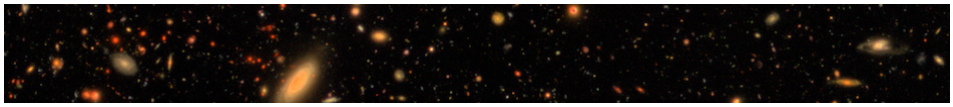

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Bubble misalignment mechanism for axions

Wednesday 16 October 2024 11:00 (20 minutes)

We study the dynamics of axions at first-order phase transitions in non-Abelian gauge theories. When the duration of the phase transition is short compared to the timescale of the axion oscillations, the axion dynamics is similar to the trapped misalignment mechanism. On the other hand, if this is not the case, the axions are initially expelled from the inside of the bubbles, generating axion waves on the outside. Analogous to the Fermi acceleration, these axions gain energy by repeatedly scattering off the bubble walls. Once they acquire enough energy, they can enter the bubbles. If the axion oscillations are relevant only inside the bubbles during the phase transition, the axion abundance is significantly enhanced compared to models where the axion mass is either constant or varies continuously as a function of temperature. The increase in axion abundance depends on the axion mass, the duration of the phase transition, and the bubble wall velocity. This mechanism results in a spatially inhomogeneous distribution of axions, which could lead to the formation of axion miniclusters. It has potential implications for the formation of oscillons/I-balls, axion warm dark matter, cosmic birefringence, and the production of dark photons.

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