

Investigating the effects of various statistical model fitting criteria in Kosmulator

Dr. Renier T. Hough^{*†}
Prof. Amare Abebe

This project utilises the Python-based `Kosmulator` framework to investigate how different statistical information criteria impact cosmological model selection. With recent data (e.g., *DESI*) suggesting potential deviations from the standard model, robust statistical comparison is crucial. By implementing new selection criteria into `Kosmulator`'s post-processing pipeline and testing them against late-time observational datasets, this study aims to evaluate the penalty these criteria place on extended models and provide insights into the current cosmological landscape.

1 Objectives

- Familiarisation with the `Kosmulator` framework and its Markov Chain Monte Carlo (MCMC) output structures.
- Implement two feasible criteria (e.g., AICc and DIC) and one moderately complex criterion (WAIC) into the statistical post-processing module.
- Perform automated model selection using solely background/late-time observational datasets (e.g., Type Ia Supernovae, Cosmic Chronometers, and BAO/*DESI*).
- Compare the selection criteria across a specific set of models:
 - The standard Λ CDM model as a baseline.
 - Extended standard models: w_0w_a CDM and $\Omega_k\Lambda$ CDM.
- Evaluate and document how each criterion penalises the extra degrees of freedom across the different datasets.

2 Special requirements

The student should have experience programming in Python and basic Linux terminal usage.

This is an Honours level project that can be extended to a Master's level.

renierht@gmail.com
North-West University