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Axion dark matter with thermal friction

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Axion as a non-thermal dark matter could significantly change its cosmological evolution by interacting with a thermalized hidden sector. We study pure hidden Yang-Mills (YM) gauge fields as an example. The hidden YM gauge fields effectively act as friction to the axion field, and it results in the significant dilution of the axion abundance. We present an analytical and numerical understanding of the cosmological evolution of the axion with thermal friction and apply the results to the QCD axion. The dilution of the axion abundance makes the overabundant region of the axion dark matter viable with tuned friction parameters. We also analyze the evolution of the axion density perturbations under friction and briefly discuss its implications in pre- and post-inflationary scenarios.

Summary

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