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The decay of primordial magnetic fields and CMB spectral distortions

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We calculate the CMB spectral distortions due to the decay of causally generated magnetic fields at the electroweak and QCD phase transitions. We show that the decay of non-helical magnetic fields generated at either the electroweak or QCD scale produce μ and y -type distortions below 10^{-8} which are probably not detectable by a future PIXIE-like experiment. We show that magnetic fields generated at the electroweak scale must have a helicity fraction $f_* > 10^{-4}$ in order to produce detectable μ -type distortions. Hence a positive detection coming from the decay of magnetic fields would rule out non-helical primordial magnetic fields and provide a lower bound on the magnetic helicity.

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