

The cosmological lithium problem revisited

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We report a few recent attempts to find theoretical solutions by our group at Texas A&M University (Commerce & College Station). Our studies on the theoretical description of electron screening, the possible existence of parallel universes of dark matter, and the use of non-extensive statistics during the Big Bang nucleosynthesis (BBN) epoch. For the calculation of reaction rates in the BBN one assumes the validity of the Maxwell-Boltzmann (MB) distribution of velocities of the nuclei in a plasma. The effects of a non-extensive statistics for BBN has been used to make predictions for the abundances of light nuclei using the available experimental data of these reactions. We conclude that it is not possible to solve the lithium puzzle with use of a non-extensive statistics to calculate the reaction rates during the BBN. The departure from the Boltzman-Gibbs (BG) statistics in fact worsens the lithium problem by increasing its abundance.

Last but not least, we discuss possible solutions within nuclear physics realm. The impact of recent measurements of relevant nuclear reaction cross sections for the Big Bang nucleosynthesis based on indirect methods is also assessed. Although our attempts may not able to explain the observed discrepancies between theory and observations, they suggest theoretical developments that can be useful also for stellar nucleosynthesis.