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A Cosmological Lithium Solution from Discrete Gauged Baryon Minus Lepton Number

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We propose the infrared gauge symmetry of our sector includes an unbroken discrete gauged subgroup of baryon minus lepton number of order 2 x 3 colors x 3 generations = 18, the inclusion of which does not modify local physics. We UV complete this at Λ as the familiar U(1)_{B-NcL} Abelian Higgs theory, and the early universe phase transition forms cosmic strings which are charged under an emergent higher-form gauge symmetry. These topological defects catalyze interactions which turn 3 baryons into 3 leptons at strong scale rates in an analogue of the Callan-Rubakov effect.

The cosmological lithium problem—that the observed primordial abundance is lower than theoretical expectations by a factor of a few—is perhaps the most statistically significant anomaly of SM+ΛCDM, and has resisted decades of attempts by cosmologists, nuclear physicists, and astronomers alike to root out systematics. We write down a model in which B-NcL strings superconduct bosonic global baryon plus lepton currents and catalyze solely 3p+ ⟶ 3e+. We suggest that such cosmic strings have disintegrated O(1) of the lithium nuclei formed during Big Bang Nucleosynthesis and estimate the rate, with our benchmark model finding Λ~10ˆ8 GeV gives the right number density of strings.

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