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Confronting the Universe's Accelerating Expansion: Insights from a Hybrid Scale Factor

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The Lambda Cold Dark Matter (ΛCDM) model is a well-known cosmological model that has been used to investigate the acceleration of the universe. In our earlier study, we introduced a modified scale factor (Aydiner et al., 2022) to examine the universe's accelerating expansion without relying on the conventional dark energy framework of the lambda-cold-dark matter model. In order to test the viability of the Modified Scale Factor (MSF), we constrained the model using the observational Hubble parameter (OHD) and the distance modulus measurements (SNIa) and a combination of the data sets. Through numerical simulations and observational constraints, our findings demonstrated that the MSF model aligns well with empirical data, offering a competitive alternative to ΛCDM. Specifically, we explore its implications for cosmic evolution beyond the previously considered data sets, assess its predictive power in a broader observational context, and investigate potential refinements that improve its consistency with large-scale structure observations.

Author: GAEDIE, Goratamang Ann (North-West University/South African Astronomical Observatory)

Co-authors: Prof. ABEBE, Amare (North-West University); AKALU, Shambel Sahlu (Centre for Space Research North-West University, South Africa)

Presenter: GAEDIE, Goratamang Ann (North-West University/South African Astronomical Observatory)