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Diluting the inflationary axion fluctuation by a stronger QCD in the early Universe

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We propose a new mechanism to suppress the axion isocurvature perturbation, while producing the right amount of axion dark matter, within the framework of supersymmetric axion models with the axion scale induced by supersymmetry breaking. The mechanism involves an intermediate phase transition to generate the Higgs μ -parameter, before which the weak scale is comparable to the axion scale and the resulting stronger QCD yields an axion mass heavier than the Hubble scale over a certain period.

Combined with that the Hubble-induced axion scale during the primordial inflation is well above the intermediate axion scale at present, the stronger QCD in the early Universe suppresses the axion fluctuation to be small enough even when the inflationary Hubble scale saturates the current upper bound, while generating an axion misalignment angle of order unity.

Summary

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