Contribution ID: **2** Type: **not specified**

Early cosmology of ultralight dark matter

Monday, September 29, 2025 10:15 AM (45 minutes)

Ultralight dark matter (ULDM) has emerged as a compelling candidate to explain the dark sector, motivated not only by its potential to resolve small-scale structure issues but also by its natural appearance in high-energy theories such as string compactifications, as well as the coincidence of the observed abundance in the case of spin-0 scalar dark matter. In this talk, I will discuss the early cosmology of ULDM. I will review the misalignment mechanism for spin-0 scalar fields and its relation to inflationary dynamics, addressing constraints from isocurvature perturbations and possible resolutions. Building on this, I will then explore the case of spin-1 ULDM. In particular, I will analytically reinterpret some known numerical results for light dark photon production from spin-0 scalar by the stimulated scalar decay, and argue that the analytic formulation is independent of the particle spin. This suggests that the mechanism may provide a generic production channel for ULDM of arbitrary spin.

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