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A Comprehensive Analysis of Beyond \(\Lambda\)CDM with Cosmological Data

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In this talk the discrepancies include the long-standing difference in the Hubble constant \(H_0 \), as well as variations between Planck data and weak lensing measurements regarding the matter-energy density \(\Omega_m \) and the amplitude \(\sigma_8 \) (or the redshift space distortion \(f \sigma_8 \)) of cosmic structures will be explored. These inconsistencies suggest the possibility of new physics beyond the standard ΛCDM model, such as early dark energy or modified gravity theories. Resolving these tensions is crucial for improving our understanding of the Universe's accelerating expansion and large-scale structure formation, and it may highlight limitations in existing cosmological models.
This study highlights resolving such cosmological tensions through alternative theories of gravity from various observational datasets, including Planck-2018, DESI, CMB, RSD, and SNIa. The observed tensions suggest potential discrepancies between model predictions and observational constraints, indicating a need for thorough evaluations of modified gravity theories as alternatives for cosmic acceleration. Resolving these tensions is critical for improving our understanding of dark energy, matter density, and the dynamics of the Universe. Furthermore, addressing the disparities in these measurements will inform the design of future cosmological surveys and help prioritize observational strategies, potentially leading to significant discoveries about the nature of gravity and the Universe.

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