MEASUREMENT OF REACTION CROSS SECTIONS FOR $^{9-12}$C ISOTOPES

Kenji Nishizuka, Department of Physics, Niigata University, Niigata, Japan

I. Kato[2], M. Mihara[3], D. Nishimura[4], M. Takechi[1], T. Ohtsubo[1], M. Fukuda[3], K. Abe[4], T. Izumikawa[5], H. Oikawa[4], J. Ohno[3], S. Ohmika[2], Y. Kanke[4], S. Kanbe[3], H. Kikuchi[1], A. Kitagawa[6], S. Sato[6], U. Sayama[1], J. Shimaya[3], S. Suzuki[6], T. Suzuki[2], Y. Taguchi[4], Y. Takeuchi[2], T. Takemoto[4], N. Tadano[2], M. Tanaka[3], Y. Tanaka[3], H. Du[3], J. Nagumo[4], S. Fukuda[2], K. Hori[3], S. Matsunaga[2], A. Mizukami[4], E. Miyata[1], D. Murooka[1], S. Yamaoka[3], T. Yamaguchi[2], K. Yokoyama[1], H. Takahashi[1], K. Chikaato[1], A. Ikeda[1], K. Ohnishi[3], T. Sugihara[3], K. Aoki[4], Y. Takei[4], A. Takenouchi[4], T. Nagai[4], M. Machida[4], S. Yagi[4],

1 Department of Physics, Niigata University, Niigata, Japan

2 Department of Physics, Saitama University, Saitama, Japan

3 Department of Physics, Osaka University, Osaka, Japan

4 Department of Physics, Tokyo University of Science, Tokyo, Japan

5 RI center Niigata University, Niigata, Japan

6 NIRS, Chiba, Japan

Differences between matter and charge distribution in isospin-asymmetric nucleus is an intriguing issue, which gives an important clue for nuclear structures and also the equation of state of nuclear matter. Reaction cross section (σ_R) of atomic nucleus is the physical quantity which has strong relation to the nuclear matter radius. Since 1980's, studies of nuclear radii have been extensively performed through the measurements of cross sections, which leads to the discovery of neutron halo structures in light neutron-rich nuclei [1]. In 1990's, matter radii of neutron-rich Na isotopes were studied and the emergence of neutron skin in these isotopes has been observed from the comparison between matter radii deduced from their experiment and charge radii of Na isotopes measured by the laser spectroscopy method [2].

In this study, we tried to deduce the differences between proton and matter radii based only on the σ_R measurements. The σ_R data for $^{9-11}$C on C and proton targets have been obtained at 40 ~ 120 *A* MeV to study the evolution of proton radii in the light proton-rich nuclei. Owing to the large differences between proton-proton and proton-neutron scattering cross sections, σ_R data on proton target would have sensitivity to the differences between matter and charge radii. Experiments were performed using the secondary beam line at HIMAC (Heavy Ion Medical Accelerator in Chiba) facility, NIRS [3]. The transmission method was employed for the measurements of σ_R. For the particle identification before and after the reaction target, we used $B\rho$ - *TOF* - ΔE method and ΔE - *E* method, respectively. In this experiment, measurements have been done using C and CH2 reaction targets to deduce cross sections for proton target.

The σ_R data have been obtained precisely within the error of a few percent and nucleon density distributions of $^{9-11}$C were deduced from those data by using of the Glauber-type calculation [4].

The nuclear matter radii have been derived from the obtained nucleon density distributions and proton radii of C isotopes have been deduced from σ_R data on proton targets. The enhancements of proton radii with the increase of Z/N ratio in C isotopes have been observed. This is consistent with the evolution of charge radii in Li and Be isotopes measured by the laser spectroscopy method [5] in proton-rich side.

In the presentation, the detailed results of our experiments will be introduced and evolution of proton radii in proton-rich C isotopes will be discussed.

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