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Electrically charged curvaton

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We consider the possibility that the primordial curvature perturbation was generated through the curvaton mechanism from a scalar field with an electric charge, or precisely the Standard Model U(1) weak hypercharge. This links the dynamics of the very early universe concretely to the Standard Model of particle physics, and because the coupling strength is known, it reduces the number of free parameters in the curvaton model. We show that the model is compatible with CMB observations for large Hubble rate and large curvaton mass. Charge fluctuations generated during inflation are screened by electron-positron pairs, and therefore do not violate observational constraints. The interaction with the gauge field leads to interesting dynamics after inflation, including resonant preheating, with non-trivial observational consequences.

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