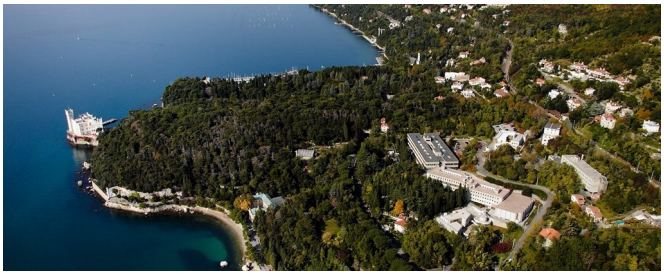

Contribution ID: **152** Type: **not specified**

A transitional Planck Mass exploration in light of cosmological tensions

Friday 1 September 2023 17:50 (25 minutes)

Deviations from the standard cosmological model (ΛCDM) at early times, specifically in the context of Early Dark Energy (EDE), have garnered attention in the cosmological community as a potential solution to the Hubble/sound horizon tension. These deviations can also be achieved through modifications of gravity, providing an alternative way to modify the expansion history and potentially alleviate the H_0 tension. These modifications also impact the growth of perturbations, altering the shape of the Cosmic Microwave Background (CMB) spectra and the inferred value of the S8 parameter from Planck data. In this talk, I will present results for a specific modified gravity model known as the Transitional Planck Mass (TPM) model. This model incorporates a transition in the value of the effective Planck mass (or effective gravitational constant) on cosmological scales prior to recombination. I will show how such transition can be obtained within the framework of the Effective Field Theory of Dark Energy and Modified Gravity, and show constraints on the model obtained using CMB, Baryon Acoustic Oscillations, and Type Ia Supernovae data. The constraints obtained for the TPM model prefer a ~5% shift in the value of the effective Planck mass (<10% at 2σ) prior to recombination. The transition in the TPM model can occur at any point over multiple decades of the scale factor prior to recombination, characterized by log10(a) = −5.32+0.96−0.72 (68% CL). This transition reduces the sound horizon at last scattering, resulting in an increased Hubble constant. With a combination of local measurements as a prior, the Hubble constant is determined to be 71.09±0.75 km s−1Mpc−1, and without the prior, it is 69.22+0.67−0.86 km s−1Mpc−1. The TPM model exhibits improvements in the goodness-of-fit (χ^2) compared to ΛCDM, with $\Delta\chi^2 = -23.72$ when using the Hubble constant prior and $\Delta\chi^2 = -4.8$ without the prior. The TPM model allows for values of $H_0 > 70$ km s−1Mpc−1 and S8 < 0.80 simultaneously, with lower values of S8 compensating for the increase in H_0 relative to ΛCDM. Recent constraints obtained using Dark Energy Survey and South Pole Telescope data will also be presented. While the TPM model represents a specific modified gravity model, exploring other variants of modified gravity may offer a productive path toward potentially resolving cosmological tensions. By studying different modifications of gravity, we can gain deeper insights into the nature of the universe and its expansion, and potentially uncover new avenues for addressing the outstanding challenges in cosmology.

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Session Classification: Parallel