

Generación de campos gaussianos en teorías inflacionarias

TFG: FS20-29-FSC

13 de noviembre de 2022

Universidad de Córdoba

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Abstract

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In order to explain certain peculiarities that appear in the Big Bang theory, we resort to the concept of inflation. By treating this idea in a quantum way, a mechanism that produced the primordial density fluctuations that gave rise to the complex structures of the universe such as galaxies, stars and life itself appears.

This paper gives an introduction to the theoretical framework of the Big Bang and its problems and inflation, as well as the fluctuations that occurred in the primordial universe and the statistics needed to understand them. The initial distribution of these fluctuations can be shaped by means of a random density field with Gaussian statistics (which is fully characterized by its primordial power spectrum $P_0(k) \propto k^{n_s}$), as predicted by inflationary theories. For the purpose to delve, beyond intuition, into the meaning of such a Gaussian statistics, an algorithm has been programmed in the Python language that is able to numerically simulate these fluctuations in the primordial universe and in the recombination epoch by incorporating the transfer function $T(k)$ into the power spectrum $P(k) \propto k^{n_s} T^2(k)$. This is done by using tools such as the fast Fourier transform or random numbers, of which a theoretical introduction is also provided.

Finally, the numerical simulations for different n_s values are represented by means of heat maps, which are the peak results of the work.

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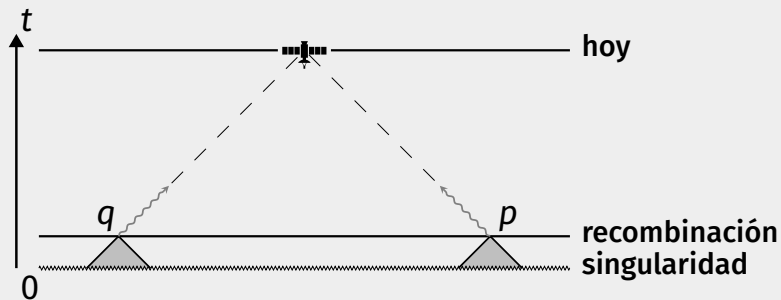
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Inflación

En el *Hot Big Bang* aparecen una serie de problemas teóricos, entre ellos: **el problema del horizonte**

Introducción



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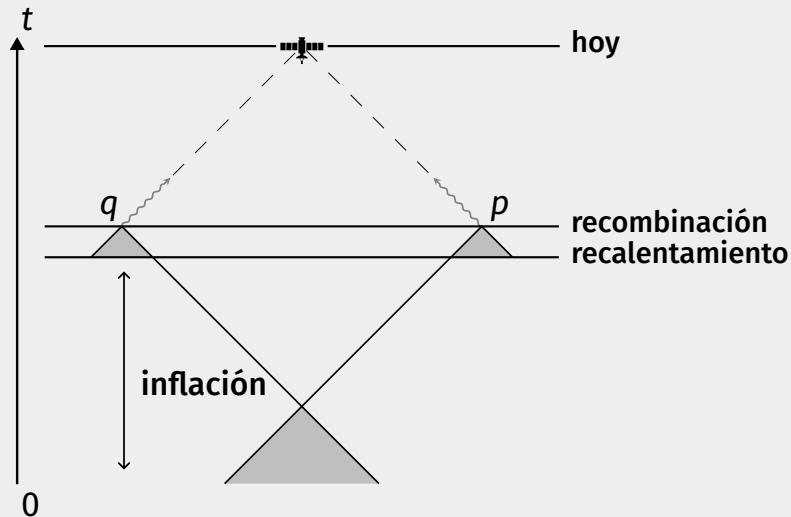
Inflación

En el *Hot Big Bang* aparecen una serie de problemas teóricos, entre ellos: **el problema del horizonte** y el **problema de la planitud**:

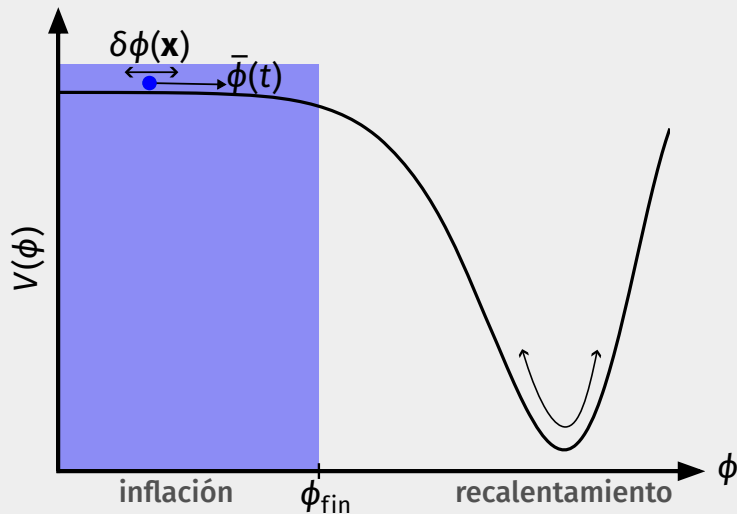
$$H^2 = \frac{8\pi G}{3}\rho - \frac{kc^2}{a^2}, \quad \rho_c \equiv \frac{3H^2}{8\pi G} = \rho.$$

Inflación es capaz de resolver estos dos problemas y además provee de manera natural un mecanismo generador de las fluctuaciones primordiales.

Introducción



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Espectro de potencias y función de transferencia

Pue' eso.

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