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A Dark Sector to Restore Cosmological Concordance

Monday, 24 May 2021 16:45 (15 minutes)

There are currently tensions between observations of the early and late Universe in the determination of the cosmological parameters S_8 and H_0. In this talk, I will discuss a new phenomenological model that addresses these tensions. Our scenario features: (i) a decaying dark energy fluid, which undergoes a transition at $z \sim 5,000$, to raise today's value of the Hubble parameter – addressing the H_0 tension, and (ii) an ultra-light axion, which starts oscillating at $z \sim 16,000$, to suppress the matter power spectrum – addressing the S_8 tension. Our Markov Chain Monte Carlo analyses show that such a Dark Sector model fits a combination of early time datasets slightly better than the ΛCDM model, while reducing both the H_0 and S_8 tensions to $<\sim 3\sigma$ level. Combined with measurements from cosmic shear surveys, we find that the discrepancy on S_8 is reduced to the 1.4σ level, and the value of H_0 is further raised. Adding local supernovae measurements, we find that the H_0 and S_8 tensions are reduced to the 1.5σ and 1.1σ level respectively, with a significant improvement $\Delta\chi^2 \simeq -17$ compared to the ΛCDM model. A particle physics realization of this model could be found in a dark confining gauge sector and its associated axion, although embedding the full details within microphysics remains an urgent open question. This scenario will be decisively probed with future CMB surveys. This talk is based on Ref. 2104.12798.

Summary

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