

Scalars 2023

Contribution ID : 69

Role of scalars in gravitational production of vector dark matter

Saturday 16 Sep 2023 at 09:15 (00h15')

Content :

The existence of dark matter (DM) has been well established by overwhelming indirect evidence indicating the presence of a dark Universe. However, very little is known about its origin and nature. Despite our general lack of knowledge, it is indisputable that dark matter interacts gravitationally with visible matter. Although in a plethora of DM models, it is commonly assumed that DM couples to the Standard Model particle content through some additional force, this premise might be naive wishful thinking. Thus, it is natural to raise a question: what if DM has only gravitational interactions with the visible sector? In this talk, I will explore a very minimal DM scenario by assuming that the dark sector comprises massive spin-1 particles with no direct or indirect interactions other than gravity. In particular, I will focus on the description of DM production mechanisms in the primordial Universe, considering the role of a scalar field in such phenomena. Three irreducible DM production processes will be discussed: tachyonic enhancement during inflation, gravitational production in the oscillating inflaton background, and gravitational freeze-in from the Standard Model bath. I will demonstrate that accounting for the dynamics of the early Universe, i.e., the inflationary and reheating phases, is crucial for determining the evolution of purely gravitational dark matter.

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Session classification : Parallel Session 8

Track classification : --not yet classified--

Type : --not specified--