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Ruling out light axions : The writing is on the wall

Monday 23 January 2023 16:00 (45 minutes)

We revisit the domain wall problem for QCD axion models with more than one quark charged under the Peccei-Quinn symmetry. Symmetry breaking during or after inflation results in the formation of a domain wall network which would cause cosmic catastrophe if it comes to dominate the Universe. The network may be made unstable by invoking a 'tilt'in the axion potential due to Planck scale suppressed non-renormalisable operators. Alternatively the random walk of the axion field during inflation can generate a 'bias'favouring one of the degenerate vacuua, but we find that this mechanism is in practice irrelevant. Consideration of the axion abundance generated by the decay of the wall network then requires the Peccei-Quinn scale to be rather low —thus ruling out e.g. the DFSZ axion with mass below ~ 60 meV, where most experimental searches are in fact focussed.

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