



ID de Contribution: 25

Type: Non spécifié

Axion-like particle dark matter: Beyond the standard paradigm

mercredi 27 septembre 2023 11:10 (20 minutes)

Axions and axion-like particles (ALPs) are among the most popular candidates that explain the origin of the mysterious dark matter. The most popular ALP production mechanism studied in the literature is the misalignment mechanism, where an ALP field with a quadratic or cosine potential has negligible kinetic energy initially, and it starts oscillating when its mass becomes comparable to the Hubble scale. Recently, there has been an interest in models that go beyond the standard assumptions. These models extend the ALP dark matter parameter space and provide a rich phenomenology absent in the standard scenario. In particular, the ALP fluctuations grow exponentially via parametric resonance and tachyonic instabilities. In this talk, after giving an overview of the alternative production mechanisms, I will discuss the observational consequences of this exponential growth and show that a sizable region of the ALP parameter space becomes testable even if ALPs have only gravitational interactions.

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Classification de Session: Cosmo