

QCD axion window and low-scale inflation

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We show that the upper bound of the classical QCD axion window can be significantly relaxed for low-scale inflation. If the Gibbons-Hawking temperature during inflation is lower than the QCD scale, the initial QCD axion misalignment angle follows the Bunch-Davies distribution. The distribution is peaked at the strong CP conserving minimum if there is no other light degree of freedom contributing to the strong CP phase. As a result, the axion overproduction problem is significantly relaxed even for an axion decay constant larger than 10^{12}GeV . We also provide concrete hilltop inflation models where the Hubble parameter during inflation is comparable to or much smaller than the QCD scale, with successful reheating taking place via perturbative decays or dissipation processes.

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