Renormalization of Nonequilibrium Dynamics in FRW Cosmology *

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1 Introduction

Over the last 15 years there has been a sustained effort to study the evolution of scalar fields within the context of the early universe. These efforts have been largely fueled by the introduction of inflation [1], which has been shown to be a possible solution of the horizon and flatness problem. In addition to model building and other discussion of how scalar field theories can produce inflation, the question of the reheating [2, 3] of the universe, the transfer of energy from the inflaton mode to other particle modes, has recieved much attention. The reason for this is, that the exponential expansion of during inflation makes the universe to become very cold. In order to achieve the standard results of nucleosynthesis and other processes, the universe must be reheated to temperatures above those at which important processes take place. Early efforts to account for the necessary reheating introduced an ad hoc decay width to the inflaton. It was assumed that the energy transfer occured through single particle decay. However, more recently, it has been realized that there are much more efficient processes such as parametric resonance [4] in the case of chaotic inflation. Such mechanisms, in which the rate of energy transfer grows exponentially, are referred to generally as preheating [4, 7]. Recently, the dynamical processes of inflation and preheating are treated within a nonequilibrium formalism [5-14]. It is necessary due to

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