Predictive physics of Inflation for and from the CMB and Large Scale Structure observations

Inflation is today part of the Standard Model of the Universe supported by the cosmic microwave background (CMB), large scale structure (LSS) and other precision cosmological observations. A recent White Paper for the CNRS Prospectives 2020 « Physics of Inflation and Dark Energy » presents the state of the art and the timely actuality of the effective theory of inflation in the Ginsburg-Landau approach (developed by de Vega, Sanchez and collaborators) and its successful confrontation to all the CMB and LSS data till now. This White Paper paves the way to extract high scientific benefit from the forthcoming CMB and LSS data, it adds interdisciplinarity, unifying with gravitational and particle physics within a strongly predictive approach.

Inflation naturally generates the density fluctuations that seed the large scale cosmic structures, the CMB anisotropies, and the tensor perturbations: the primordial gravitational waves of quantum mechanical origin or primordial gravitons. Inflation is based on a scalar field (the inflaton) whose potential is fairly flat leading to a slow-roll evolution preceded by a generic very short fast roll stage.

The formulation of inflation in the field theory approach of phase transitions (the Ginsburg-Landau approach in superconductivity), as developed by de Vega, Sanchez and collaborators, see the news here for instance https://www.observatoiredeparis.psl.eu/a-new-analysis-of-wmap-and-large-scale-structure.html?lang=en
shows itself highly timely and predictive.

The White Paper [ref 1] focuses on realistic and timely situations of inflation in connection with the CMB, gravitational and particle physics, as the primordial gravitational waves generated by inflation, the hints of the Grand Unification energy scale (10^{14} - 10^{16} GeV) and the super-symmetry breaking scale through inflation.

All CMB+LSS (Large Scale Structure) data until now (from WMAP to Planck and the other data) show the power of the Ginsburg-Landau effective theory of inflation in predicting the whole set of observables including the inflation energy scale and the inflaton potential, and which has much more to provide in the future.

Inflation is thus placed in the setting of field theories of particle physics and phase transitions. It sets up a clean way to directly confront the inflationary predictions with the CMB and LSS data and select a definitive model.

Forthcoming observations of CMB anisotropies and polarizations as well as large scale deep surveys will provide a substantial body of high precision observational data.

The physical synthesis presented in the White Paper ref [1] integrates and establish cross-correlations of the present knowledge and data, intended to fruitfully extract high scientific benefit and interpretation from the new data: for the low and high multipoles,

for the Electric (E) and Magnetic (B) polarization spectra, for the signatures of the fast -roll initial stage, the very small primordial non-gaussianity and the still more small running of the primordial spectral index, and for the objective of detection of the B modes: the primordial gravitational waves of quantum mechanical origin.

Keywords: Standard Model of the Universe. Ginsburg-Landau approach. Grand unification physics. CMB data. LSS data. Large scale surveys. Primordial gravity waves.

Reference [1]: Norma G. Sanchez , *Predictive physics of inflation and grand unification for and from the CMB observations.*

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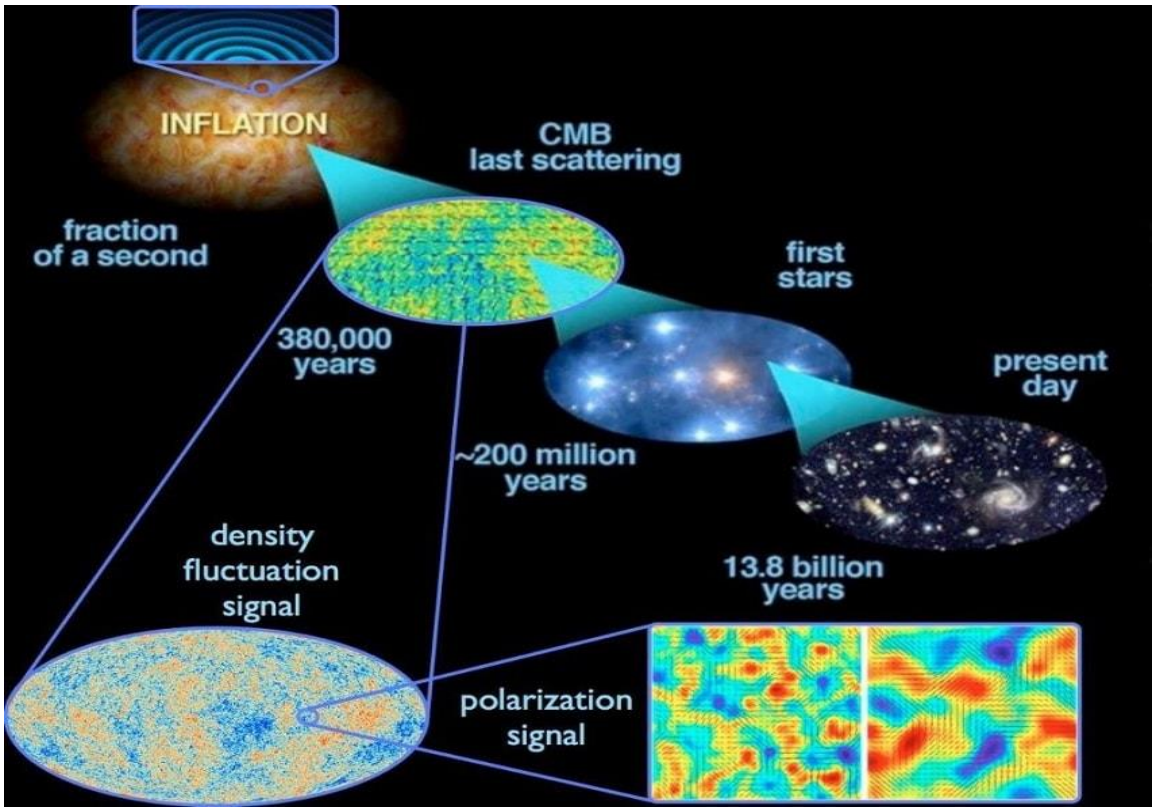

The image shows Inflation within the cosmic evolution of the Universe. Inflation produces at the same time density and tensor fluctuations which are imprinted in the CMB fluctuations patterns of temperature and polarization signals.