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Searching for signatures of non-Gaussianity in the Cosmic Web with the Peak Patch simulations

All models of inflation predict some non-Gaussian signatures in the cosmological distribution of energy, the search for which is a subject of great importance to our understanding of the early universe. In this work, we present simulated sky maps for a novel extended stochastic inflation model that is motivated by an ambitious suite of high-accuracy lattice simulations of early-universe field theories. This model leads to spatially-localized, intermittent and uncorrelated non-Gaussianities with amplitudes not confined by the tight constraints on classical $f_{\rm NL}$. Post-inflation fields are input to produce dark matter halo catalogues and mock observables of Sunyaev-Zel'dovich effects, the cosmic infrared background (CIB) and lensing maps using the Peak Patch-Websky pipeline, which is being effectively used at CITA for a wide array of large-scale structure (LSS) modelling. These simulations are fast and versatile because the highly dynamical halos are modelled patches moving through a weakly non-linear background, so only low-order solutions to the equations of motion are needed to produce catalogues. As a result, we can generate maps at orders of magnitude less computational expense than N-body simulations, making this both a highly efficient and sustainable template to identify important non-Gaussian features in the complex cosmic web.

Author: CARLSON, Nathan J. (CITA/University of Toronto)

Co-authors: BOND, J Richard (CITA); Mr HAIDER, Jibran (CITA/University of Toronto); Mr MORRISON, Thomas (CITA/University of Tornto)

Presenter: CARLSON, Nathan J. (CITA/University of Toronto)

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