



Contribution ID: 1

Type: **not specified**

UV Freeze-in in Starobinsky Inflation

Thursday 24 September 2020 10:00 (20 minutes)

In the Starobinsky model of inflation, the observed dark matter abundance can be produced from the direct decay of the inflaton field only in a very narrow spectrum of close-to-conformal scalar fields and spinors of mass $\sim 10^7$ GeV. This spectrum can be, however, significantly broadened in the presence of effective non-renormalizable interactions between the dark and the visible sectors. In particular, we show that UV freeze-in can efficiently generate the right dark matter abundance for a large range of masses spanning from the keV to the PeV scale and arbitrary spin, without significantly altering the heating dynamics. We also consider the contribution of effective interactions to the inflaton decay into dark matter.

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Session Classification: CoCo