

Cosmological Solutions to the Lithium Problem

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The abundance of primordial lithium is derived from the observed spectroscopy of metal-poor stars in the galactic halo. The observationally inferred abundance remains at about a factor of three below the abundance predicted by standard big bang nucleosynthesis (BBN) [1]. The resolution of this dilemma can be either astrophysical (stars destroy lithium after BBN), nuclear (reactions destroy lithium during BBN), or cosmological, i.e. new physics beyond the standard BBN is responsible for destroying lithium. In this talk we will overview a variety of possible cosmological solutions. In particular, we examine the possibility [2] of physical processes that modify the velocity distribution of particles from the usually assumed Maxwell-Boltzmann statistics. On the one hand, an inhomogeneous spatial distribution of domains of primordial magnetic field strength has been shown [3] to reduce the primordial lithium abundance. Another possibility [4] is that scattering with the mildly relativistic electrons in the background plasma alters the baryon distribution to one resembling a Fermi-Dirac distribution. This talk will show that neither of these possibilities can adequately resolve the lithium problem. A number of alternate hybrid models will be suggested including a mix of neutrino degeneracy, dark matter, axion cooling, and the presence and/or the decay of exotic particles [5,6].

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