Contribution ID: **28** Type: **Experimental Nuclear Physics**

Study of the contribution of the ^{7}Be(d, p) reaction to the ^{7}Li problem in the Big-Bang Nucleosynthesis

Saturday, 20 August 2022 13:45 (15 minutes)

Our research goal is to measure the cross-section of the ^{7}Be(d, p) reaction in search of a solution to the cosmological ^{7}Li problem (CLP). The CLP is the overestimation of primordial ^{7}Li abundance in the standard Big-Bang nucleosynthesis (BBN) model compared to observed abundances, a major unresolved problem in modern astrophysics. A recent theoretical BBN model emphasized the primordial ^{7}Li abundance is about three times larger than the recent precise observation [1], [2]. ^{7}Li nuclei were considered to be produced predominantly by the electron capture decay of ^{7}Be after the termination of nucleosynthesis in the standard BBN model. We focus on the ^{7}Be(d, p) reaction since it is considered one of the contributors to ^{7}Be destruction in the BBN [3]. We developed a method to produce ^{7}Be (half life = 53.22 days) target to measure the reaction cross-section in normal kinematics. The experiment was performed at the Tandem Electrostatic Accelerator, Kobe University [4]. A 2.36 MeV proton beam irradiated a natural-Li target to transmute ^{7}Li particles to ^{7}Be particles via the ^{7}Li(p, n)^{7}Be reaction [5]. We produced 3.03×10^{13} ^{7}Be particles in the target after two days of proton irradiation. After the target production, the beam ion was changed to deuterons and the ^{7}Be(d, p) reaction measured at energies 0.6, 1.0, and 1.6 MeV. The outgoing protons were measured by layered-silicon telescopes placed at 30 and 45 degrees. In this talk, I will report the experimental setup and preliminary results of this study, including the ^{7}Be(d, p) cross-section.\\
\\
References\par
[1] R. H. Cyburt {\it et al.}, J. Cosmol. Astropart. Phys. {\bf 11}, 012 (2008).\par
[2] Brian D. Fields {\it et al.}, J. Cosmol. Astropart. Phys. 03(2020)010.\par
[3] S. Q. Hou {\it et al.}, Phys. Rev. C {\bf 91}, 055802 (2015).\par
[4] "Kobe University Tandem Electrostatic Accelerator" \url {https://www.maritime.kobe-u.ac.jp/en/study/tandem_e.html} (Accessed 4th August 2022)\par
[5] K. K. Sekharan et al., Nucl. Instr. Meth. {\bf 133}, 253-257 (1976).

Primary author: INOUE, Azusa (Research Center for Nuclear Physics, Osaka university)

Co-authors: TAMII, Atsushi (Research Center for Nuclear Physics, Osaka university, Institute of Radiation Science, Osaka University); CHAN, Phaikying (Research Center for Nuclear Physics, Osaka university); HAYAKAWA, Seiya (Center for Nuclear Study, University of Tokyo); KOBAYASHI, Nobuyuki (Research Center for Nuclear Physics, Osaka university); MAEDA, Yukie (Faculty of Engineering, University of Miyazaki); NONAKA, Kotaro (Faculty of Engineering, University of Miyazaki); SHIMA, Tatsushi (Research Center for Nuclear Physics, Osaka university); SHIMIZU, Hideki (Center for Nuclear Study, University of Tokyo); TRAN, Dinh Trong (Research Center for Nuclear Physics, Osaka university, Vietnam Academy of Science and Technology); WANG, Xuan (Research Center for Nuclear Physics, Osaka university); YAMAGUCHI, Hidetoshi (Center for Nuclear Study, University of Tokyo, National Astronomical Observatory of Japan); YANG, Lei (Center for Nuclear Study, University of Tokyo, China Institute of Atomic Energy); YANG, Zaihong (Research Center for Nuclear Physics, Osaka university, School of Physics, Peking University)

Presenter: INOUE, Azusa (Research Center for Nuclear Physics, Osaka university)

Session Classification: Young Scientist Session 1