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Varying Higgs VEV in Cosmology and an Axionic Solution

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The ΛCDM model provides an excellent fit to the CMB data. However, a statistically significant tension emerges when its determination of the Hubble constant H_0 is compared to the local distance-redshift measurements. The axi-Higgs model, which couples ultralight axions to the Higgs field, offers a specific variation of the ΛCDM model. It relaxes the H_0 tension as well as explains the ^{7}Li puzzle in Big-Bang nucleosynthesis, the S_8 tension with the weak-lensing data, and the observed isotropic cosmic birefringence in CMB. In this letter, we demonstrate how the H_0 and S_8 tensions can be resolved simultaneously, by correlating the axion impacts on the early and late universe. In a benchmark scenario selected for experimental tests soon, the analysis combining the CMB+BAO+WL+SN data yields $H_0 = 71.1 \pm 1.1$ km/s/Mpc and $S_8 = 0.766 \pm 0.011$. Combining this (excluding the SN(supernovae) part) with the local distance-redshift measurements yields $H_0 = 72.3 \pm 0.7$ km/s/Mpc, while S_8 is almost unchanged.

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