Nuclear Theory

Nuclear reaction rates and the primordial nucleosynthesis

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The theoretical predictions of the primordial abundances of elements in the big-bang nucleosynthesis (BBN) are dominated by uncertainties in the input nuclear reaction rates. We investigate the effect of modifying these reaction rates on light element abundance yields in BBN by replacing the thirty-five reaction rates out of the existing eighty-eight. We have studied these yields as functions of evolution time or temperature. We find that using these new reaction rates results in only a little increase in helium mass fraction over that obtained previously in BBN calculations. This allows insights into the role of the nuclear reaction rates in the setting of the neutron-to-proton ratio during the BBN epoch. We observe that even with considerable nuclear physics uncertainties, most of these nuclear reactions have minimal effect on the standard BBN abundance yields of ^{6}Li and ^{7}Li.

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