2 - 28 Knockout Reactions from ^{14}O at Around 300 MeV/u

Wang Shitao, Sun Zhiyu, Zhang Xueheng, Yu Yuhong, Yue Ke,
Tang Shuwen, Fang Fang, Yan Duo and Zhou Yong

Knockout reactions at intermediate and high energies have been proved to be a powerful tool for probing the single-particle structure of rare isotopes[1]. The spectroscopic factors and orbital angular momenta of the removed nucleons can be deduced by comparison of the experimental cross sections and longitudinal-momentum distributions to those calculated in the Glauber reaction theory. Recently, study shows that for strongly bound valence nucleon knockout, the experimental cross sections are much smaller than reaction theory predictions[2].

The intranuclear cascade (INC) calculations[3] suggest that nucleon evaporation from the one-nucleon removal residues play a major role in the reduction of strongly bound nucleon removal cross sections. However, the mechanisms in the knockout of strongly bound nucleons are still not well understood.

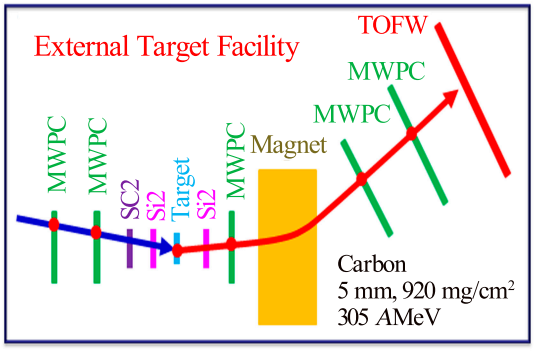

Fig. 1 (color online) Layout of the External target Facility.

To understand the strongly bound nucleon knockout mechanism, knockout reactions from ^{14}O at around 300 MeV/u have been studied at the Heavy Ion Research Facility in Lanzhou[4]. The primary beam ^{16}O was accelerated to 360 MeV/u by the synchrotron CSRm. The ^{16}O beam was extracted from the CSRm and then was impinged on a Be production target of 2.79 g/cm^2 thickness. The secondary cocktail beams were separated according to magnetic rigidity by using the RIBLL2. The reaction residues were measured by using the External Target Facility, the layout of which is shown in Fig. 1. In this experiment, the measured cross section of ^{12}N was 30(6) mb. Such a large cross section is expected to receive a contribution from an indirect process, namely, one-neutron knockout followed by proton emission. If this was the case, the missing one-neutron knockout strength from ^{14}O could be found in the unbound ^{13}O, and the eikonal reaction model then might be not valid for the cases of knockout of strongly bound valence nucleons.

References

[1] P. G. Hansen, J. A. Tostevin. Ann. Rev. Nucl. Part. Sci, 53(2003)219.

[2] A. Gade, D. Bazin, B. A. Brown, et al., Phys. Rev. Lett, 93(2004)042501.

[3] C. Louchart, A. Obertelli, A. Boudard, et al., Phys. Rev. C, 83(2011)011601(R).

[4] Z. Y. Sun, D. Yan, S. T. Wang, et al., Phys. Rev. C, 90(2014)037601.