

# 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  $\Lambda$  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  $\Omega_m$  in excellent agreement with observations.

**Primary author:** SCACCO, Andrew (UC Davis)

**Co-author:** ALBRECHT, Andreas (UC Davis)

**Presenter:** SCACCO, Andrew (UC Davis)

**Track Classification:** Aug/12