Contribution ID: **488**   Type: **parallel talk**

Variation of α from a Dark Matter Force

Tuesday 8 May 2018 16:30 (15 minutes)

We consider a feeble long range scalar force that mainly couples to dark matter and unstable Standard Model states, like the μ. The induced background scalar field depends on dark matter number density, causing the mass of the unstable particles to have spatial and temporal variations. These variations would leave an imprint on the value of the fine structure constant α. This mechanism can accommodate the mild preference of the Planck data for such a deviation, $(\alpha_{\mathrm{CMB}} - \alpha_{\mathrm{present}})/\alpha_{\mathrm{present}} = (-3.6 \pm 3.7) \times 10^{-3}$. In this case, the requisite parameters typically imply that violations of the Equivalence Principle are not far beyond current limits.

Summary

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Session Classification: Cosmology II