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Probing Unification Scenarios with Big Bang Nucleosynthesis

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Big Bang Nucleosynthesis (BBN) is an observational cornerstone of the Hot Big Bang model and a sensitive probe of physics beyond it. Although some analytic approximations can be made, a fully consistent analysis must be done numerically, starting with the classic code by Kawano and leading to the recently developed PRyMordial, a publicly available Python code. An example of physics beyond the standard model to which BBN is sensitive are Grand Unified Theory (GUT) models. A self-consistent perturbative analysis of the effects of variations in nature's fundamental constants, which are unavoidable in a broad class of GUT models, has recently been developed. The specific goal of this PIC project is to implement this perturbative approach in the PRyMordial code. This will enable a subsequent use of the extended code to obtain constraints on GUT models using current observations, and also detailed forecasts of improvements expected with next generation astrophysical facilities, such as the ANDES spectrograph for the ELT.

Primary author: DREYER, Iuna

Presenter: DREYER, Iuna