

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

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Our research goal is to measure the cross-section of the  ${}^7\text{Be}(d, p)$  reaction in search of a solution to the cosmological  ${}^7\text{Li}$  problem (CLP). The CLP is the overestimation of primordial  ${}^7\text{Li}$  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  ${}^7\text{Li}$  abundance is about three times larger than the recent precise observation [1], [2].  ${}^7\text{Li}$  nuclei were considered to be produced predominantly by the electron capture decay of  ${}^7\text{Be}$  after the termination of nucleosynthesis in the standard BBN model. We focus on the  ${}^7\text{Be}(d, p)$  reaction since it is considered one of the contributors to  ${}^7\text{Be}$  destruction in the BBN [3]. We developed a method to produce  ${}^7\text{Be}$  (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  ${}^7\text{Li}$  particles to  ${}^7\text{Be}$  particles via the  ${}^7\text{Li}(p, n){}^7\text{Be}$  reaction [5]. We produced  $3.03 \times 10^{13}$   ${}^7\text{Be}$  particles in the target after two days of proton irradiation. After the target production, the beam ion was changed to deuterons and the  ${}^7\text{Be}(d, p)$  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  ${}^7\text{Be}(d, p)$  cross-section.

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References

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