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Stochastic inflation from QFT and the parametric dependence of the effective noise amplitude

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During inflation, quantum field fluctuations are placed in squeezed states which undergo quantum-to-classical transitions on super-Hubble scales, in the sense that the non-commutative parts of the fields then become small compared to their anti-commutative parts. An effective theory for the physics of the long-wavelength parts of quantum scalar fields in the super-Hubble regime is the stochastic inflation formalism. In this framework, the non-linear dynamics of the long-wavelength perturbations may be phrased in terms of an effective classical, but stochastic evolution equation. The stochastic noise represents short-wavelength modes which continually redshift into the long-wavelength domain during the inflationary expansion. Long-wavelength observables can be computed from a corresponding Fokker-Planck equation, and has been shown to reproduce the correct IR behaviour of the full QFT statistical propagator to leading order in the coupling. This has made stochastic inflation a popular resummation method in the cosmological context, yet its range of validity compared to other QFT methods remain unclear. In this talk I will discuss some recent progress related to how the stochastic dynamics may be derived from first-principles QFT in an expanding background through a sequence of approximations.

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