

Interpretable Neural Networks for testing Beyond- Λ CDM scenarios with CMB and Large-Scale Structure Data

Monday, July 14, 2025 4:00 PM (25 minutes)

The era of precision cosmology has provided an unprecedented opportunity to test fundamental physics using Cosmic Microwave Background (CMB) and Large-Scale Structure (LSS) data. In this talk, I will present our recent work on applying neural networks (NNs) for cosmological model selection, focusing on two case studies: CMB power spectra from Planck 2018 data and galaxy clustering surveys. Our approach explores the ability of NNs to distinguish between the standard Λ CDM model and beyond- Λ CDM scenarios, including modified gravity (Hu-Sawicki $f(R)$) and inflationary feature models. A key aspect of our methodology is the implementation of interpretability tools, such as SHAP and LIME, to identify the most relevant features driving the model classification. Our results demonstrate that NNs can achieve high accuracy in discriminating between models, while interpretability techniques help reveal some key physical processes governing these scenarios. These findings highlight the potential of machine learning to enhance cosmological inference and pave the way for its integration into next-generation surveys.

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