AN UNIVERSE FINITE : COSMIC MICROWAVE BACKGROUND AND NEWTON LAW OF GRAVITATION

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Abstract

Is the Universe finite or infinite ? In this paper we assume that the Universe is finite . The sites for posible stars the Universe could admit of is finite . Such number can be described from a dimensionless parameter . This dimensionless parameter consists of two particular length dimensions : Bohr radius and Planck's length . Besides length dimensions , since the universe is dynamic , we must include an exponential parameter .

Keywords : Universe finite , gravitational potential energy , cosmic microwave background (CMB)

Method

The aim of this article is to describe the behaviour of a finite universe. The numerical equivalence between the gravitational potential energy and the energy associated to the photons of the cosmic microwave background (CMB).

Let's start defining a dimensionless number that works as a quantifier parameter i.e. a parameter that displays how many *elements* could be involved in any system . That we call *confined number* . It' worth to note that the confined number of elements about what we are hypothesizing , take for granted a finite Universe .

$$(N_{...}) = \frac{1}{e^m}\frac{a_0}{L_P} = 1.2045 \text{ x } 10^{24} \qquad (1)$$

In the above definition are two physical constants and a mathematical constant . As for the physical constants they represents length dimensions

a_0 refers to Bohr radius $= 5.291772\ x\ 10^{-11}\ m$

L_P refers to Planck's length $= 1.6162\ x\ 10^{-35}\ m$

Mathematical constant is represented by Euler's number

$e = 2.7182818$ ...

A logical consequence of a finite Universe compel us to apply the parameter $(N_{...})$ as a *quantifier* parameter of the elements involved in any system . In the case at hand , the system is the universe. Since the definition of $(N_{...})$involves physical length constants (Bohr radius and Planck's length) such elements are the number of sites or gaps for potential stars . At this point it is essential to explain the meaning of potential stars . As the figure 1 shows , the number of active stars are not the same 400.000 years after the big bang than 10^{11} years after the big bang. Wich means that parameter $(N_{...})$ is conceived as the number of ''potential stars.'' Universe finite entails finite energy and finite celestial bodies such as stars Therefore is constant .

Besides a finite Universe , we see a dynamical Universe . According to the standard model of cosmology the size of the universe varies over time , displaying an exponential dynamics . For that reason we have incorporated the concept e^m in equation (1)

As for the exponent m, it involves cosmological concepts

$$m = xt \tag{2}$$

where $x = \frac{r\,H}{C}$ (3)

r has lenght dimension , meters . H has dimension T^{-2} or $\frac{1}{s^2}$

and C is the speed of light in vacuum . Let's type the equation (2) using SI units (meter, second)

$$m = \frac{s\,m\,s}{m\,s^2} \tag{4}$$

Will apply specific values in equation (2) at the present time

$r \sim 1.3\ x\ 10^{26} m$, $H \sim 5.23\ x\ 10^{-36} s^2$, $C = 299792458\ m\ s^{-1}$, $t_0 \sim 4.4\ x\ 10^{17} s$

r represents the radius of the observable universe and symbol H is defined as

$H = \left[\frac{H_0}{M_{pc}}\right]^2 \sim 5.23\ x\ 10^{-36} s^2$ where

$H_0 \sim 7.0630\ x\ 10^4\ m\ s^{-1}\ M_{pc}^{-1}$ current value of Hubble parameter

$M_{pc} = 3.0857\ x\ 10^{22} m$ astronomical unit of distance measurement called megaparsec

As for the symbol t_0 , it represents the life time of the universe .

Hydrogen atom and CMB

Type the numerical equivalence

$$\frac{P}{V} = \frac{N_s}{(N_{...})} \tag{5}$$

describe all symbols

$$V = G_N \frac{p_m e_m}{r} \tag{6}$$

where G_N refers to the Newtonian constant of gravitation :

$6.674\ x\ 10^{-11}\ m^3\ kg^{-1}s^{-2}$

p_m symbolizes the mass of the proton : $1.673\ x\ 10^{-27}\ kg$,

e_m refers to electron's mass : $9.11\ x\ 10^{-31}\ kg$

and r the distance between both particles : $r \sim 10^{-11}\ m$, next to the Bohr radius

$P = \hbar\ \nu_0$ where $\hbar$ is the reduced Planck constant : $1.054572\ x\ 10^{-34}\ J\ s$

the spectral radiance peak of the cosmic microwave backgroud (CMB) occurs at

$\nu_0 \sim 1.602\ x\ 10^{11}\ s^{-1}$

$(N_{...})$ the quantifier parameter already defined , a dimensionless constant that represents the *confined-number* of stars in the universe

$N_s \sim 2\ x\ 10^{57}$ refers to the approximate number of hydrogen atoms required to ignite a star like the sun .

Scholium

A few words about equation (5) . Plausibility of numerical and physical relationship between gravitational potential energy of an atom of hydrogen with respect to the emission of photons whose frequency mode of vibration is equal to the spectral radiance peak of the CMB . Oscillations of the gravitational field in hydrogen atom leads to the emission of photons . The probability of such events could be calculated by means of the equation (5). Or in alternative way

$$G_N \frac{p_m e_m}{r} \frac{N_s}{\hbar \nu_0} = (N_{...}) \tag{6}$$

Further analysis is required .

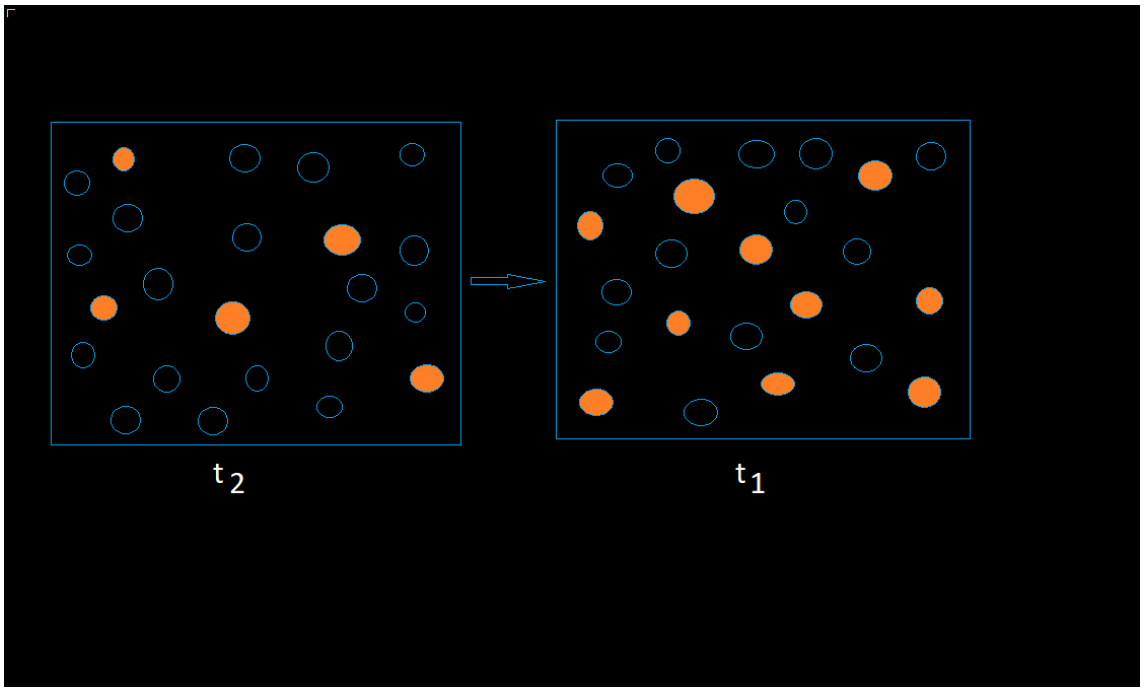

Figure 1 .