

New Constraints on the Primordial Magnetic Field

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We present the newest statistical and numerical analysis of the matter and cosmic microwave background power spectrum with effects of the primordial magnetic field (PMF) included. New limits on the PMF strength and power spectral index are obtained based upon the accumulated data for both the matter and CMB power spectra on small angular scales. We find that a maximum develops in the probability distribution for a magnitude of the PMF of $|B_\lambda| = 0.85 \pm 1.25$ nG on a comoving scale of at 1 Mpc, corresponding to upper limits of $B_\lambda < 2.10$ nG (68% CL) and $B_\lambda < 2.98$ nG (95% CL). While for the power spectral index we find $n_B = -2.37^{+0.88}_{-0.73}$, corresponding to upper limits of $n_B < -1.19$ (68% CL) and $n_B < -0.25$ (95% CL). This result provides new constraints on models for magnetic field generation and the physics of the early universe. We conclude that future observational programs for the CMB and matter power spectrum will likely provide not only upper limits but also lower limits to the PMF parameters.

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