MAGIC

Science of the Cosmos

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Statistical Analysis of Cosmologies in \(f(R) \) Theories with DESI DR2 2025 Data

This year, a publication from the DESI DR2 project has attracted significant attention by reporting new measurements of Baryon Acoustic Oscillations (BAO), which provide very strong evidence in favor of an alternative cosmological model compared to the standard cosmological model (ΛCDM). Specifically, the authors perform a statistical analysis using these data for both the standard ΛCDM model and an alternative dark energy scenario characterized by a time-dependent equation of state, followed by a Bayesian model comparison. It is through this comparison that, notably, very strong evidence was found in favor of the alternative model —an outcome that explains the considerable impact of the publication.

Motivated by these results, we have carried out a similar analysis to investigate the Bayesian comparison between the ΛCDM model and a class of alternative cosmologies derived from generalized theories of gravity of the $f(R)$ type.

These kind of models are capable of explaining the accelerated expansion of the Universe without invoking dark energy proposing that acceleration arises from intrinsic geometrical properties of spacetime itself.

We analyze four of the most widely accepted $f(R)$ gravity models, incorporating a comprehensive set of cosmological observational data. Our analysis includes cosmic chronometers, Type Ia supernovae (SNe Ia), and the latest, high-precision Baryon Acoustic Oscillation (BAO) measurements from the DESI Data Release 2 (DR2).

Our findings also show very strong evidence in favor of the alternative model over the standard cosmological paradigm.

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