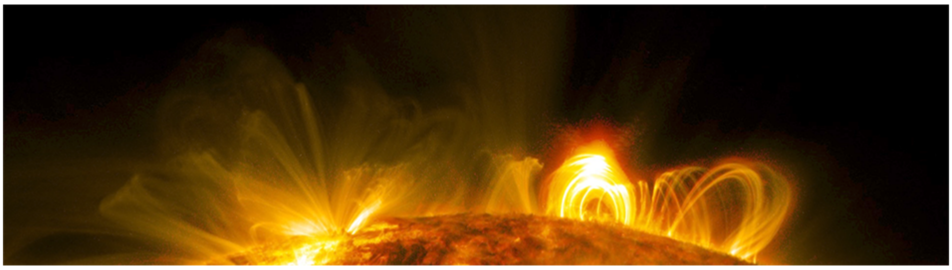

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Effect of Magnetic Field Dissipation on Primordial Li Abundance

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The standard Big Bang Nucleosythesis (BBN) model predicted the abundances of light elements that led to one of the main observational supports of the Big Bang theory. However, current observational data no longer confirm the standard BBN (SBBN) confidently. Measurements of Li abundances in metal-poor stars clearly contradict the SBBN value by more than a factor of 3-4 [1,2]. In addition, a possible discrepancy has been pointed out between observed D abundances in absorption systems of quasars and the SBBN value [3]. We investigated dissipation effects of primordial magnetic fields on primordial elemental abundances, and show one probable way to solve the problems of primordial abundances based on the mechanism for acceleration of charged particles by field dissipations. When a magnetic field reconnects, its energy is converted to kinetic energies of charged particles as observed as solar energetic particles arriving on earth. If it happens in the early Universe, it accelerates cosmic background nuclei, and energetic nuclei induce nonthermal reactions. We solve how low-energy cosmic rays come to be, after generation, by including a quick energy loss in a dense cosmic plasma. A constraint on the dissipation is then derived from a theoretical calculation of the nonthermal reactions during BBN. We find that observations of the Li and D abundances can be explained if 0.01-0.1 % of cosmic energy density was utilized for nuclear acceleration after the cosmological electron-positron annihilation epoch. Also, we evaluate that this size of magnetic field energy density explains an acceleration of plasma particles up to kinetic energies suitable for nonthermal nuclear reactions. Therefore, the acceleration of cosmic background nuclei associated with a primordial magnetic dissipation is a possible generation mechanism of soft CRs that has been suggested as a solution to the Li problem [4]. Only the dissipating magnetic field model suggested here simultaneously explains observations of both low Li and high D abundances without assuming nonstandard physics. Therefore, signatures of strong magnetic fields in the early Universe have possibly been observed in primordial elemental abundances.

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