

Towards the prediction of primordial- black-hole clusters

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Primordial black holes (PBHs) are a major candidate for dark matter, expected to form from the collapse of large density fluctuations generated during inflation. Their abundance is highly sensitive to non-linear effects, some of which can be described through the δN formalism. This approach models the universe as a set of locally homogeneous patches evolving independently throughout inflation. However, accounting for the spatial correlations between these patches is crucial to predicting the spatial distribution of PBHs and the formation of clusters. In this talk, after reviewing the δN formalism, I will show how to include spatial correlations within this framework. As an illustration, I will discuss the ultra-slow-roll model and compute the curvature perturbation ζ —necessary to determine PBH formation —and its spatial correlations. In the future, this could enable the prediction of PBH binaries and clusters, which may leave observable imprints such as gravitational waves.

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