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Dark Matter Annihilations in the Causal Diamond

We investigate the implications of dark matter annihilations for
cosmological parameter constraints using the
causal entropic principle. In this approach cosmologies are
weighted by the total entropy production within a
causally connected region of spacetime. We calculate the expected
entropy from dark matter annihilations within the causal diamond and investigate the preferred values of
the cosmological constant and the mass and annihilation cross section of the annihilating dark matter
and their dependence on the assumptions in the models. For realistic values of the cross section we typically
find preferred values of Λ on the order of 10^{-5} of the
present value assuming dark matter annihilations are the primary
source of entropy production. The
greatest amount of entropy production from dark matter within the
causal diamond is likely to occur with light keV scale dark matter with low annihilation cross section. We
also investigate the effect of
combining this entropy with the entropy production from stars, and show that if the primary source of entropy
production is from stars, varying the dark matter cross section directly produces a preferred value of Ω_m in
excellent agreement with observations.

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