Contribution ID: **81** Type: **not specified**

Measurement of the 6Li(n, t)4He Cross Section with Multi-purpose Time Projection Chamber at the Back-n White Neutron Source of CSNS

Tuesday, 27 May 2025 11:40 (15 minutes)

Neutron-induced reaction 6Li(n,t)4He plays an important role in nuclear energy and nuclear data evaluation. The cross section of 6Li(n,t)4He has been adopted as standard in the energy range of 0.0253eV–1.0MeV [1], and is commonly used as reference for other cross section measurements. Previous works have shown non-negligible discrepancies in cross section results [2,3,4], and the angular distribution data in high neutron energy region are scarce.

The multi-purpose time projection chamber (MTPC), which is designed for measuring neutron nuclear data of varied field, has been fabricated in the back-streaming neutron facility (Back-n) at China Spallation Neutron Source (CSNS). The detector is able to measure the charged particles emission from neutron-induced reactions. We have carried out an experiment with MTPC for measuring the total cross section as a function of neutron energy and the differential cross section as a function of the product particle emission angle of 6Li(n,t)4He in the energy range of 0.5eV–100keV. In the experiment, we use a Lithium Fluoride sample with the aluminum substrate as the target, and a gas composition of 93% Argon and 7% Carbon Dioxide is used. Different experimental conditions were set for measuring different emission particles.

In this work, detector design and experiment setup are firstly introduced. Then the data analysis of MTPC is discussed in detailed, and results of total cross section and differential cross section is presented. Finally, an upgrade on the detector is shown as a new measurement of the 6Li(n,t)4He in the energy range of 100keV-10MeV is on schedule.

Reference:

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Primary authors: CHEN, Hongkun (Sun Yat-sen University); YI, Han (IHEP, CAS); CHU, Tianzhi (Shenzhen University); CHEN, Haizheng (Xi'an Jiaotong University); LI, Yang (CSNS); LV, You (CSNS); FAN, Ruirui (CSNS)

Presenter: CHEN, Hongkun (Sun Yat-sen University)

Session Classification: Parallel Session 2: Nuclear data for applied and scientific purposes/Neutron detection & Methodical aspects

Track Classification: Parallel session: Parallel session 2