

QCD Axion Kinetic Misalignment: Observational Aspects

When the spontaneous breaking of the Peccei-Quinn (PQ) symmetry occurred, the resulting angular direction of the PQ field, i.e. the axion could have possessed an initial nonzero velocity arising from additional terms that explicitly break the PQ symmetry. This opens up the possibility for smaller values of the decay constant than in the conventional scenario. We elaborate further on the outcome of this “kinetic misalignment” framework, assuming that axions form the entirety of the dark matter abundance. The kinetic misalignment framework possesses a weak limit in which the axion field starts to oscillate at the same temperature as in the conventional scenario, and a strong limit corresponding to large initial velocities which delay the onset of oscillations. We show how this scenario impacts the formation of axion miniclusters, and we sketch the details of these substructures along with potential detecting signatures.

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