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ARE SUPERLUMINAL THE NEUTRINOS?

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ABSTRACT

In September and in its review of November 2011 Opera reported the results of four years of experiments that established the superluminal speed of neutrino in near 0.25 thousandth, if the issue was political, extremely little difference unimportant but powerful as a scientific issue. In June 2012, after an embarrassing episode, which was ended with an experiment realized by Icarus, rival group, the CERN belied to Opera and maintained the validity of Special Relativity because the official speed of neutrino remains subluminal. In Rome, in July 2015, MG14-ICRA, the astrophysicists Eduard Mychelkin and Maxim Makukov, of the Fesenkov Astrophysical Institute of the Republic of Kazakhstan, presented their remarkable reflection on the superluminal neutrino due its invariance helicity. Are truly superluminal the neutrinos? We present this result, contextualized within the phenomenon of the superluminal quantum nature; it has been sufficiently proven by actual experiments, realized from different perspectives.

Keywords: Neutrino; superluminal; quantum entanglement; quantum fluctuations; relativity.

1. INTRODUCTION

Science works with models that abstractly represent reality and consequently only it reaches approximately, with some grade of discrepancy.

Scientific work, as a producer of knowledge differs from other class of works in that its outcome before its completion there is not known. In opposition, the work, that produces the material goods, changes the shape of the object of work and other auxiliary materials involved, in the shape of an object previously existent as an idea, therefore, is the material transformation of reality from a mental model that gradually pervades and adapts until reach the planned ideal object, in which man give objective form to their ideas and he achieves his goals.

In the scientific work, the object of work is a theoretical object that represents to a real object. And the process is to adapt this theoretical object to reach the essential aspect of the real object, more approximate and deeply, in its essence and laws governing it. It is the passage from a generality, to another generality, through higher approximations to concrete, using as working means a generality such as are scientific expertise, technologies and techniques, packaged in crucial experiments. The man transforms his thinking in line with his work object, existing in reality; it is the process regulated, academic and experimental of subjectivation of the reality. Thus there is no ultimate truth.

Throughout the experiments with electric and magnetic charges was developed theory about them and their electric currents induced on cables, too, about the generation of force fields, which act through the ether (truly, quantum vacuum, in permanent fluctuation and sea of virtual particles [1]), and that

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are dependent on the distance and relative velocity of the charges. These are the electric and magnetic static fields that when combined produce the Lorentz force which is exerted on the charged particles or electric currents. The oscillation of the electric-magnetic field generates the electromagnetic waves, which manifest as the strength of Poynting-Robertson.

The experiments were carried out by many scientists, among which stand out the discoverers of the fundamental laws as Gauss, Faraday, Ampere and Ohm. Maxwell unified these laws in a mathematical model of eight equations, that Heaviside and Gibbs upgraded by reducing to four equations in vector notation, which is the model used today, with the addition of the fifth original equation of Maxwell on the Lorentz force. Furthermore, Maxwell [2] discovered the formula of the speed of the electromagnetic wave $c = 1/\sqrt{\varepsilon_0\mu_0}$ independently from the relative speed of inertial reference frame used and, of course, the vacuum phenomenon gives the physical properties of permittivity ε_0, and magnetic permeability μ_0 to the space, which as space-time is geometrical and structural form of the dynamic matter [3].

Electromagnetic waves are the biggest support for the telecommunication of information that man has reached during age of their civilization, using the energy transport by the electromagnetic wave, that likely, a future civilization will revolutionize, similar to the pass of communication from smoke signals by Indians of North America to the electromagnetic waves. That future step necessarily involves transmission at super speeds that will link us with alien civilizations, which surely exist.

Lorentz made the discovery that the equations of Maxwell are invariants for all the observers located in different inertial frames of reference, since its coordinates are transformed from a frame to another, according to your mathematical group of four equations, amended by Poincare of some initial inconsistencies to change of the transformation of Galilei. The Lorentz transformation preserves constant the velocity of electromagnetic wave c, for all inertial reference frames, which is consistent with the results obtained in the experiments of Michelson-Morley.

In the Lorentz transformation, from, of absolute time and space Newton, only previously existing categories were subdivided into the subcategories proper and improper. As, in Newton, was preserved absolute the proper time and the proper length. While the measurement of the improper time and improper length are distorted proportionally to the Lorentz factor γ, by the effect of the relative speeds, passing between inertial frames. Lorentz thought that such distortions were a physical effect. Between two inertial frames, one at rest and the other with a relative velocity relative to the first, this is conventional, since the second can too be, although with change of helicity. The proper time and the proper length are measured at the frame in rest while the improper time and the improper length are measured at the frame in motion, corresponding to the measurements done at the frame in rest. Therefore, improper time = γ proper time and improper length = proper length / γ.

In Special Relativity, Einstein eliminated the mechanical ether (certainly, not the quantum vacuum) of the inertial frames and he explained the effects of distortion in improper quantities, such as the expansion of the improper time and shortening of the length improper of the Lorentz transformation, as coordinate effects and not physical effects. However, in clear contradiction, that Einstein justified in the accelerated systems, they become physicals as Lorentz believed happened in the inertial frames, and c was postulated like the maximum speed limit for particles with mass, which based on the most accurate experiments, with 99.9999% c for the inability to reach c, due to increase of the mass, since asymptotically it would approximate to infinity. In the section 2 it discusses this fallacy. In section 3 it analyzes, the Special Relativity postulate that c is the maximum limit to which information can be transmitted, truly limitation of the power of current technology. In section 4 it presents, the result of the superluminal speed of neutrino, according to experiments of OPERA in litigation with ICARUS, MINOS y NASA, and the masterful reflection of the astrophysicists Eduard Mychelkin and Maxim Makukov on superluminal neutrinos, due to their invariance of chirality. And in section 5, it presents some alternatives of the amended Special Relativity that allow super luminal speeds.

2. THE MODEL OF SPECIAL RELATIVITY AND SOME OF ITS ANOMALIES

In 1887, the experiments of Edward Michelson-Albert Morley established the invariance, in vacuum, of the speed, c, of the electromagnetic wave with respect to all inertial coordinates (A), one of the two laws of the Special Relativity on the speed c, which led to generalize, for these frames, the transformation Lorentz-Poincare, unifying Galilean coordinates with electromagnetics. The second law postulated speed c as the last possible for particles with mass according to the cuadri momentum vector, which is the inertial

rest mass, m_0, by the quadrivector particle velocity, $dx_i/d\tau$ (x_i derived from the position on the proper time τ), i.e., the combination of linear momentum with the rest energy of the particle.

The inertial mass was postulated as the property of a particle or system of particles (usually organized in the structure of bodies), free of forces, by resistance to change the vector of its velocity in magnitude and / or direction, i.e. undergo acceleration with respect to the quantum vacuum (B). Relativity extended the inertia of the mass to all forms of energy [4,5].

According Einstein, the general equation of the total energy, E, of a particle (equivalent to the mass of the moving particle or relativistic mass) is: $E^2 = p^2c^2 + m_0^2c^4$ (where p is the impulse), which is obtained of: $E_0 = m_0c^2$ (rest energy E_0 equivalent of the rest mass of the particle), that conceptually implicate the equivalence between energy and mass, unlike Newton, where they are different substances. The rest mass (characterized by a zero impulse) is invariant with respect to all coordinate systems and different from the moving mass (invariant mass + kinetic energy/c^2, therefore, with momentum> 0) which depends on the relative speed of these. In the case of a system of particles, the invariant mass is the mass of the system when its mass center lacks of impulse.

Expression of energy in terms of the particle velocity, v, relative to the speed of the electromagnetic wave is $E = \gamma mc^2$ (where $\gamma = 1/\sqrt{1 - v^2/c^2}$), which means when v = c an outcome not defined in the real numbers, since division by 0 does not exist. However, it is obtained by the approximation of the velocity of the particle to c that the particle mass asymptotically approaches to infinity (truly the impulse asymptotically approaches to infinity, unlike the mass asymptotically approaches to infinity).

The relativistic mass as $M = \gamma m_0$ is not a physically correct expression, since m_0 is a fermionic structure (made of fermions) that the addition of kinetic energy does not change, of course, is the kinetic energy which increases tending asymptotically infinity in the vicinity of c. Furthermore, the kinetic energy by depend of the coordinates (i.e., observers and their relative speeds) its increase has only local validity and not global, since the speed of a particle with respect to a frame may be different with respect to other, i.e, the particle has not a single speed, therefore, a single kinetic energy.

The theoretical foundation of the inability to overcome c is that for a massive particle necessarily with subluminal speed locally, to accelerate it, at least at the speed c, the energy that would be necessary to apply, in this limit, it does not become faster particle but in increased strength of the particle to change its state of motion because the total inertia (rest energy + kinetic energy) tend to infinity so it needs impossible infinite acceleration with finite time or infinite time with finite acceleration, to achieve c.

According to the relativistic speed equation: $v = c\sqrt{1 - m_0c^2 / E}$, the energy required to accelerate from 0 to c is increased in direct proportion to the magnitude of the velocity, so that the whole energy provided in 0 becomes velocity of the particle and in the vicinity of c in energy of the particle without being able to reach c (by the progressive increase in the total inertia of the particle, the magnitude of the kinetic energy / c^2 that was additionally added) while in the intermediate values, it increases the velocity relative of particle, also it is used ¡in accelerate to the same kinetic energy¡ that progressively increases the magnitude of inertia of the particle although it is likely to continue increasing its speed.

The Lorentz-Poincare transformation in accelerated systems, with respect to particle velocity, cause, inversely, in the direction of motion, the contraction of length and directly the dilation of time while particle inertia rise (total energy increasing or in its equivalent, the relativistic mass increase). In experimental terms are checking these relationships between speed, time, length and mass, although, always constrained to be locals. It has observed, directly, the time dilation, where more success has had, and the apparent increase in mass (actually the mass m_0 itself remains, while the kinetic energy is increased), confirmed with great precision of 1 part per million, and it has observed, indirectly, the length contraction due to their low magnitude in the particles.

(A) The constancy of the speed of light is a physical law of inertial frames of Galilee or Minkowski and a convention for other frames. In addition, the constancy of c was established only in vacuum, at the travel light round-trip. Not so for the travel of light on a single track, where the constant value is a simple convention. In general, the speed c is provided as a result of calculating average values of the speed in two ways into in a closed loop. Therefore, the invariance of c is a weak physical law of speed.

(B) Newton postulated that acceleration is referred to absolute space. In 1983, Ernst Mach, in dissent, suggested that the source of inertia would stellar matter. Between1912-1918, unsuccessfully Einstein pursued incorporate, in the mechanics of General Relativity, the

principle of Mach making totally dependent the metric tensor, Gμν, of the energy-momentum tensor, Tμν. In 1921, Einstein postulated acceleration referring to all the local surrounding matter, finally dismissed as a real effect, and explained as an false effect of coordinates. On the other hand, Newton's absolute space does not exist in exchange we have the quantum vacuum, quantum fluctuations exactly [6].

Consequence of speed limit c is the relativity of simultaneity, since simultaneous events (with $t = 0$) occurring in separate space (with status $\neq Ax = 0$), since they cannot connect quasi instantaneously (i.e. with $v \rightarrow \infty$, it is impossible to comply with $Ax = 0$), as it is not possible be determined absolutely that occur at the same time, therefore, different observers, depending on their relative movements, assigned different times of occurrence of such events, due $\Delta t' \neq 0$.

In the Brookhaven National Laboratory it has achieved with electrons, with respect to the accelerator, near to 99.9999% c which increases locally in 1000 times the total energy of the electron. Of course this is the result of the Lorentz transformation that matches experiment. However, what will it physically happen with speeds millions of times closer to c? What will it physically happen to the kinetic energy progressively increasing without augment the speed of the particle? What is the physical meaning of energy accelerating kinetic energy?

In Special Relativity the mass inertia, it extends to all forms of energy since the energy is equivalent to mass and mass is equivalent to energy. With respect to this equivalence Special Relativity presents a twofold problem. The first is about the conservation of momentum, that due to the relativity of simultaneity only is valid approximately, since, in general, changes in the momentum of a body there is uncertainty about conservation, then the measure of inertia change in mass units lacks accuracy. And the second problem is the partial validity of the equivalence of energy and mass, according to its definition in the four-vector relativistic momentum, because it violates the principle of correspondence with the kinetic energy in the Newtonian limit, causing the energy concept loses representativeness, and the equivalence of energy and mass ceases to apply to the total inertia of a body. For these two reasons the Special Relativity fails to adequately explain the unity and mass-energy equivalence. 'The Equivalence of mass and inertia seems to be true as all empirical evidence. In theory at least they are sometimes seen as distinct qualities "[7]. There are even physicists who argue the existence of an irreducible basic mass, i.e. mass without energy [7]. Both problems have led to the revision of the scope of the mass-energy equivalence in relation to inertia. Some still defend the terms of relativistic mass and rest mass in its original sense. With regard to the relativistic mass they say “the two small atoms have slightly less mass than the original largest atom,but in the division the total mass is preserved, because the two atoms smaller have enormous speeds, so that the total relativistic mass is exactly conserved (this physical preservation is the main reason that the old concept of relativistic mass has never been completely discarded)”. "In any case (fission or fusion), a net reduction of rest mass occurs, accompanied of an equivalent amount of kinetic energy and radiation”. “The actual detailed, whereby the binding energy mechanism, originally a characteristic of the rest mass with isotropic inertia becomes a kinetic property representing what we call anisotropic relativistic mass inertia, is not well understood” [7]. These physicists show, firstly, that in terms of the mathematics of Special Relativity only it explains the conservation of momentum for interaction forces on a body in contact at one point and in the direction of its movement and other hand, only the extra inertia is explained, that acquires a body due to its motion.

Even confronted forecasts equations of Special Relativity with experiments with very favorable results, the invariance principle (C) and the speed limit c are discussed and dissident scientists considered erroneous. These dissident scientists are progressively increasing (D). Greater is the confusion of the author in relation to rest mass is not cause of impossibility of carry to a particle with velocity c but the inertia of the kinetic energy required for this purpose when the photon, without rest mass, travels with speed c, course, with a lot of kinetic energy, whose momentum should preclude such speed or energy accelerates the kinetic energy or that the magnitude of speed has not physical effects in the inertial systems but, instead, has physical effects locally in the accelerated systems. Or that there is absolute motion as the author demonstrates by a thought experiment [8].

(C) Though many experiments appear to have confirmed the light speed invariance postulate of Special Relativity theory, this postulate is actually unverified. This paper resolves this issue by first showing the manner in which an illusion of light speed invariance occurs in two-way light speed measurement in the framework of a semi-classical absolute space theory. It then demonstrates a measurable variation of the one-way speed of light, which directly

invalidates the invariance postulate and confirms the existence of the preferred reference frame of the absolute space theory [9].

(D) Jean Climont, editor of book the "Dissident scientists in the world", wrote me the following note: "You will find 515 opponents to the absolute value of the speed of light in the Worldwide dissident scientists list new issue 2016 now including more than 8000 names with many more emails and web addresses together with more information on critics and alternative theories".

3. SUPERLUMINAL SPEEDS

3.1 Quantum Entanglement

Somewhat parallel to foundation and evolution of Relativity it produced the quantum theory, which Einstein wanted to immediately integrate with your theory. Werner Heisenberg was the author of the first version of quantum mechanics, which introduced in the scale of the microcosm, the uncertainty principle, as inherent in nature, which postulates the impossibility of simultaneously measuring the position and momentum of particles at this scale, according to the relationship $\Delta x \Delta p \geq \hbar/2$ (Ax is the position Δp is the impulse and $\hbar$ is Planck's constant).

In the 1920s, occurred the controversy between Einstein, with his hidden variables, sub quantum, that once established could demolish the uncertainty and extend the deterministic description to quantum scale and Niels Bohr, reaffirming the stochastic nature in it. In 1932, John von Neumann theoretically demonstrated the impossibility of the existence of such hidden variables, but without allowing physical experimental verification.

In 1935, Einstein, Podolski and Rosen proposed a thought experiment, known as the EPR paradox, to refute the uncertainty principle, since Einstein said: God does not play to the craps. If two particles collide and go away in opposite directions, it will be possible from the measurements of momentum and position in one, infer this information to the other, also the spins of the two that was added later by David Bohm. Thus it preserved the property of locality, whereby an event that occurs in a place may not affect any other to distance unless they are bonded by a signal, traveling at maximum speed c.

In that same 1935, EPR led to Erwin Schrödinger discover the intertwining of subatomic particles such as electrons, photons or molecules, which only occur in quantum mechanics. Entanglement means that a set of particles cannot be defined as single particles with defined states but to exist as a system with a single wave function. Consequence, of the formation of pairs or groups of entangled particles, is that the action of a particle or group instantaneously changes the state of the other to remote distance. Therefore, it produces the effect of non-locality, as both particles are intertwined with some kind of disturbance that would be transmitted at speeds greater than c and the uncertainty principle is retained, since its value would be extreme, because it would be more uncertain the position of the two particles when the lineal momentum of the other is measured, and vice versa.

The response of EPR is that entanglement is a simple property of statistical correlation between a pair of particles originated from the same source, due to the law of conservation of momentum. According EPR after established entanglement between two particles, if simultaneous the linear momentum is measured in one and the position in the other, then the limitations of the measurement imposed by the uncertainty principle it cancels because their high correlation allow infer the position, time, spin or polarization of the other.

In 1964, 29 years later, John Bell formulated the theorem of inequalities that allowed conducting a physical experiment that would prove or rule out the demonstration of von Neumann of the absence of hidden variables, therefore solve Einstein-Bohr controversy. After several attempts by several physicists, in 1981, 17 years later, Alain Aspect realized the crucial experiment, confirming the actual existence of entanglement and, of course, agreeing with Niels Bohr. However, yet fully not tested no locality.

In March of 2015, 33 years later, the scientists Maria Fuwa, Shuntaro Takeda, Akira Furusawa, Marcin Zwierz and Howard Wiseman of the universities of Tokyo, Warsaw and Griffith (Australia), published in Nature Communications that measuring in a particle whether affects to other position. Other experiments have shown interlacing of two particles; the new experiment interlaced a photon with itself. The electromagnetic wave was transmitted as a single photon, and the photon was divided into two. Prior to the experiment, there was a superposition of photons, the burst of photons it sent to a splitter that passed half wave to a laboratory and the other half was reflected to another. So, it was proven that a measurement in a laboratory causes an instantaneous change in the local quantum state in the other lab, therefore, with six settings of different measuring and quantitatively was verified what Einstein believed

would be spooky action impossible, since inequality Einstein-Podolsky-Rosen-address was violated [10].

This finding was confirmed by a team of scientists, led by Professor Ronald Hanson of the Delft University, Netherlands, published in Nature in October 2015. They have instantly entangled electrons in traps of diamond, separated by 1,3 kilometers, which proves the hypothesis of quantum entanglement, occurring at a distance instantaneously. They reported "on a Bell experiment that is free of any such additional assumption and thus directly tests the principles underlying Bell's inequality. We employ an event-ready scheme that enables the generation of high-fidelity entanglement between distant electron spins. Efficient spin readout avoids the fair sampling assumption (detection loophole); while the use of fast random basis selection and readout combined with a spatial separation of 1.3 km ensure the required locality conditions" [11]. What has been tested produces the restoration of instantaneous remote action.

In Delft experiment, if it binds two particles in one quantum spin state zero, then when it rotates a upward, the other instantly receive a disturbance that cause spin down, i.e. change instantly his chirality.

How many more years will be needed to discover the nature and measure the disturbance, which undoubtedly must transport currently inaccessible energy for its immense weakness? How many more years will be needed to produce the technology to use it as support of our communications?

3.2 The Near Field

According the model of electrodynamics, the cause of the electrostatic field, which exists in three-dimensional spherical space of the quantum vacuum [10], with center in a charged particle at rest or in uniform motion is the potential electric that initially coincides with the mass of a charged particle, for example with the mass of an electron or a free atomic nucleus. Instantaneously when a particle is in the presence of other charged particle, for example, an electron in an atom of hydrogen, the electric potential of the electron and the proton, which is the nucleus of hydrogen atom, extend beyond the masses of these particles for encompass a to the other. This is the phenomenon of pass of the respective electric potential to the electrostatic fields generated by electron and proton. Although the electrons move inside orbitals around the nucleus of atoms, this is equivalent to electron motion rectilinear uniform, since while the electron is in the same orbital non-radiates.

Relative to an inertial observer, the particles are at rest when its speed measured by this observer, is zero. And a particle is in equilibrium with respect to an inertial observer when its acceleration is zero. Therefore a particle is in equilibrium when the resultant force of all forces acting is zero. Of course, a particle can be at rest relative to an inertial observer, but not be in equilibrium. Likewise, a particle can be in balance and not be at rest relative to an inertial observer.

Electric charges fill the surrounding space of the quantum vacuum. A charge at rest occupies this space with virtual photons, in what is called the electrostatic scalar potential. A charge when moving at constant speed, in both direction and magnitude, i.e., when generating a steady current, fills the three-dimensional space with virtual photons, within what is called the vector electrostatic potential. A moving charge accelerated fills the space with energy radiation, i.e, with real photons. Therefore, the potentials are distribution within the space of photon radiation by a charge, so they have been known as charge distribution. However, within the formalism of electrodynamics theory the phenomenon of radiation is only recognized for charges that produce real photons.

According to the electrodynamic theory the electromagnetic field generated by an electrodynamics potential, i.e., when the potential consists of real photons are radiated by charges in accelerated motion, is divided into two regions: the near field and the field far. In turn, the near-field region is subdivided into the reactive near field and radioactive near field. Thus, the electrodynamic field comprises the reactive near field, radioactive near field (known as Fresnel region) and the far field called also Fraunhofer region. These three fields are not separated abruptly but are mixed within its boundaries.

The reactive near field exists throughout space around a source of electricity. It comprises separate electric and magnetic fields that is, not mixed. These fields are created by reaction to dominant alternate current electricity. This field is closed to the source within a radius smaller than a length of the radiated wave. The power density of the field grows toward the border with the Fresnel region, but decays rapidly within a distance with a radio few times the wavelength.

The radioactive near field, respect to the source, begins approximately one wavelength. This field is formed by electric and magnetic fields that are

combined to form circular waves in relation to the source. These waves propagate outwards. The power density of this field is more or less constant. This region of Fresnel is of the preformation of wave, which is radiated in the Fraunhofer region.

The near field is formed by virtual-real photons while the far field is compound of real photons. Therefore, the wave is radiated fully formed and propagates in the far field, but it preform and it radiates in circular waves in the near field.

The far field, respect to the source, begins after of the Fresnel region, a distance which, Charles Capss estimated three times the wavelength radiated. This field is formed predominantly by plane waves, that is, local uniform distribution of electric field intensity and magnetic field intensity, transverse to the direction of wave propagation planes. The power density of the field decreases with the square of the distance. This power is distributed in a series of highs and lows, in the manner of a sine function.

In 2000, William D. Walker, of the Royal Institute of Technology, KTH-Visby, Department of Electrical Engineering in Sweden, performed a real experiment indicating that electromagnetic fields propagate superluminally in the field near a source of electromagnetic waves constituted by an oscillating electric dipole. Walker found that the transverse electric field travels at infinite speed in the first third of the formation of the electromagnetic wave. This speed gradually decreases to become closed to c when the first length of the electromagnetic wave is completed, and remains constant thereafter.

The superluminal speed of the transverse electric field in the near field is both the phase velocity and the group velocity. These results are consistent with the theoretical model for the propagation of electric and magnetic fields in the near field of oscillating electric dipole, which Walker obtained from the standard electrodynamic theory.

The mathematical reason that the propagation of electric and magnetic fields occur superluminally it is that within a length less than a length of the electromagnetic wave, this field cannot be modeling by a sinusoid (i.e the sine function (wt)) but a sinusoid inside a Dirac function (i.e, the function ϱ [r-d0 sin (wt)]) [12]. That is, as the wavelength is measured between two successive peaks or valleys of a wave, of course, during the preforming of the electromagnetic wave these sinuses not yet exist. Therefore, in the equations of the phase and group velocities of the denominators are zero, when calculated for a distance smaller than a wavelength, resulting in the phase and group superluminal speeds that were confirmed in the experiments of Walker, although without superluminal energy transport by happen before it is completed the first wavelength. But there are two speeds for the radiation field of the electromagnetic wave; one is the speed of the dynamic far field, and the other speed of the near dynamic field.

In nature the energy of a system can be transmitted to other in two ways: by irradiating waves or by a force of interaction, both phenomenon transfer momentum. But the unique that carries directly detectable energy is the wave, since energy which also carries the forces of interaction of static fields, is directly undetectable; however the transference of energy by the forces of interaction is manifested by the impact energy at each point in space, since particles on them have potential energy, which can be measured.

3.3 Evanescent Waves

Prof. Dr. Günter Nimtz has produced very weak waves that it propagates with superluminal speed. The first experiment, performed in 1992 with Achim Enders, wherein optical photons were transmitted to a photon barrier, via a microwave tunnel. Nimtz said: "A signal is characterized by a carrier frequency and modulation".. "Here the carrier frequency was 2 * 10^{14} Hz and the modulation frequency band was 10^{-4}. For long distance transmission of these signals were modulated in high frequency." [13].

“These very weak waves of very low frequency are the refraction with limit 0.001% of the energy of the electromagnetic signal used as a source to produce them [13]. They are evanescent waves, because its wave number is an imaginary value. Nimtz explains them as composite waves of virtual photons [13].

The evanescent waves are produced by passing the source signal, via tunneling through barriers dielectric of photons, black box, which is of two types. In the first, the signal passes through the center of the waveguide, sufficiently narrow, less than half of the wavelength in both directions perpendicular to the propagation section through which pass only frequencies more low of the source signal. In the second, the signal passes through the air gaps of heterostructures or double prisms, in them the failure of the total internal reflection occurs; the mechanism, in the air gaps, was the change in signal transit between a refractive index greater than 1 and the dielectric refractive index ≈ 1 of the air gap.

The group velocity in the black box of the experiment (i.e. in the tunnel barrier) was determined and the data are also valid for the transmission of signals. By sending signals, containing millions of optical

photons, analogous to microwave experiment, in the black box it obtains the same superluminal group velocity that in the singular photon experiment. In both experiments: microwave and photon singular, the group velocity was measured with a detector located in the free space far from the black box. In such asymptotic measures the relationship is preserved, i.e., the group velocity equal that the speed of the signal [13].

The maximum superluminal speeds was achieved with the double prism. In these experiments two dielectric prisms of perspex, same refractive index, were used, up to 5 cm separate by an air gap. The signal was microwaves of 3 cm. in length, with which has been achieved to 30c, group velocity of the evanescent waves induced [13].

The evanescent waves are waves refracted of very low frequency, hence with very low energy. These waves are produced as the residual energy of the order less than or equal that .001%, that it refracts when the total internal reflection occurs. The microwaves enter to the prism at an angle of incidence greater than the angle of reflection overall, these waves collide with limit of the first prism. This is the phenomenon of tunnel according to quantum mechanics, since the refractive energy so weak can overcome the high potential energy of the barrier, which is theoretically impossible in classical mechanics of waves. These superluminal waves do not travel to the past but they do not spend time to across the air barrier since they arrive at the receiving antenna earlier than photons [13].

The evanescent waves are characterized by exponential smoothing and their pass through the barrier they do not spend time, since have no phase change [14], which is the cause of their superluminal speeds. In 2009, Nimtz extended his experiments to phonons and electrons with the same result, therefore, said: "It seems the time via tunnel is an independent universal property of the field in question" [15].

4. SUPERLUMINAL NEUTRINOS

4.1 The OPERA Experiment

In the research laboratory "Gran Sasso", Italy, in the "Oscillation Project with Emulsion-tracking Apparatus" (OPERA), a group of scientists discovered accidentally that the muon neutrino traveling in vacuum with a speed greater than c, approximately 25/10000. This result was obtained in accordance with the ratio (speed muon neutrino - c)/c = (2.37±0.32 (statistical uncertainty) + (0.34, -0.24) (total systematic uncertainty)) x 10^5 [16]. Experimentally, these scientists were investigating the first direct evidence, of the oscillation between neutrinos: muon and tau [17], which is the conversion of one another by change in the amount of mass, which only occurs under the particles with mass.

The neutrino, which exists in the states of electron, muon and tau, interchangeable during his oscillation, was postulated by Wolfgang Pauli in 1930 and observed for the first time in 1956.

The neutrino oscillation was proposed in 1950 and observed in 1998. The neutrino is a lepton, that is, an elementary particle with constituent quarks of matter, without charge, which only experiences the weak interaction, giving it charge, and the gravitational interaction generated in the decay of the proton. The neutrino has mass, according to the cuadri vector momentum, which is equivalent in energy = (0.24 eV, <15.5 MeV) [18]. The muon resulting from the oscillation of the electron neutrino has a mass <170 keV (in OPERA experiments, the maximum value was 2 eV).

Surprisingly, in February 2012, a junior scientific, of OPERA, said that were found infrastructure failures that forced to repeat the experiment. Such failures were a bad connection of a wire of fiberglass that is connected to a small box, which converts the optical signal into an electronic signal and the other was the correct synchronization between the clock of Gran Sasso with the master clock OPERA. Thus, it is not confirmed the superluminal speed of neutrino but in litigation. Let's say that the risk of crisis, due to the very low difference of the neutrino speed with c, in the Special Relativity was fast ended.

It is strange that these failures remained hidden during the long period when the experiment was repeated before that OPERA officially report its finding. The results obtained in 2008, 2009, 2010 and 2011 were consistent with the rigorous statistical tests to they were subject, when supposedly the semi loose cable would be a condition subject to chance. Moreover, while it was expected that OPERA repeat the experiment was ICARUS, group rival of OPERA, who performed it and was the official spokesman of the Direction of investigation of CERN who said, in June 2012, that really the speed of neutrinos is lower than c. Previously, the official spokesman of ICARUS said: “OPERA could not do the experiment properly. Thus, a single experiment with negative value rejected numerous experiments with positive values.

Officially, the new director of OPERA announced that this group will not coming back to perform experiments on the speed of neutrinos, but continued

studying the mechanism of neutrino oscillation. Of other hand, MINOS [19] confirmed result of ICARUS and too a paper of NASA [20].

The experiment of direct observation of neutrino oscillation is extremely complex, supported in processes of advanced technologies and great technical rigor. At CERN in Geneva, in the Super Proton Synchrotron, protons are accelerated to the maximum possible energy for this experiment, which is of 400 GeV/c, with a cycle of 6 s. These protons, at the target chamber, are addressed by two magnetic dipoles (magnets) against target graphite 2 m in length, of two extractions, one takes place in the room B and the other in the room C, separated by 50 ms, each extraction lasts 10.5 microseconds [21]. The signal used to launch the protons, is the Coordinated Universal Time (UTC), and the lapse of each launch is 524±5 ns. The two extraction system generates two distributions of protons, which in turn produces, in time, two distributions of neutrinos both in output at CERN and in arrival at Gran Sasso. This redundancy is performed in order to estimate the statistical and systematic uncertainties and statistical adjustment by the maximum likelihood method [22], which allows the calculation of the speed of neutrinos. The result of the collision of protons into graphite, are mesons (hadrons formed by a pair of quark and antiquark), with positive and negative electric charges, highly unstable, which decay by: kaon → two pions or 3 pions and a pion → two gamma rays, an electron and a muon neutrino, inside a tunnel decay under vacuum, rectilinear of 1095 m in length. By this tunnel muon and electron neutrinos pass to a interrupter of hadrons (18 ms in length) and then to the adjacent first detector muon electron (5 m long), which is connected rectilinearly, through a tube of 67 meters in length, to a second electron muon detector (5 m long). From this detector the beam of nearly pure muon neutrinos get out with an electron neutrinos pollution ~ 0.9% [23]. Neutrinos are cleaned by a magnet placed on detectors, which separates the neutrinos of muon electron that have escaped from the interrupter hadrons, which are deflected in the opposite direction to its negative charge direction while the neutrinos go rectilinearly. Neutrinos cross a straight channel of 730 kilometers underground, traveling at a constant speed to the OPERA detector of the Gran Sasso Laboratory. Inside channel ($\nu\mu \rightarrow \nu\tau$)) the beam of muon neutrinos travel with an average energy of $E\nu \sim 17$ GeV. In this experiment, the neutrino energy depends on the energy of pions and the energy of pions from their parents, the protons, at the time of their collision against the target, and in general, depends on the energy of the trigger production process. The detection of the beam of neutrinos in the Gran Sasso, takes place under the weak interaction of charged current, i.e, via boson W ± (the other way is the neutral interaction via boson Z0), with the atomic electron detector Gran Sasso. The minimum energy required for this interaction is > 11 GeV [24]. The distribution of the neutrino energy within the range (total average ~ 17 GeV) of the experiment, had no effect on its speed, since the speed for higher energy (average of ~ 43 GeV) was the same for lower energy (average of ~ 14 GeV) [25]. The constant speed of neutrinos, as well as its mass and positive energy ranks neutrinos in the category of non-tachyon particles [24]. At CERN and the Gran Sasso are installed two identical systems in UTC time measurement, consisting of a GPS receiver, Septentrio PolaRx2e [26], and an atomic clock, Symmetricom CS4000 [27]. The clocks are synchronized by the GPS, with an error of 2 ns [28]. This experiment, with various modifications, was conducted in 2008, 2009, 2010 and 2011 and provided statistics, high accuracy, related to the muon neutrino superluminal velocity [16].

4.2 The Invariance of Helicity of Neutrinos

The astrophysicists, of the Republic of Kazakhstan, of the Fesenkov Astrophysical Institute, Eduard Mychelkin and Maxim Makukov in his work "Tachyonic approach to neutrino dark matter" say, "according to the experiments of parity violation in weak interactions, all neutrinos are left-handed (and antineutrinos are right-handed). If the speed of neutrinos is less than the speed of light then in some frames of reference it should exchanges helicity of neutrinos to opposite. As this has never been observed, the conclusion is that the speed of neutrinos should be (within the accuracy of the experiments) greater than the speed c. In this case the tachyonization of neutrinos is not an ad hoc hypothesis, but the consequence of the chiral invariance " [29]. Of course, for neutrinos their spin is always opposite to their momentum and this is known as "left hand", while antineutrinos are always "right hand". Neutrinos are the only particles of matter in the Standard Model of particle physics that have only been observed left hand so far [30] and at least since 1957 [31], when they first were theoretically discovered. By this, the conclusion, of Mychelkin and Makukov, it should be noted although it is opposite to the measurements of Minos [19] and NASA [20].

With respect to this lack of correspondence between the conclusion of Mychelkin and Makukov and ICARUS-Minos-NASA the author got the following response from them: “Whether neutrinos are super- or subluminal is a matter of experiments/observations which must have extremely accurate precision, since expected deviation of neutrino velocity in either

direction from the speed of light is very small at detectable energies. Experiments of such precision are unattainable presently. Therefore, currently no one can confirm if neutrinos are super- or subluminal.

What we do in our papers is developing a theory of superluminal neutrinos which is consistent with current experimental and observational data. Again - this by itself does not prove that neutrinos are indeed superluminal. But if future experiments/observations will confirm that they are, we will already have a working theory to describe them" (E-mail, 19 February of 2016).

5. SPECIAL RELATIVITY VERSUS SUPERLUMINAL SPEEDS

5.1 Relativity does not allow Speeds Greater than c

In Relativity, formulated in the absence of the distinction between real and virtual particles, all particles existing in nature have a speed $\leq$ c. Even when in quantum mechanics the difference between real and virtual particles was introduced from the Heisenberg uncertainty principle, and when, in 1929, was discovered the first virtual particle by Paul Dirac, without review this restriction is maintained.

The big adoption at the Academy of Relativity has caused over an extended period, started at 1905, a unanimous rejection of superluminal speeds in nature.

By part of scientists, recognized by the world scientific community, it was only from 1992 that Günter Nimtz, Steve Carlip- Matthew Wiener [32] and William Walker, have argued that the virtual photon has a velocity > c and Tom Van Flandern [33] and Walker that virtual graviton speed is superluminal. But Carlip after he said on behalf of FAQ, where, in 1994, for the first time Matt McIrvin said [34], in his later works returns to the defense of relativistic orthodox thinking and Van Flandern, after of be object of abuse, today, after his death, he is ignored.

During period 1905-1992, only as theoretical solutions of the equations, first of General Relativity, in 1949, Kurt Gödel found if the speed of the particle is > c then the particle travels time like, exactly at one geodesy in the past light cone, which under a strong gravitational field, is a geodetic time in a closed curve, which allows travel into the past. Later, in 1960 decade, in the equations of the Special Relativity was formulated the tachyon, with speed always > c. Independently, Arnold Sommerfeld, George Sudarshan, Olexa-Myron Bilaniuk, Vijay Deshpande and Gerald Feinberg found the tachyon.

The travel of a particle time like, violates the principle of consistency of Novikov, which postulates that if an event exists and causes a paradox, or any change to the past that the cause, then the probability of event is zero or the conjecture Hawking's chronology protection and, in general, the law of causality. And the tachyon in quantum field theory, due its imaginary mass is too unstable for be considered real.

The only consistent solution of the equations of General Relativity, about a superluminal speed is of Stephen Hawking. That he presents in his work on wormholes [35], which would allow time travel to the future, through a tunnel-cutoff spacetime. As in the case of false Hawking radiation [36] the superluminal speed is an apparent effect since within the wormhole, only it would travel to a speed (<c, c).

5.2 Versions of Relativity with Speeds Greater than c

5.2.1 Superluminal relativity

In 1998, Petar K. Anastasovsk considered: "Our stand point is that the vacuum should have properties which are connected with the mass of the particles, as well. The main supposition of the theory for Superluminary Relativity is that besides the vacuum properties covered by the Special Relativity and corresponding observed phenomena, there exist some other vacuum properties as well, which are additional to the first ones, but which allow the possibility for v>c". This thesis arises as a result of his outstanding research in nuclear physics where he finds a better understanding of nuclear phenomena if speeds greater than c are supported. Moreover, Anastasovski solves the mathematical problem of the Lorentz transformation formulated for v> c, so that c is kept as a constant of nature, for all inertial observers, but not as a final speed (in this case, $x' = \sqrt{(1 - c^2 / v^2)}\ (x + vt)$, $y' = y$, $z' = z$, $t' = 1 / \sqrt{(1 - c^2 / v^2)}\ [t + \sqrt{(c^2 (v^2-c^2) / v^4}\ x])$ [37].

5.2.2 Extension of special relativity to superluminal speeds

Due to the measurement by OPERA of the superluminal neutrino, in 2012, mathematician James Hill and Barry Cox, of the University of Adelaide, Australia, proposed two new transformations between inertial systems that apply to relative velocities greater than the speed c, which is not required for such particles imaginary mass and energy and that are complementary to the Lorentz transformation, and

Relativity it extends from sub light speeds $0 \leq v \leq c$, the superluminal velocities $c < v < \infty$. However, it is not clear whether it preserves causality. These new transformations arising from Lorentz, eliminating the singularity $v = c$, but preserving it for $uv = -c^2$. The result is that certain regions of the plane (u, v), is superluminal $| U | > c$ being sub light $| U | < c$, rest of plane, such that the same law of Einstein, of the sum: $U = (u + v) / (1 + uv / c^2)$, which for $v = \infty$ implies invariant $uU = c^2$. From the dependence of the relative velocity of the Lorentz transformation are derived new transformations between inertial systems of the relative velocity, v, greater than c, under two possible criteria, one invariance physically retains much more likely than the other in which it omits. The energy-momentum equations that maintain invariance are $m = (p\infty / c) [(v / c)^2 - 1]^{-1/2} e = mc^2$, for $c < v < \infty$, where $p\infty$ is the limit of the impulse of the relative speed infinite, v. If invariance is removed, then it can have new equations of mass and energy, giving an example of mass nonzero finite in the limit of infinite relative velocity [38,39].

5.2.3 Special relativity symmetrical sitter

Also, as a result of the neutrino experiment OPERA, in 2012, the mathematical physicists, Mu-Lin Yan, Xiao Neng-Chao, Huang and Shen Wei Hu of the University of Science and Technology of China, formulated superluminal speeds under Special Relativity, SR, but with the symmetry of Sitter spacetime (DS-SR), which does not violate causality. The difference between SR and DS-SR is that, according to Minkowski spacetime metric of SR is $\eta_{\mu\nu}$ = diag {+, -, -, -}, whose broader transformation that preserves invariance is the Poincare group (or homogeneous group of Lorentz ISO (1, 3)) which is the limit of Sitter group with pseudo sphere radius $R \rightarrow \infty$. Due that other groups with finite radius Sitter also produce SR in the 1970s Lu Qi-Keng and colleagues ZL Zou and H.Y. Guo found DS-SR, i.e Special Relativity with SO (4,1) space-time symmetry Sitter where $c_{photon} > c$, finally, in 2005, Yan, Xiao Huang and S. Li applied the Lagrangian formalism - Hamiltoniano dS-SR with universal constants c and R. Under the assumptions of the Special Relativity that a photon is a massless particle, c_{photon} its speed universal parameter and the phase velocity of an electromagnetic wave in a vacuum, $c_{wave} = \lambda\nu$, is independent of the reference system it obtains the relationship $c = c_{wave}$ consequence of null result of the Michelson-Morley experiments as the basis for SR and DS-SR. The contribution of Yan, Xiao and Hu is that c_{photon} is derived of the charger generated from Noether symmetries of space-time SR. Therefore, while SR $c_{fotón} = c = c_{wave}$ in DS-SR due to $c_{photon} > c$ and that, $m\nu$ is quite small, it is easy to conclude that $c_{photon} > v_\nu > c$ when E_ν is large enough. Thus, using the context DS-SR, Yan, Xiao, Huang and Hu, explain the superluminal speed, measured by OPERA that agrees with the prediction of the DS-SR with $R \simeq 1.95 \times 10^{12}$. Based on the relation p-E of DS-SR, also showed that the argument of Cohen and Glashow on possible Cherenkov radiation due to superluminal neutrinos is prohibited. Finally, they got the conclusion that the results of OPERA and ICARUS are consistent, since they are fully explained under DS-SR [40].

6. CONCLUSIONS

Beyond doubt, the nature, in quantum scale, is quantum fluctuations and superluminal quantum entanglement. Also, the scale where there are high speeds such as the velocities of electromagnetic wave and neutrino. If speed of neutrino is greater than c is not possible establish now, due to limitation of the accuracy of the experiments.

Our current knowledge on the quantum scale consolidated with quantum entanglement, although recent poses great challenges to technology both to allow greater deepening that allows us to discover the nature of the disturbance of that quantum link and for industrial use in our communications.

The theory of relativity is a model that approximates but is not reality itself, therefore has anomalies. The scientific critical thinking should be open to sacrifice Relativity and has not force reality to conform to it.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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