mean energy of 3.6 *A*MeV and an average intensity of 2.5×10^5 particles/s, was then delivered to the secondary target position and bombarded a thick H_2 gas target in which the beam was stopped. The experimental setup at the final terminal is shown in Fig. 1. The H_2 gas target chamber is in a semi-cylindrical shape with a radius of 300 mm. The recoiled light particles were measured by using three sets of ΔE-E Si telescopes at averaged angles of $\theta_{lab} \approx 3°$, 10° and 18°, respectively. Fig. 2 shows the particle identification by using the ΔE-E method and the recoiled protons are clearly identified. The energy calibration for the silicon detectors was performed by using a standard triple α source. Due to the pulse height defect, a secondary proton calibration based on the α calibration was made using proton beams of various energies. In addition, at secondary target position, an Ar gas target at 158 mbar was used in a separate run for evaluating the background contribution. Nowadays, the data analysis is still in progress.

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2 - 21 Progress Report on Lanzhou Penning Trap (LPT)

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The Lanzhou Penning Trap (LPT) is an ion trap facility that is presently under construction at the Institute of Modern Physics (IMP). Its main goal is to perform direct mass measurements on fusion-evaporation residues and if possible for the heavy isotopes. Mass measurements of stable and exotic nuclei allow determination of nuclear binding energies and hence provide important data for nuclear physics and astrophysics. The following progresses on the LPT have been achieved in 2012:

(1) All parts of the whole LPT beam line have been assembled and put together, including two Penning traps, beam transport devices, and other devices for vacuum pumping, support, and so on. Fig. 1 shows a photo of the core part.

(2) The beam line alignment has been conducted and the test results have shown that the overall accuracy is within ±0.5 mm and mostly ±0.2 mm. The vacuum tests have been taken and an ultra high vacuum $\sim 10^{-6}$ Pa has been achieved. The gas feeding system to the purification trap has been also tested and a pressure ratio of ~35 has been measured between the purification trap and the measurement trap. At last the feedthrough for the electrodes has been finished and assured by using a 500 V tramegger.