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Reaction rates of 6Li(p,γ)7Be process and primordial abundance of the 7Li element

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The "cosmological lithium"problem is connected to the abundance of the lithium isotopes in the Universe and includes two puzzles. The first lithium puzzle is a difference between predictions of the Big Bang nucleosynthesis (BBN) model and astronomical observations in metal-poor halo stars for the primordial 7Li/H ratio. The model predictions (5.61 ± 0.26)x10-10 [1] and (4.72 ±0.72) x10-10 [2] are about three to four times larger than values of x10-10 [3] and x10-10 [4] from analysis of the observational data. The second lithium puzzle is caused by a disagreement between estimations of model and astronomical observation data for the primordial abundance ratio of the lithium isotopes (6Li/7Li), which means that their discrepancy is about three orders of magnitude. Actually, nuclear astrophysics, cosmology, and astronomical observations are being comprehensively studied to solve these problems.
Nuclear reaction rates involving lithium and beryllium play a major role in the solution of above problems from the nuclear physics side. In particular, in the Ref.[5] the astrophysical direct 6Li(p,γ)7Be capture process has been studied for the purpose of calculation of reaction rates in the frame of the potential model approach. It should be noted that one of the most important input quantity for the estimation of primordial abundances of chemical elements in the BBN model of the Universe is the rates of the basis nuclear reactions. The reaction rate NA(v) is calculated by the well-known expression in Ref.[6] on the basis of calculated cross-section of the 6Li(p,γ)7Be capture process within the potential model. The estimated 7Li=H abundance ratio of (4.67±0.04)x10-10 [5] is in a good agreement with the recent BBN ratio of (4.72±0.72)x10-10 [2] after the Planck observation.

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