

ASTROPHYSICS SEMINAR SERIES

Relativistic electron scattering in Big Bang Nucleosynthesis

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Big Bang Nucleosynthesis (BBN) is a pillar of modern cosmology. It is the only probe of the radiation-dominated epoch of the universe and as such is a valuable tool with which to constrain the physics of the early universe. However, a fundamental assumption in BBN is that the nuclear velocity distributions obey Maxwell-Boltzmann statistics as they do in stars. In this letter, however, we point out that there is a fundamental difference between stellar reaction rates and BBN reaction rates. Specifically, the BBN epoch is characterized by a dilute baryon plasma for which the velocity distribution of nuclei is mainly determined by the dominant scattering with relativistic electrons. This modifies the nuclear velocity distributions and significantly alters the thermonuclear reaction rates, and hence, the light-element abundances. We show that this novel result alters all previous cosmological constraints based upon BBN.



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