

IberiCOS 2022



Contribution ID : 70

Type : not specified

Axion-like particles from primordial black holes shining through the Universe

Thursday, 5 May 2022 17:15 (15)

We consider a cosmological scenario in which the very early Universe experienced a transient epoch of matter domination due to the formation of a large population of primordial black holes (PBHs) with masses $M < 10^9$ g, that evaporate before Big Bang nucleosynthesis. In this context, Hawking radiation would be a non-thermal mechanism to produce a cosmic background of axion-like particles (ALPs). We assume the minimal scenario in which these ALPs couple only with photons. In the case of ultralight ALPs ($m < 10^{-9}$ eV) the cosmic magnetic fields might trigger ALP-photon conversions, while for masses $m > 10$ eV spontaneous ALP decay in photon pairs would be effective. We investigate the impact of these mechanisms on the cosmic X-ray background, on the excess in X-ray luminosity in Galaxy Clusters, and on the process of cosmic reionization.

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