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Signals from the QCD phase transition in the early universe

The QCD phase diagram might exhibit a first order phase transition for large baryochemical potentials. We explore the cosmological implications of such a QCD phase transition in the early universe. We propose that the large baryon-asymmetry is diluted by a little inflation where the universe is trapped in a false vacuum state of QCD. The little inflation period will change the freeze-out criteria for WIMP dark matter so that their annihilation and production cross section would be reduced by orders of magnitude. In addition the power spectrum of cold dark matter can be affected up to mass scales of globular clusters. The effects of the QCD phase transition on the relic gravitational wave spectrum is controlled by the trace anomaly of QCD where we apply recent data from lattice gauge calculations. The QCD transition imprints a strong step into the spectrum of gravitational waves depending on the strength of the QCD phase transition which could be detected with the gravitational wave detectors LISA, BBO and by pulsar timing. The little QCD inflation scenario could be probed with the low-energy run at BNL's RHIC, at the heavy-ion program at GSI's FAIR, and also at CERN's LHC as it changes the freeze-out criteria for WIMP dark matter.

References:
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