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Small-scale clustering of Primordial Black Holes

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In this talk, based on arXiv:2402.00600, we revisit the initial spatial clustering of Primordial Black Holes (PBHs) originating from the Hubble reentry of large Gaussian density fluctuations in the early Universe. Using an excursion-set approach, we derive the two-point correlation functions of PBHs, properly accounting for the "cloud-in-cloud" mechanism. Our expressions naturally and intrinsically correlate the formation of pairs of PBHs, which is a key difference with the Poisson model of clustering. Our approach effectively includes short-range exclusion effects and clarifies the clustering behaviors at small scale: PBHs are anticorrelated at short distances. Using a scale-independent collapse threshold, we derive explicit expressions for the excess probability to find pairs of PBHs, as well as the excess probability to find pairs with asymmetric mass ratio. Our framework is model independent by construction, and we discuss possible other applications.

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