

Cosmological-scale magnetic fields from galactic outflows

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We study the effects of galaxy formation physics on the magnetization of the intergalactic medium (IGM) using the IllustrisTNG simulations. We demonstrate that large-scale regions affected by the outflows from galaxies and clusters contain magnetic fields that are several orders of magnitude stronger than in unaffected regions with the same electron density. Moreover, like magnetic fields amplified inside galaxies, these magnetic fields do not depend on the primordial seed, i.e. the adopted initial conditions for magnetic field strength. We study the volume filling fraction of these strong field regions and their occurrence in random lines of sight. We discuss the effects of these strong magnetic fields on Faraday Rotation Measure, ultra-high energy cosmic rays, gamma-ray propagation, and put bounds on the photon-axion conversion from spectral distortion of the CMB.

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