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On the IR divergences in de Sitter: from trees to loops and back

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Interacting light scalars in de Sitter spcae (dS) normally lead to infrared divergences. I shall revisit this topic with recent developments of the cosmological bootstrap. At the tree level, we see that for both contact and exchange diagrams, the boundary differential equations become the ones from anomalous conformal Ward identities. The results from massless exchanges allow us to bootstrap a full set of non-Gaussianities from multi-field inflation. At the loop level, we apply the wavefunction method, and identify that the leading contributions to IR-divergent correlators always come from classical loops from tree-level wavefunction coefficients. This significantly simplifies the problem and indicates the importance of the saddle-point approximation when we go beyond perturbation theory. With this insight, we present a non-perturbative derivation of the stochastic formalism. Using the semi-classical wavefunction, we find that the Fokker-Planck equation follows from a combination of the Schroedinger equation and the Polchinski equation for the exact renormalization group flow.

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