FINE STRUCTURE CONSTANT AT COSMOLOGICAL SCALE

Alberto Coe . Independent researcher

albamv8@gmail.com

Abstract

Will describe the ratio between two energies .The energy of photons associated to the cosmic microwave background and the gravitational potential energy of a system of particles (protons and electrons). The value of this ratio is equivalent to the current value of the fine structure constant .

Keywords . *Fine structure constant , cosmic microwave background ,gravitational potential energy.*

Method and results

Energy of one photon of the cosmic microwave background .

applying the formula Einstein-Planck

$$E = \gamma \, \hbar \, \nu_0 \qquad (1)$$

$\gamma \sim 10^{89}$ assumed number of photons in the observable universe

$\hbar = 1.054572 \, x \, 10^{-34} \, Js$ refers to the reduced Planck constant

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

$E = 1.6894 \, x \, 10^{66} \, J$

Gravitational potential energy in a system constituted by protons and electrons

Apply the equation of gravitational potential energy of a system of particles , equivalent to the gravitational potential energy for a constant density sphere of mass M and radius d ,

$$U = -\frac{3}{5} \, G_N \, \frac{M^2 N^2}{d} \qquad (2)$$

Let's neglect the term $(-\frac{3}{5})$

and write the equivalence $M^2 = (p_m \; x \; e_m)$

$G_N = 6.674 \; x \; 10^{-11} m^3 kg^{-1} s^{-2}$ the Newtonian gravitational constant

$p_m = 1.673 \; x \; 10^{-27} kg$ proton mass

$e_m = 9.10938 \; x \; 10^{-31} kg$ electron mass

$N \sim 10^{81}$ defines the assumed number of protons and electrons in the observable universe

$d = e \; f \; l_P = 4.393 \; x \; 10^{26} \; m$.

$e = 2.71828 \ldots$ Euler constant

$f \sim 10^{61}$ orders of magnitude between the radius of the observable universe and Planck length

Radius of the observable universe $\sim 10^{26} m$

$l_P = 1.6162 \; x \; 10^{-35} \; m$, Planck's length

Therefore the resulting gravitational potential energy

$U = 2.315 \; x \; 10^{68} \; J$

Divide both energies

$\frac{E}{U} = \frac{1.6894 \; x \; 10^{66} \; J}{2.315 \; x \; 10^{68} \; J} = 0.0072973 \ldots = \alpha$, the fine structure constant .

Note that the more the distance d in equation (2) increases , the lower the value of E in equation (1) .