## Phenomenology 2021 Symposium



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## A Dark Sector to Restore Cosmological Concordance

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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 ultralight 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  $\Lambda$ CDM 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  $1.4\sigma$  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  $1.5\sigma$  and  $1.1\sigma$  level respectively, with a significant improvement  $\Delta \chi^2 \simeq -17$  compared to the  $\Lambda$ CDM 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

Authors: ALLALI, Itamar; HERTZBERG, Mark (Tufts University); ROMPINEVE, Fabrizio (Tufts University)

Presenter: ALLALI, Itamar

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