

## The Apparent Fine-Tuning of the Cosmological Constant

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Observational cosmology is at its golden age with high precision experiments such as the Planck satellite measuring the cosmic microwave background with unprecedented precision. In the cosmological model in vogue, the Lambda-CDM model, the universe is flat (or very close to it), with a conspicuous component accounting for the majority of the energy density of the universe, which can be the dark energy or cosmological constant, and a smaller contribution from baryonic and dark matter. The cosmological constant has a very small value which cannot be explained by fundamental physics. A consequence of this apparent fine-tuning is that changes in the value of this constant may affect the growth of structures such as galaxies, rendering life impossible. Although the underlying theoretical framework of Lambda-CDM is well understood, it is interesting to study alternative models to explore the consequences of “untuning” the cosmological constant.

In this summer project the student will study cosmological models in detail and explore the issue of the apparent fine-tuning of the cosmological constant. By confronting theoretical models with observations, it will be possible to constrain some scenarios and acquire basic skills for research on theoretical cosmology. The results of this research project will be used to feed an outreach website on the physics of fine-tuning, which will contain detailed derivations of equations, interactive graphs and discussion of related topics.

Required skills:

Good computational skills are required. Knowledge of JavaScript is a plus. Background in cosmology is desirable.