Dynamical reduction theories, inflation and the emergence of structure in the universe

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Inflationary cosmology is claimed to provide the most natural account for the generation of the primordial density inhomogeneities representing the seeds of all structure in our universe. The framework involves the quantum fluctuations of the initial state of the space-time metric and matter fields, a state which is however homogenous and isotropic. It its worth pointing out that the situation seems to be the only one where general relativity and quantum theory come together in a context which is empirically accessible.

On the other hand, the fact is that none of the existing interpretational frameworks for quantum theory seems to be able to provide a reasonable account for the breaking of the initial symmetries of homogeneity and isotropy that are intrinsic to the inflationary paradigm.

We will argue that if the empirical success of inflation regarding its prediction of the spectrum of primordial fluctuations" is to be put in solid conceptual grounds, some modification of quantum theory is required.

We will discuss the nature of such modifications, which in our view are likely to fall into the class of what are generally known as dynamical reduction theories, such as suitable modifications of GRW or CSL. Moreover we will analyze the way in which such theories can be incorporated modifying the standard treatments of the problem at hand, as well as ideas regarding their likely origin and their possible connection with other open issues in the interface of quantum theory and gravitation.