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Magnetogenesis from anisotropic universe

Magnetic fields are observed throughout the universe on different length scales having different strengths. Galaxies and galaxy clusters have a magnetic field strength of $\sim 10^{-9}\ G$ coherent over a 1KPc scale. We find magnetic fields at $\sim 1MPc$ scale having a strength of $\sim 10^{-16}\ G$ in the intergalactic medium (IGM). Inflationary magnetogenesis is the most profound theory of large-scale magnetic field generation. Here, we propose that a spatial anisotropy in spacetime during the inflationary era can induce a large-scale magnetic field. The spatial anisotropy generically breaks the conformal invariance of the Maxwellian gauge field and produces an electromagnetic (EM) field with a present-day strength of $\sim 10^{-20}\ G$. This formalism does not suffer from the strong coupling problem, as it does not include explicit coupling with the inflaton field. Furthermore, we show that the produced electromagnetic field does not affect the inflationary background or the anisotropy. In addition, assuming very low conductivity during the reheating era, we can further observe the evolution of the EM field. Moreover, with the data from PLANCK and other observables of the magnetic field, we can put strong bounds on the effective equation of state ω_{eff}.

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