Cosmic Magnetism in Voids and Filaments



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Inflationary helical magnetic fields with a sawtooth coupling

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We study the generation of helical magnetic fields during inflation by considering a model which does not suffer from strong coupling or large back-reaction. We consider a hybrid axion-Ratra model where the EM part is coupled to a non-monotonic time-dependent function with a sharp transition during inflation. The magnetic power spectrum is scale-invariant up to transition and blue-shifted after that. Electromagnetic conformal invariance is recovered at the end of inflation. The subsequent evolution of the helical magnetic field is subjected to an inverse cascade mechanism. We apply this model of magnetogenesis to a specific framework, namely a scale-invariant model of quadratic gravity, which is known to allow for inflationary trajectories in agreement with observations. Scale-invariant inflation also provides a theoretical motivation for having a non-monotonic coupling. We show that magnetic fields as large as ~ nG at present can be generated on Mpc scales. This result is obtained without significantly lowering the energy scale of inflation, as done in other works.

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