Contribution ID: **5** Type: **not specified**

Constraining the Primordial Lithium Abundance: New Cross Section Measurement of the 7Be + n Reactions Updates the Total 7Be Destruction Rate

This is condensed from the article in Astrophys. J. Lett. 915, L13 (2021).

The cosmological lithium problem (CLP) stems from the outstanding discrepancy between theoretical predictions and astronomical observations of primordial lithium abundances. For the radiogenic production of 7Li, 7Be plays a pivotal role in the Big Bang nucleosynthesis (BBN). Nevertheless, the data for neutron-induced 7Be destruction processes were still sparse, and especially lacked information on the contributions of transitions to the 7Li excited states. In this work, we have determined the 7Be(n,p_0)7Li, 7Be(n,p_1)7Li*, and 7Be(alpha,n)4He reaction cross sections by means of the Trojan Horse method. The present and the previous data were analyzed together by a multichannel R-matrix fit, providing an improved uncertainty evaluation of the (n,p_0) channel and the first-ever quantification of the (n,p_1) contribution in the BBN-relevant energy range. We implemented the revised total reaction rate summing both the (n,p_0) and (n,p_1) contributions in a state-of-the-art BBN code PRIMAT. As a consequence, the present nuclear-physics data offers a reduction of the predicted 7Li abundance by about one-tenth, which would impose a stricter constraint on BBN and head us in the correct direction to the CLP solution.

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Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies