A new relativistic wave equation and its application to cosmos

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Abstract

A new relativistic wave equation has been developed; the equation applied to the cosmos justifies the beginning of the universe without additional hypotheses and predicts low-energy background.

1.- Development of the new relativistic wave equation

To develop the wave equation that I will propose I start with the relativistic formula of the energy of a particle and the Schrodinger´s wave equation.

The total mechanical energy in a physical system is calculated by adding the kinetic energy, the potential energy, and the specific term of relativistic energy.

Total mechanical energy = kinetic energy + potential energy + mc^2

At the beginning of the twentieth century, the corpuscular character of electromagnetic waves, known as the photoelectric effect, and the wave character of moving matter, known as the corpuscle wave duality, were discovered. From this the physicist Schrodinger developed a wave equation for particles that considered these hypotheses and was structured in a non-relativistic energy balance.

$ih(\psi/\eth t) = H_t\psi$

$H_t\psi = -(h^2/8\pi^2 m)\ (\eth\psi/(\eth^2(x,y,z)) + V(x,y,z,t)\psi$

The first member is the Hamiltonian of the system and represents the total energy, in the second member it seems the term kinetic energy, and the potential energy. This equation is applicable to a single particle. Equation, on the other hand, well known to those present here.

If we want the first member to represent a relativistic Hamiltonian, we must add the term relativistic mass energy to the second member of the equation.

$H_t\psi = -(h^2/8\pi^2 m)\ (\eth\psi/(\eth^2(x,y,z)+V(x,y,z,t)\psi + mc^2\psi$ (a)

Within the solutions of this equation, I look for those that satisfy the equation of eigenvalues. I try to solve a differential equation of eigenvalues, with the physical meaning of an energy balance.

The potential, in this wave equation is usually calculated by determining the potential function of the force field, that is, a scalar function whose gradient is the force field.

Considering that the wave equation represents the energy balance, we can also calculate the potential in the same way that the potential energy is calculated in a force field, that is, as the divergence of the force field with opposite sign. We will apply this freely when establishing our wave equation.

Consider a field of forces that gives rise to an acceleration in a mass "m", we know that the force at each instant is equal to the mass multiplied by the acceleration and that the acceleration at each instant is the second derivative of the position with respect to time. We will apply this freely by proposing our wave equation by creating an acceleration vector through the wave function solution of the equation.

So, with all this I propose the following relativistic wave equation for a mass "m" and a problem with spherical symmetry.

$E_t\psi = -(h^2/8\pi^2m)\,(ðψ/(ð^2r)) - m\,(ð/ð_r(ðψ/(ð^2t)) + mc^2\psi$

where Ψ = ψ(r,t), is the wave function solution of the equation.

The first term on the right is the term kinetic energy and is taken from the Schrodinger's wave equation, the second term is the term of potential energy and is obtained from the considerations made above, finally the third term is the specific of relativistic energy.

The object space of the wave function is the four space-time dimensions that Einstein develops is his theory of generalized relativity, the image space of the wave function, does not have a clear physical interpretation now, I am currently working on it, but it is expected to be related in some way to the position, velocity, or some other movement parameter in the space-time.

2.- Using the equation developed, I then study a physical system that includes photons and positive masses and whose total energy is equal to zero.

The first thing I determine by my relativistic wave equation is the energy of the photons, treated as plane waves and as particles.

Let's take the following wave function for photons where c is the speed of photons, the speed of light.

$\Psi_{photon}=e^{ict}= e^{ir}$

In addition, I consider in this work that the photon has a moving mass of value $m=E/c^2$, where E is the interaction energy of the photon that according to Planck's formula turns out to be E=hμ being μ the frequency

Performing the calculations with the wave functions of the photons and substituting the results in our relativistic wave equation result

$(E_t + (h^2c^2/8\pi^2h\mu - i(h\mu)))e^{ir}= h\mu e^{ir}$

Taking modules and operating results this equation

$mod((E+(h^2c^2/8\pi^2h\mu-ih\mu)).mod(e^{ir}) =mod(h\mu).mod(e^{ir})$

$((E+h^2c^2/8\pi^2h\mu)^2+h^2\mu^2)^{1/2} = (h^2\mu^2)^{1/2}$

$(E+h^2c^2/8\pi^2h\mu)^2 + h^2\mu^2 = h^2\mu^2$

$h^2c^2/8\pi^2 = (6,63.10^{-34})^2.9.10^{16}/8.(3.14)^2 = 5.10^{-52}$

$(E+5,10^{-52}/h\mu)^2 = 0$

$E = -(5,10^{-52}/h\mu)$

Thus, the energy of the photons, calculated through the relativistic energy balance that my wave equation represents, turns out to have a negative value.

And because of this it is possible the existence of masses, which have positive energies, and photons, which present negative energies, in the same physical state of total energy equal to zero.

$E= 0 = -(10^{-51}/2h\mu) + 1/2\ Mv^2 + Mc^2$

this equation is expressed in the international system of units.

We see that finally this equation has a solution for values of positive masses and photons coexisting both together, although the total energy balance is equal to zero.

3.- Some conclusions

What has been developed in this work leads to a physical and mathematical explanation of the origin of the initial matter of the universe and does not invalidate the Big Ban hypothesis at all.

Studying our last equation and observing some conclusions that can be drawn from it we see that in a physical state of total energy equal to zero there is, according to our equation, a solution with positive masses and photons, being a state of zero energy the very likely initial state of the universe.

Therefore, since there is a solution for zero energy, this solution being with positive masses and photons, our universe of matter and light can be energetically justified without any additional hypotheses.

Therefore, the existence of the origin of the universe is energetically justified by the wave equation developed here without the need for any initial energy.

The low-energy background radiation that fills the universe can also be explained by the equation. It justifies the beginning of the universe and predicts the existence of low-energy electromagnetic radiation in it. Therefore, low-energy background radiation would be justified.

4.- Summary

The relativistic wave equation obtained in this work can be applied to gravitation. The results obtained here are very hopeful and lead to clarify some hither to obscure questions related to the origin of the universe, and the background radiation. Further study of the equation and its solutions is expected to augur even more surprising results. I therefore invite my fellow researchers to make this effort in the hope that it will not disappoint them.

5.- Bibliography

1.- Einstein's articles on the photoelectric effect and the theory of relativity, restricted and generalized 1905, - 1915

2.- De Broglie's thesis in 1925

3.- Quantum, relativistic and classical mechanics