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The seperate universe approach to multifield inflation

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Primordial black holes could constitute part or all of dark matter but they require large inhomogeneities to form in the early universe. These inhomogeneities can strongly backreact on the large scale dynamics of the universe. Stochastic inflation provides a way of studying this backreaction and getting an estimation of the abundance of primordial black holes. Because stochastic inflation focuses on large scale dynamics, it rests on the separate universe approach. However, the validity of this approach has only been checked in single field models, but not in multifield models in which we expect strong boosts in the power spectrum, leading to the formation of primordial black holes. We will check the validity of a separate universe approach in multifield models by matching it with a complete cosmological perturbation theory approach at large scales. In particular, we wish to compare these two paradigms and their differences in the adiabatic and entropic directions of the phase space. This will give us a range of validity and conditions one needs to verify in order to apply the separate universe approach and stochastic inflation in multifield models. We will then focus on gauge fixing in these two paradigms and check when the matching still holds.

Astrophysics Field

Theoretical cosmology

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