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Live Talk 6: De Sitter Diagrammar and the Resummation of Time [Matthew Baumgart]

Wednesday 9 September 2020 16:00 (1 hour)

Abstract: Light scalars in inflationary spacetimes suffer from infrared logarithmic divergences at every order in perturbation theory. This corresponds to the scalar field values in different Hubble patches undergoing a random walk of quantum fluctuations, leading to a “simple toy landscape” on superhorizon scales, in which we can explore questions relevant to eternal inflation. However, for a sufficiently long period of inflation, the infrared divergences appear to spoil computability. Some form of renormalization group approach is thus motivated to resum the log divergences of conformal time. Such a resummation may provide insight into De Sitter holography. We present here a novel diagrammatic analysis of these infrared divergences and their resummation. Basic graph theory observations and momentum power counting for the in-in propagators allow a simple and insightful determination of the leading-log infrared divergences. One thus sees diagrammatically how the superhorizon sector consists of a semiclassical theory with quantum noise evolved by a first-order, interacting classical equation of motion. This rigorously leads to the “Stochastic Inflation” ansatz developed by Starobinsky to cure the scalar infrared pathology nonperturbatively. Our approach is a controlled approximation of the underlying quantum field theory and is systematically improvable.