

Abstract

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We studied the cosmological linear perturbation theory. To learn how the perturbation variables evolve we derived a set of coupled Boltzmann-Einstein equations for the perturbation variables. These equations cannot be solved analytically all at once. We studied the leading order solutions in four approximations: super-horizon modes, sub-horizon modes, modes which crossed horizon at early and late times. The solutions are sensitive to the initial conditions. We also discussed a modified theory of gravity for the early universe motivated from the works in quantum gravity. Under such modified theory we again constructed the modified equations for dynamics and kinetics between the components of our universe. This modified theory suggest an inclusion of a pre-inflationary era. We propose for future exploration that one needs to examine how the initial conditions set at the end of the pre-inflationary era translates to the initial conditions at the end of inflation which are the standard initial conditions for the linear perturbation theory and see if there is any signature of the quantum gravity effect at the late time evolution of perturbation variables.