The real value of vacuum density and information theory

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Abstract

The value calculated by quantum field theory for the energy of the vacuum disagrees greatly with the observational value. In this article we show how to calculate it using information theory and the E8 group.

1 Introduction

In some of our previous works we have calculated the value of the quantum vacuum using the geometrized system of units; that is when: c (speed of light) and Gn (gravitational constant) are equal to unity. This way of proceeding showed interesting connections with various aspects of the Higgs vacuum,

especially with the mass of the Higgs boson (mh). But if we want to obtain a real value in agreement with the observed one (at cosmological level) we have to adopt other hypotheses that will lead us successfully in this calculation.The mistake that physicists make is that they start from a local principle and not a global one. By this we mean that they use calculations for the vacuum as if it were polarized or in the presence of real particles. For example: part of the vacuum is calculated at the energy level of QED, or QCD. But this is a mistake. When the Big Bang arose, the quantum vacuum was emptied of all its contents by becoming the real matter and energy that constitute the present universe with all its galaxies, etc., and the microwave background or relic of the initial radiation.

The vacuum value changes depending on, for example, the existence of two conductive plates, which gives rise to the Casimir effect and which has been experimentally proven. Another example is how the quantum vacuum behaves differently in the presence of real particles in the double slit experiment. And so we could list different situations in which the quantum vacuum varies according to different physical configurations (repulsive Casimir effect is another example).

Therefore the value of the vacuum, which is in agreement with the observed one, is the one obtained by the well-known equation of general relativity. And this is so because the only virtual energy that remains is the gravitational one, which with its negative pressure explains the expansion of the universe.

The first hypothesis we will make is that information is a crucial aspect of the universe. This information is encoded as the In(ma/mb) for masses a and b; and where In(ma/mb) is the amount of entropy or amount of information and/or equiprobable quantum states.

For non-equiprobable states we will have, for a variable x, that its entropy is In(x)/x

The second hypothesis is that the information of the quantum vacuum is encoded in the E8 group (or the E8 lattice) and that its number of possible states is equal to the 240 root vectors of this group. Or the 240 eight-dimensional spheres of the E8 lattice.

This last hypothesis is of great importance since it is what allows us to calculate with total accuracy the observational value of the quantum vacuum using the first hypothesis at the same time.The E8 group is chosen for the fundamental reason that it allows us to calculate, as we will see, the baryon density of the universe. And also because of its relationship with the fact that the number of physical dimensions is 8 (seven compacted spaces + time) and three extended.

Let us take into account how we obtained the value of the mass of the Higgs boson under the premise of the existence of seven compacted dimensions, apart from the four extended ones, counting time.The Seven Higgs Bosons and the Heisenberg Uncertainty Principle Extended to D Dimensions

For the calculations we will use the scientific E unit of the calculators.

Inverse Fine structure constant =137.035999084= $\alpha^{-1}(0)$

1.1 The E8 group, the entropy In(planck mass/electron mass), the fine structure constant and the density of baryons

The inverse of the fine structure constant is a dimensionless quantity of photon pairs, since its inverse is the probability of emission or absorption of a photon by an electron. For virtual vacuum, antiparticle-particle pairs are produced. On the other hand the Planck mass/electron mass entropy is the number of electrons. In addition, the universe most likely began as a kind of electromagnetic radiation burst, producing particle-antiparticle pairs. Thus for the quantum vacuum of the E8 group with dimension 240 or the E8 lattice (see, for example, the Casimir effect) the following equation is the baryon density:

$$\frac{2 \cdot \ln\left(m_{PK}/m_e\right) + \alpha^{-1}(0) - 240}{2} = \Omega_b = 0.045839537445$$

Note how for the Casimir effect and its pressure, given by the following equation:

$$\frac{F_c}{A} = \frac{\hbar \cdot c \cdot \pi^2}{240 \cdot a^4}$$

a is the distance between the two plates. 240 is the regularization or renormalization carried out with the Riemann zeta function for 7 dimensions, that is:

$$240 = \frac{1}{\varsigma\left(-7\right)}$$

By the equation to obtain the density of baryons, it is confirmed that the mass of the electron is a privileged reference mass (minimum mass with electric charge and completely stable particle, so it can no longer decay into other particles).

Using the entropy of equiprobable states we calculate the amount of information between the mass ratio of the Higgs boson and the mass of the electron:

$\ln\left(m_h/m_e\right) = \ln\left(4 \cdot (2\pi)^{7-1}\right) = 12.413556759576$ The Seven Higgs Bosons and the Heisenberg Uncertainty Principle Extended to D Dimensions

1.2 General relativity equation for critical density

$$\rho_c = \frac{3 \cdot H_0^2}{8\pi \cdot G_N}$$

Where H is the Hubble constant

1.3 Physical mathematical equivalence between sum of probabilities (as an integral) or sum of dimensionless curvatures of circles

$\int_1^x \frac{dx}{x} = \ln(x)$

1.4 Non-equiprobable entropies of the Higgs vacuum

Now we will have to consider the non-equiprobable entropies due to the different couplings of the Higgs boson to the different particles or the different probabilities of decay in those particles. In this way we will be able to subtract from the 240 states of the virtual quantum vacuum, the sum of the entropies in the interval [1, In(mh/me)] and taking into account the particle antiparticle pairs of the virtual vacuum (without interference from real particles or any specific and/or privileged space-time-energy configuration). Once this sum is obtained as an integral, we can subtract it from the 240 states and in this way obtain the value of the quantum vacuum of minimum energy or the cosmological or global one.

This value obtained will be like an equiprobable entropy of the Planck mass-energy/vacuum mass-energy ratio. And taking into account that we are in the virtual vacuum of particle-antiparticle pairs.

1.4.1 Calculation of the integral or sum of non-equiprobable entropies

$$\int_1^{\ln(m_h/m_e)} \frac{2 \cdot \ln(x)\, dx}{x} = \ln^2(m_h/m_e) = (12.413556759576)^2 = 154.096391423215$$

The number two in the above equation is for particle-antiparticle pairs.

1.5 Final calculation of the real or cosmological quantum vacuum

As we have already mentioned, when subtracting the states given by the sum-integral of the non-equiprobable entropies, only the value of the vacuum can remain as pairs of state-antistate (particle-antiparticle) in the form of equiprobable entropy as a Planck energy ratio. /cosmological vacuum energy. This is manifested in the following final equation:

$$\ln(m_{PK}/m_{vac}) = \frac{240 - 154.096391423215}{2} = 42.9518042883925$$

$$m_{vac} = \frac{m_{PK}}{\exp\left(42.9518042883925\right)} = 4.830480743518E - 27\ Kg$$

$$\frac{m_{vac}}{\cos\left(spin\ 2 = 2/\sqrt{6}\right)} = 5.916428348679E - 27\ Kg$$

With the Heuristic-empirical introduction of the cosine of the graviton spin, a result is obtained in excellent agreement with that observed experimentally.

The empirical observational value is the following: $E_{vac} = 5.3566E{-}10\ J/m^3 \longrightarrow$ $m_{vac} = 5,96002129E - 27\ K_g$

1.6 Another possible example: the scale of unification of the GUT theories

$$\frac{240 - \ln^2\left(V_H/E_e\right)}{2} = 34.38658401287 = \ln\left(M_X/m_Z\right) \longrightarrow M_X = 7.8314012E16\ Gev$$

$V_H = \ Higgs\ Vacuum = 246.219650794138\ Gev \quad , E_e = electron\ energy$

Mx= Mx boson GUT theories, Mz= Mz boson

2 Conclusions

In a very simple way, taking into account the theory of information and the group or lattice E8, it has been possible to successfully calculate the value of the cosmological quantum vacuum (global and not local free of interference. Only the vacuum itself). It is logical to have chosen the Higgs boson since the Higgs vacuum is what gives the mass to all particles, theoretically and in reality. Quantum information in the form of entropies has shown its power to solve a problem that has puzzled physicists for many years.

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