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Bias with a Timer: Axion Domain Wall Decay and Dark Matter

Monday, 25 August 2025 16:00 (20 minutes)

We explore the interplay of the post-inflationary QCD axion and a light scalar field for the axion domain wall decay and dark matter (DM).
The interaction between the scalar field and the axion effectively serves as an explicit Peccei-Quinn (PQ) violating term. At a temperature below the PQ phase transition, the effective PQ violating interaction generates the axion potential which generally contains multiple degenerate vacua leading to the formation of the axion string-domain wall networks. Then we explore the evolution of string-wall system as the QCD phase transition provides another contribution to the axion potential making domain walls decay.We keep track of the evolution of the axion-scalar system and discuss the production of the axion DM through the domain wall decay and the misalignment contribution.We also discuss the viable parameter spaces in our model.
We find some interesting domain wall strcutures that the string-wall network in some cases can decay due to its structural instability, rather than the volume pressure, and the correct axion DM abundance is realized with the decay constant larger than that of the conventional post-inflationary QCD axion without fine tuning.

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