

## QUANTUM VACUUM ENERGY DENSITY

**POPESCU GEORGE** - *Universitatea “Constantin Brâncuși”, Tg Jiu, ROMÂNIA*

**Abstract:** It proposed a new method for determining the quantum vacuum energy density, based on the research of Nassim Hamein scientist.

**Key words:** random fluctuations of energy, Planck mass, Planck length.

There is a huge reservoir of energy that is not spoken.

Quantum mechanics has shown that there is no vacuum or anything. What we tend to think that it would be empty, if all the space would be empty of matter and energy, even interstellar space, it is in subatomic terms, a highly active energy area.

The uncertainty principle (or indeterminacy), developed by Werner Heisenberg, claims that no particles remain in a state of complete rest, but is always in motion, due to the fundamental energy field that interacts with all subatomic matter.

Which means that the basic structure of the universe is a sea of quantum fields that can not be removed by any known laws of physics. What we believe, our universe stable, static, is actually a whirl seething of subatomic particles that float in and disappearing from appearing existence. Although famous Heisenberg's principle refers to uncertainty related to measuring physical properties of the subatomic world, this basically means that we can not know to both the energy and the life time of a particle, because the subatomic phenomena, which occurs in a very small period of time, involve an uncertain amount of energy.

Largely due to the theories of Einstein and his famous equation  $E = mc^2$ , establishing a relationship between energy and mass, all elementary particles interact with each other by exchanging power with other quantum particles, which is believed to arise from

nowhere, combining and annihilating each other in less than a snap, - more precisely  $10^{-23}$  seconds - causing random fluctuations of energy without no apparent cause. Ephemeral particles generated during those intimate moments are known as "virtual particles". those intimate moments are known as virtual particles". They differ from real particles because there is only during this exchange during the "uncertainty" uncertainty principle permits.

This subatomic matter movement how short, when aggregated in the entire universe, produces an enormous power, more than that contained all matter exists in everyone. Named vacuum of physicists , Zero Point Field was so named because in the field are still detectable fluctuations at absolute zero, the lowest energy state, in which whole matter was removed and there was nothing left to produce any movement. Zero point energy is the energy present in "the empty" state of the place, to the lowest energy level, beyond which it can not be "taken out" energy, closest state to zero that this movement could achieve. But due to the uncertainty principle will always be a certain residual "swing" generated by the exchange of virtual particles.

Fluctuations in the atomic world amounts to a relentless pass forward – back energy, like a ball in a game of ping-pong. This kind of emission and absorption of virtual particles happening not only among photons and electrons, but with all quantum

particles in the universe. Any exchange of virtual particles radiate energy.

Zero point energy in any transaction of an electromagnetic field is incredibly slow, half the energy value of a photon. It has been calculated that the total energy of Zero Field Point is beyond all the energy in the field by a factor of  $10^{40}$ , or 1 followed by 40 zeros. As the great physicist Richard Feynman once said, in trying to give us an idea of this magnitude, the energy of a single cubic meter of space is enough to boil all the oceans of the world. "

Because of quantum effects, the concept of a well-behaved spacetime geometry must lose its meaning as one approaches the so-called Planck frequency (wavelength  $\sim 10^{-33}$  cm) where the geometry dissolves into a quantum "foam-like structure." Assuming a high-frequency cutoff at this frequency, they estimate an energy density which, though not infinite, might as well be for all practical purposes (mass equivalent of  $\sim 10^{94}$  g/cm<sup>3</sup>). Feynman, arguing that what counts is not the maximum frequency available in the ZPE background, but rather the frequency at which meaningful interactions between the background and nuclei cut off, reduces this estimate further to nuclear energy densities ( $\sim 10^{14}$  g/cm<sup>3</sup>), still an exceedingly large number.

A new method for estimating the zero-point energy density is suggested by the Nassim Hamein's scientist work.

Planck Units:

$$\text{Planck Mass: } m_1 = \sqrt{\frac{\hbar c}{G}}$$

$$\text{Planck length: } l = \sqrt{\frac{\hbar G}{c^3}}$$

in which:

$\hbar$  – reduced Planck's constant,  $\hbar = h/2$

$\pi$ ,

$c$  – speed of light,

$G$  – universal gravitational constant.

Hamein believes that the density of the vacuum of space can be calculated with the classic formula, in which the mass is replaced by the Planck mass, and volume is that of a sphere with a radius half the Planck length:

$$D_{\text{vacuum}} = m_1/V_1,$$

$$\text{With } V_1 = 4/3 \pi (l/2)^3$$

consequently,  $D = m_1/V_1 = m_1/[4/3 \pi (l/2)^3] = 6m_1 / \pi l^3 \sim 9,84 \cdot 10^{96}$  kg/m<sup>3</sup>,

and the energy density is determined  $\rho_E = Dc^2 = 9,84 \cdot 10^{96} \cdot 9 \cdot 10^{16} \sim 10^{114}$  J/m<sup>3</sup>

Opinion

**Thus proves, in another way, that the so-called quantum vacuum, there is a practically infinite reservoir of energy: about  $10^{114}$  J / m<sup>3</sup>.** Becomes obvious next challenge: capturing an amount of this energy and transform it into electricity, which apparently was achieved by Nikola Tesla, and presented under the name 'free energy'.

## REFERENCES

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