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Clustering of primordial black holes from quantum diffusion during inflation

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When investigating primordial black hole (PBH) formation scenarios, a central question is to characterise their initial clustering, which then determines their subsequent clustering evolution throughout cosmic history. In this talk I will present how top compute PBH clustering in the presence of non-perturbative non-Gaussianities, making use of the stochastic- δN formalism. To this end, I will show how to derive the two-point statistics of the curvature perturbation in stochastic inflation, consistently including volume-weighting effects. Due to the presence of exponential tails, the joint distribution of large fluctuations is of the form $P(\zeta_{R_1}, \zeta_{R_2}) = F(R_1, R_2, r)P(\zeta_{R_1})P(\zeta_{R_2})$, where ζ_{R_1} and ζ_{R_2} denote the curvature perturbation coarse-grained at radii R_1 and R_2, around two spatial points distant by r. This implies that, on the tail,the reduced correlation function, defined as $P(\zeta_{R_1} > \zeta_c, \zeta_{R_2} > \zeta_c)/[P(\zeta_{R_1} > \zeta_c)P(\zeta_{R_2} > \zeta_c)]-1$, is independent of the threshold value ζ_c. This contrasts with Gaussian statistics where the same quantity strongly decays with ζ_c, and shows the existence of a universal clustering profile for all structures forming in the exponential tails. Structures forming in the intermediate (i.e. not yet exponential) tails may feature different, model-dependent behaviours.

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