Speed of gravity

By Alfonso León Guillén Gómez

aguillen@gmx.net

Bogota, Colombia, octuber 2005

TABLE OF CONTENT

Summary

Still nowadays is not known: What is the gravity? Which is its speed?.

However, in the world, the great majority of the physicists follow the General Relativity, which explains the gravity like the effect of the curvature of the spacetime in the movement of free fall of the bodies. But, simultaneously they agree that gravity as gravitational waves is a quantum phenomenon, endowed with a transmitting particle, known as real graviton, whose origin is the energy of the oscillation of the spacetime. Thus the gravity appears like geometric and quantum phenomenon, that has not allowed unify General Relativity and Quantum Physics. This is the other great existing physical theory, from which has been derived, the Quantum Gravity theory, whose carrier is the virtual graviton.

This problem has two basic alternatives to solve it. One is the theory of "Everything" that is based on explaining the quantum character of the gravity from strings in spaces of 5 and more dimensions, where the particle is turned pure geometry, but in spite of the great efforts realized, it is not surpassed the low energies. The other alternative is to leave General Relativity in search of the unification of the gravity and other physical phenomenons in a quantum theory, but of material particles. This scenery is again explored, as soon as it was left by the pioneers of the quantum gravity.

The geometric-quantum duality of the gravity, of the General Relativity, also, has darkened so much the concept of speed of the gravity like the development of an suitable technology to measure it, that according to the relativity must be equal to c. This was the goal for the end of 2005, of the Laser Interferometry projects of LIGO, GEO, VIRGO, TAMA, LISA, etc.

In 2002, the ingenious experiment made for to measure the speed of the gravity, by the scientist Sergei Kopeikin is not accepted due to its controversial effectiveness.

In 1998, from Quantum Gravity, from the material particles, in a theoretical experiment, the prestigious scientist Tom Van Flandern calculates the speed of the gravity at least in 2×10^{10} times c, that is consistent with the thesis of the author, formulated within an analogous scenery, in 1969, about the superluminal speed of the gravity.

In this paper the author presents the controversy on the speed of the gravity between

General Relativity and the Quantum Theory of the Gravity and exposes the foundations of his thesis.

PACS 04.20.-q general Classical relativity

04.60.-m Quantum gravity

Introduction

The gravity in analogy with electromagnetism includes the static and dynamic gravitational fields. The static field is the cause of the free fall of the bodies. The dynamic field is the cause of the gravitational waves.

1 The static gravitational field cause of the Universal phenomenon of the gravity

In both theories, gravity is caused by the static gravitational field, although it is formulated in two configurations:

- Static gravity field true of the General Relativity that remains always equal, while does not occur a transformation of cosmic magnitude, because it is the curvature of spacetime of a local region.
- Static gravity field apparent of the quantum gravity since it would be really made up of virtual gravitons, but because these gravitons exist within of the lapse of uncertainty, they never can be detected and the gravitational field always seems same it.

1.1 The static gravitational field according to General Relativity does not have speed.

In the General Relativity the gravity, that causes the fall of the bodies and explains the Celestial Mechanics, is the phenomenon of the curvature of spacetime of a local region.

The spacetime is the geometric place of all events (pasts, presents and futures) of the Universe, that in a local region exist in a curved manifold of Lorentz, dimensions $x\mu$ (x_0, x_1, x_2, x_3), because its tangent spacetime is the plane of Minkowski, characterized so that speed c is an insurmountable limit and the speed of the light is invariant for all observer.

The curvature of spacetime of a local region is caused by the existing mass-energy in that region, in agreement with the equation of Einstein $G_{\mu\nu} = 8\Pi\, G/c^2\, T_{\mu\nu}$. This equation gives the curvature in a event, in four dimensions, based in the fluxes of energy-momentum in the same one. This curvature is defined through derived partial from first and second order of the metric tensor $ds^2 = g_{\mu\nu}\, dx_\mu dx_\nu$. This tensor gives the distance between two closely events, $x_\mu + dx_\mu$.

In free fall, consequently, subjects to a field of gravitation, the bodies inertially move with accelerated movement, in curved trajectories that are the geodesies under metric $g_{\mu\nu}$. If curvature is zero then by inertia the bodies are in relative rest or relative rectilinear uniform movement, in a flat spacetime. Since the gravity is not more than the distortion of the geometry of flat spacetime by the presence of the mass-energy then does not exist transmission of gravitational force between the bodies, since they travel free of forces on geodesies, that are the shortest trajectories, and the bodies are not pushing among them. It is the metric $g_{\mu\nu}$, underlying to geodesies that it distorts the straight geometry of the geodesies of a flat spacetime and it turns them in curves. Thus, there is no class of radiation between the bodies connected within a gravity relation, equal than radiation no exist in the transmission of the electrical or magnetic force between electrical charges in rest or in uniforms rectilinear movement.

The components of the metric tensor $g_{\mu\nu}$ are equivalents to the gravitational potential of Newton, which multiplied by the gradient gives the acceleration that experiences a body in a point of the field of gravitation, $g = \nabla\varphi$. Einstein replaces the gravitational force by a purely geometric amount, $\Delta g_{\mu\nu}$. For Newton, this acceleration, g, is the gravitational force by unit of mass applied in a determined point of the field of gravitation.

The components, of the connection of Levi-Civita, link the metric with the

characteristics of the curvature. These component are known like symbols of Christoffel, $\Gamma^{\omega}{}_{\mu\nu}$. In the application of the partial first derived of the metric tensor, it determines by means of a parallel transport, in which there is not torsion nor shortening, the form of the curve between all pair of closely events of the gravity field, in the limit that tends to 0, for example, of a system like our Solar system. Really, these components are equivalents to the force of the gravity field of Newton, but that in Einstein is not more than the form of the curvature, and the components of the tensor of curvature of Ricci, calculated from the symbols of Christoffel, in the application of the partial second derived of the metric tensor, are equivalent to the gradient in a point of the gravity field, or change of the form of the curvature, that in General Relativity causes the free fall of the bodies, that is their movement accelerated within curved geodesies. The slope in any point, inside of the infinitesimal change, is not of the potential of the gravity field of Newton but if of the curvature of the spacetime of the gravity field of Einstein, always aims at the true position of the center of masses of the gravitational system, respect to which this center always is in rest. Thus, it is clear that the gravity does not have speed.

The author, since the perspective of the Quantum Gravity, finds that if the main source of gravity is not agreeing with the center of masses of a stellar system, as it is the case of our Solar System, situation that aims to be general since a stellar system frequently will be made up of a set of stars, then it would exist a torsion force acting between the star and the planets. The speed of transmission of virtual gravitons closed c and the existing angle between the direction of the emission of virtual gravitons by the star and the center of masses of the system be would the cause of this force. Since, in our Solar system, such torsion force does not act, then implies that the speed of virtual gravitons is sufficiently over c, so much like for to act instantaneously.

1.2 Static gravitational field according to quantum gravity has speed

In the quantum gravity also the static field of gravity is responsible by universal gravitation, nevertheless this phenomenon is the interchange of virtual gravitons between two or more bodies and since the aberration is not detect the speed of the virtual graviton must exceed c (thesis of the Dr. Tom Van Flandern). This is physically possible because the virtual graviton does not have intrinsic mass, in agreement with the quadrivector momentum, p^{μ}. Nevertheless, in the present, for quantum relativist

physicists the speed of the graviton will be c, maximum limit of the speed, since the quantum gravity is derived from the Quantum Physics, that is the integration of Special Relativity and the Quantum Mechanics. Though that c comes from Special Relativity where it only limits the speed of the bodies with intrinsic mass, the relativist physicists do not make such distinction. The possibility that the graviton surpasses c was supported by Doctor Carlos Lemoine Amaya, during one of my chat maintained with him, who said: "if, is possible because the graviton does not have mass in rest", fact that I had not analyzed, although I was who introduced, in 1969, this thesis.

In 1998, the astronomer, mathematician and scientist Tom Van Flandern derived from the formulas of the Celestial Mechanics, an equation that he applied to the Earth orbit and to the pulsar binary PSR1534+12 and he obtained that the speed of the gravity would be minimum 20 billion times c. Tom says: "If the gravity is taken again like a force of the nature that propagates in flat spacetime then the speed of the propagation indicated by the observation and the experiments: is no smaller than 2 x 10^{10} c ". The author notes that in general in nature, the causal link between the events occurs through a medium, that puts them in touch, through a certain speed of transmission that it can appear infinite without being it. For example, if an observer acts upon another through of an electromagnetic signal within a distance that tends to zero, the action is transmitted through the dynamic electromagnetic field and the action occurs instantly. Not so, if the sun acts on Earth, since the electromagnetic action, it communicates in about 8 minutes. In the case of the gravitational action of the pulsar PSR1534 12 on the Earth, is transmited instantly through of the static gravitational field, according to the calculations made by Dr. Tom Van Flandern. I did, this reflection, in the conversation that I had with the scientific Erico Tanaka, in one of the breaks of the conferences during Petrov 2010 Anniversary Symposium on General Relativity and Gravity, held in Kazan, capital of the Republic of Tatarstan, Russian Federation, between 1-7 November, which I attended. If, as in reality the effect of gravity is caused by the force that carries the virtual graviton, necessarily your superluminal speed is not less than the value estimated by Dr. Tom Van Flandern. The pain that cause that this great scientist was indicated in a moment like a mad is compensated by the fact that dialectically, was honored by placing it in the gallery of the giants of thought to the that truly he belongs.

> In effect, take of again the spacetime as flat account, to its favour that the topology of the Universe seems that it is of curvature zero, then the space is plane. This implies that the spacetime, in the direction of the infinite, is also of curvature 0, ie, Minkowski' or Euclidean' spacetime. So is indicated in the experiment to measure the rate of change of the speed of expansion of the Universe made by Saul Perlmutter of "Lawrence Berkeley National Laboratory", in California, USA, published in "Nature", in 1998, that was corroborated by Peter Garnavich and

Robert Kirshner of "Harvard-Smithsonian Center", in Cambridge, England. Confirmed by the measurement on the mass of the Universe made by Paulo de Bernardis, in the Boomerang project, that coincides with the result obtained by Paul Richards, of the "Maxima" project and with the result of the "Supernova Cosmology" project. The present cosmology, based in General Relativity, for establish the topology of the Universe uses the course of the expansion from Big-Bang; this depends of the density of the matter and the speed of the expansion. The possible topologies of the superficial space are: flat (curvature 0), spherical (curvature +) and of chair to mount (curvature -). Then, the curved spacetime is only a local phenomenon because in the infinitesimal lapses is plane and the space in the Universe is plane.

Tom has said that if the speed of the gravity is c then in the propagation of the static field would produce the phenomenon of aberration and the orbits of planets would be unstable. The contradictors of Tom say that this was solved by Faraday, Maxwell and others. It is certain that the physicists of century XIX when discovering the field, through which a distant body makes contact with another body, eliminated the remote action of Newton. But, also it is certain, that the physicists of century XX discovered the quantum field, compound of virtual particles of the static field and of real particles of the dynamic field. And in the effect of Poynting-Robertson was established that the action through the field with finite speed causes orbital instability as Dr Tom Van Flandern says. The Poynting-Robertson effect is the force of the pressure of the light that due to speed c, acts throughout of the radius from the apparent position of the Sun, and not from the true position of the Sun, which affects the artificial satellite orbits [8]. Althought that the gravity force is of the class of the forces of Lorentz, the Dr. Flander showed that is transmited by a virtual wave.

The scientific Dr. Steve Carlip has said that the aberration it cancels by the law of conservation of the energy and the quadrupole nature of the gravitational radiation. Really, this argument not applies since the phenomenon of the radiation of the gravitational wave is despicable in the celestial mechanic [9]. In addition it requires of a system that generates the cuadripolo momentum of masses and this case the wave occurs outside of the radioactive near field, consequently, out of the orbits of the planets, which not would be affected by the aberration but in long time, it would occur the coalescence by lose their orbital binding energy by the radiation that the gravitational waves transport.

It was in 2004 that the author discussed the arguments of Dr. Steve Carlip against the work of Dr. Tom Van Flandern, in his paper Experiments indicate that the

speed of gravity is minimum 20 billion times c. Numeral 1.10 The reply of the relativists.

On January 24, 1996, on behalf of FAQ, until 1994, when Matt Mc Irvin contradicted which had hitherto held that the speed of virtual particles did not exceed c, on "How do gravitons escape from a Black Hole?" Drs Steve Carlip and Matthew P Wiener stated: "We don't yet have a good quantum theory of gravity, and it's risky to predict what such a theory will look like. But we do have a good theory of quantum electrodynamics, so let's ask the same question for a charged black hole: how can a such an object attract or repel other charged objects if photons can't escape from the event horizon? The key point is that electromagnetic interactions (and gravity, if quantum gravity ends up looking like quantum electrodynamics) are mediated by the exchange of *virtual* particles. This allows a standard loophole: virtual particles can pretty much "do" whatever they like, including travelling faster than light, so long as they disappear before they violate the Heisenberg uncertainty principle." (How do Gravitons escape from a Black Hole?). We agree, virtual photons and gravitons traveling above c. The contribution of these two great scientists, Drs. Carlip and Wiener is great because they gave strongly on target, since that they took the virtual photon, a particle sufficiently known, while virtual graviton is still a hypothetical particle. They do not prove or provide evidence on superluminal speed of the virtual photon, so, the author draws the conclusion that they were based on the experimental discovery by Dr. Nimtz, in 1992, only prior to that date, antecedent known by the scientific community. This Statement of Carlip-Wiener remained unnoticed, until very recently, until it lost the notion of when it was given; the author was confused at first and behind rigorously monitoring found that is relevant from 2010 and thanks Joseph W. Lazio, who from 1995 collects the concepts from the FAQ, he could determine the date exactly. Truly the virtual particles carry energy to superluminal speed. Throughout, a chain, toward the infinite, through the links annihilation-creation of virtual particles, occurring in a vacuum, the virtual photons and virtual gravitons spend the period of uncertainty (This chain, in the words of Dr. Tom Van Flandern is a wave or Dr. Nimtz is the evanescent wave or Dr. Walker is the preformation of the wave in the near field). Therefore, the energy of potential energy of static fields was transported and, accordingly, represents information.

Also, it says that the force originated in the aberration, is cancelled by the exterior gravitomagnetism. The interior gravitomagnetism would be a rotating flow of gravitational energy caused by the drag spacetime, in the gyre on its axis of the planets. This flux was predicted by Einstein and established by the NASA, in the

test of gravity B, althought with the high error of the 19%. The exterior gravitomagnetism would be the flow, created by the rotation of planets around of the Sun. The forces originated in these flows are considered very weak and despicable although the scientists Martin Tajmar and Clovis de Matos, financed by the "European Space Agency", believe to have measured, in laboratory, in the 2006, the interior gravitomagnetism, very above of the value of Relativity, in favour of the quantum gravity. The author observes that to accept the thesis of that the aberration is cancelled by the exterior gravitomagnetism, the forces would have to act in opposite sense; no is thus, since all the planets are transferred around the Sun and turn on their axis in the same sense counterclockwise called positive, then the sense, of the forces of the gravitomagnetism, matches with the sense of the forces that cause the aberration. The only exception is the turn on its axis of Venus. Thus, in general, the gravitomagnetism does not cancel the aberration but that would reinforce it.

As has happened in the past, advocates of general relativity again have changing their arguments (they abandoned the gravitomagnetism) and harassed and exasperated have chosen not to refer more to Dr. Tom Van Flandern, that is, hiding him down the dark fog. According to the old paper, "Aberration and the Speed of Gravity" of 2000, of the Dr. Carlip, now worthless, due his statement of 1996 on superluminal communication between the static electromagnetic field (electric and magnetic fields uncoupled) inside the event horizon of a charged black hole and static electromagnetic field outside, they are saying: "The finite speed of gravitational interaction in general relativity does not to lead the sorts of problems with the aberration of gravity that Newton was originally concerned with, because there is no aberration in static field effects. Because the acceleration of the Earth with regard to the Sun is small (meaning, to a good approximation, the two bodies can be regarded as traveling in straight lines past each other with unchanging velocity), the orbital results calculated by general relativity are the same as those of Newtonian gravity with instantaneous action at a distance, because they are modelled by the behavior of a static field with constant-velocity relative motion, and no aberration for the forces involved" (Speed of gravity - Wikipedia). No, this equivalence is only valid in the infinitesimal lapse of spacetime at every event using using the tangent Minkowskian space, metrics $ds^2 = g_{\mu\nu}\, dx_\mu dx_\nu$ (January 9, 2012).

2 The speed of geometric configuration of the curvature of a spacetime local region

In General Relativity the bodies inertially follow the geodesies of a certain local configuration of the spacetime. The equation of Einstein: $G_{\mu\nu} = 8 \pi G/c^2 T_{\mu\nu}$ shows as the flow of energy and momentum through a point of spacetime affects its curvature there, defined by means of the tensor of second order of Ricci that does not apply in the vacuum and it only gives information on the curvature for three dimensions, but also the spacetime empty is curved inside of a local region according to the gravitation of a stellar system described by the tensor of Weyl that transports the information of the curvature independently of the gravitational source and completes the part of the curvature of the manifold of four dimensions of the spacetime of Lorentz, not specified by the tensor of Ricci.

The speed of this connection, well-known like the speed of the connection of the field of gravity with the bodies, would be c and would be the speed of the bending spacetime of a local region. It supposes that the speed c was relevant during the formation of the Solar System possibly due to the fragmentation and the gravitational collapse of a very gigantic interstellar gas cloud and dust, does near 4,650 million years and until near 100 million years later, in which the Solar System acquired a aspect similar to the actual, composed of the Sun, sub regions of planets and their moons, asteroids, comets, meteoroides, dust and interplanetary gas. In that lapse the configurations of spacetime of the local region and of the sub regions were formed very similar to the existing configurations nowadays. The geodesies also are updated with the relative changes of position between the bodies during their relative movements of orbital transfer. Also, it is the speed of updates of these curvatures with the very smooth changes that are happening in the flows of energy and momentum within of local region due to the interaction of our Solar System with the rest of the Universe, in the processes of delivery and receipt of radiating energy. In the terms of the celestial Mechanics, the update of the geodesies lacks importance.

The changes in the configuration of the spacetime require of a causal connection between the bodies, by means of the virtual graviton interchange that the bodies radiate, from their mass-energy.

> Tom Van Flandern has demonstrated that General Relativity cannot explain this connection since it lacks of virtual gravitons. Thus, Tom rejects the geometric model and assumes the model of the quantum physics.

3. The gravitational waves and their speed in agreement with the equations of field of the general relativity

Einstein considered the existence of gravity waves in analogy with the electromagnetic waves that are produced by the acceleration of an electric charge, although, in the case of the gravity, its waves would be generate by the accelerations no uniforms, mutually induced between the bodies, that intervene in a gravity interaction. This would be the case of the elliptic orbits of the binary pulsars. But these gravitational waves are absolutely strange to the phenomenon of the Universal gravitation.

The speed of propagation of these gravity waves, predicted by Einstein, would be c, which counts on the endorsement of the community of relativistic scientists, that even they calculate can be a little minor. The professor doctor Helmut Rechenberg, of the Institute Max Planck, in Munich, Germany, that has been director of the CERN, said me in August of 2000.

What cause these not uniform accelerations? According to Einstein when at least a quadrupole mass system exists, by example, the binary asymmetric Pulsars.

The General Relativity predicts the existence of radiation of gravitational waves that, in the lowest order, is proportional to the third derivative of the quadrupole momentum of the distribution of the mass-energy of a local region. This radiation is originated in the mechanical lost energy, that is to say, kinetic and/or potential, during the accelerations no uniform of the matter inside the system. The lost energy reappears in the induced undulations of the curvature of the space-time. Due to the continuous character of space, the energy is transported from the sources to the asymptotical regions of space. During the gravitational radiation, the mass of the particle does not change, of this assumption it eliminates the possibility that the particle same, with its own energy, contributes to the gravitational radiation.

The electromagnetic waves, it generate by oscillations of two electrical or magnetic poles of equal magnitude, sign or opposite polarities, inside a very small space. In analogy, the General Relativity predicts that two star oscillating ahead-back must produce gravitational waves. In effect, this happens in binary pulsars. If the stars of the binary system are closely together then they push each one the other, and they communicate an orbital oscillating movement. Nevertheless, this analogy between electromagnetic waves and gravitational waves is not so perfect. While, electromagnetic waves propagate in the spacetime, the gravitational waves are waves of the spacetime itself, and whiles in the electromagnetism the oscillation is symmetrical and the

electromagnetic waves are spherical waves, in the gravity its waves are as the waves of the sea, that require of asymmetric sources. This is the case of a binary pulsar with ellipsoid form and/or elliptical orbits. In these pulsars with the time, inside of the dipole occurs the variation of the common center of masses; this produces the quadrupole that reunites the relation of the energy of four nonsymmetrical angular momentums of two masses.

These not uniform accelerations is believed disturb the continuous 4-Lorentzian structure of a local region but very weakly, so much that according to the calculations of the general relativity not even the gravity waves produced by the asymmetric explosion of a supernova, are capable to accelerate in a level detectable, to another star.

The emission of these gravity waves cause the loss of the orbital angular momentum of the binary Pulsars. In effect, the orbit decays for the PSR1913+16 coincides with the prediction of Einstein about of such gravity emission. This constitutes the only indirect test about its existence.

Since 2005, in the projects: LIGO and LISA, of US, GEO, of Germany, VIRGO, of Italy-France and TAMA of the Japan, it searches discovery the gravity waves and establish their speed.

The radiation of the binary pulsars is gravitational radiation?

The doctor Tom Van Flandern says that waves radiated by the binary Pulsars are not waves of gravity but if some form of electromagnetism. Tom Van Flandern ratified, this concept, to the author, by means of E-MAIL of 1/11/2000.

In 2002, the scientific Lee Samuel Finn and Patrick J. Sutton of the Center for Gravitational Wave Physics, of the University of the State of the Pennsylvania, USA combined the rates of orbital decay of binary pulsars PSR B1913+16 and PSR B1534+12 and they obtained that mass of the real graviton is maximum less than $1.35342\ 10^{-52}$ grams, with a 90% of confidence. This value is closed to superior limit of the mass of the real photon which is less than 10^{-51} grams, in agreement with calculation, made by the scientific Jun Luo and its colleagues in the Huazhong University of Science and Technology in Wuhan, China, in 2003. And very far of the value superior limit of mass of the real graviton less than $4.5\ 10^{-66}$ grams, estimated by S S Gershtein, A A Logunov and M A Mestvirishvili, in

1997, with base in the observed parameters of the expansion of the Universe. Thus, the Dr Flandern has reason and such radiation is not gravitational radiation. The rate of orbital decay of binary pulsar Hulse-Taylor, PSR B1913+16, is agrees with the predicted by General Relativity with an error of approximately + 0.3%. However, this minimum error can lead to reject thesis of which this is gravitational radiation.

4 The experiment of Sergei Kopeikin

However, the speed of the gravitational waves would be 1.06c, with an error between 10% and until 20%, in agreement with the experiment of intercontinental radio-Interferometry, that combined 10 radio telescopes on a vast distance in order to form a giant antenna able to capture very remote radio waves and obtain a set image, made, the 8 of September of 2002, by the team of astronomers directed by the scientific Sergei Kopeikin, of the university of Missouri, in Columbia, and Edward Fomalont, a radio astronomer of National Radio Astronomy Observatory (NRAO).

Which speed of gravity?. In agreement, with the email that in answer received the author of doctor Kopeikin, the 11 of January of 2003, 20:43, really this speed are not the speed of the gravitational waves anticipated by Einstein, but if the change of the gravitational field of Jupiter, throughout the trajectory of the radio ray, between quasar J0842+1835 and the barycentre of the Solar System, as a result of its accelerated movement does not uniform with respect to this quasar.

Which change of the gravitational field?. The model of gravity of Kopeikin introduces a force, produced by something that it transmits and in this sense, Kopeikin does transition to the Quantum Theory. Since, in this model through the gravity field it transmits momentum between Jupiter and the ray of the radio waves .

The force that speaks Kopeikin is a species of preformation, inside the near gravity field, of the wave gravity that occurs far away. Therefore, this force does not move the celestial bodies in its orbits around other. This force in the near field of gravity static would be originated due to the speed c of the gravity. In addition, as preformation of the wave gravity should possess the same speed of this wave, that if is the gravity wave of Einstein. That is to say, the preformation of the wave of gravity remits to Kopeikin to the wave of gravity of Einstein.

Kopeikin said, "The gravitational waves are inherent in the zone of radiation (distant) of a system that is emitting the waves. Nevertheless, the waves of gravity do not spread freely inside the interior of the zone of not radiation (near) of the system. But, the process of generation of the gravity waves produces effects retarded in the near zone that appears mainly as a force in the equations of movement of the relativity for bodies extended, inside a system of astronomical gravity. The existence of that force is the consequence of the finite speed of the propagation of the gravity."

Kopeikin said "The existence of this force was proven by J. H. Taylor in 1994", a year before Taylor gained the Nobel Prize of physics by its shining investigations on binary pulsars. Taylor found the existence of a force that according to Kopeikin can be generated in the near radioactive field of gravity.

Kopeikin took the model of Schwarzschild of the spherical symmetrical static gravity field. In addition, he included the retard of Shapiro of the Sun, the Land and Jupiter, also, the transverse retard of the moment that the gravity static field would transmit, as result of the finite speed of the preformation of the gravity wave. According to Shapiro the pulses of the electromagnetic currents of radiation suffer a retard, in front of its rectilinear path, directly proportional to the value of the curvature of the space-time of a region local that they cross.

Kopeikin with its explanation of the deflection devises a mixed model of the phenomenon of gravity that would be then geometric effect of the curvature of the space-time and a quantum effect of the gravity wave. Thus, Kopeikin reformulates the general relativity in quantum terms. This is a matter still without success.

In the explication of Einstein of deflection the gravitational field is not transmited a force and, therefore, has not speed. The static gravitational field is indeed the force absence. This phenomenon would be the simple consequence of the curvature of the space-time. The measurements made in the past of the deflection by the Sun is the effect of the gravitational potential on the electromagnetic waves, that is to say, deflection is caused by the curvature of the space-time, that cause a spherical body, on the electromagnetic ray that inertially follows such curvature.

Kopeikin used the quantum effect of the preformation of the gravitational wave in the deflection of the originating radio waves of quasar J0842+1835 by Jupiter gravity, that according to him must depend on the speed of propagation of the gravity. The doctor

Kopeikin says: "If the speed of gravity were infinite quasar he would appear to circulate in the sky to the Jupiter passes. But, if the speed of gravity is finite quasar will have to appear elliptical ". To carry out this Kopeikin calculation rewrote the equations of general relativity, concerning the deflection, in function of the speed of gravity, masses and speeds of Jupiter and J0842+1835 during its visual alignment of the 8 of September of 2002. Thus, Kopeikin hoped obtain the speed of the gravitational wave.

Kopeikin designed your experiment, very similar to the realized in 1919, that permitted to verify the prediction of Einstein of the deflection that suffers a ray of light originating from a star by the gravity of the Sun. Although in this case, a quasar replaced the star, the Sun by Jupiter and the ray of light by a radio waves ray. In addition, his objective was not to establish the deflection that the radio waves ray suffers by the gravity but if the speed of gravity. Kopeikin took Jupiter because is in motion and for to eliminate the retard that the solar plasma causes, when it interacts with the photons that compose the rays of the electromagnetic wave. This retard is very difficult to measure and constitutes the main problem to obtain a dependable result of the deflection and according to Kopeikin the speed of gravity.

The experiment of Sergei Kopeikin eludes to confront the debate scientific that in the terms of the speed of gravity requires first theoretically it resolves if the gravity is according to the relativity general of Einstein or to the quantum gravity theory. And second, to design a crucial experiment for to establish the speed of transport of the force of interaction between the source and the objective, that gravity static field transports.

> The scientific Paul Marmet and C Couture, of the Department of Physics of the University of Ottawa, by means of E-MAIL of May 15, 2003, 18:05, respond my consultation about if solar plasma affected the experiment of Kopeikin. They are authors of a magnificent study on the deflection of the electromagnetic rays of radio-waves by the plasma of the Sun. They declared, "We read that Sergei Kopeikin compared the speed of light near Jupiter with the speed of light after its retard proper to the plasma near Jupiter. He found that the difference is too much small measuring it (same value of c). You should announce that at present has been measured is the speed of light. This is not the speed of gravity." Therefore, Kopeikin does not measured the speed of gravity.

5 Is superluminal the speed of gravity wave in near field?.

The scientific William D. Walker, of the Royal Institute of Technology, KTH-Visby, Department of Electrical Engineering, in Sweden, carried out an experiment that indicates that the electromagnetic fields propagates superluminal in the field close to an electromagnetic source of waves, constituted by a dipole electric oscillating. Walker found that the transverse electric component travel to infinite speed since the first quarter of the formation of the electromagnetic wave. This speed decreases progressively until c, very closed to the moment in which it completes the first length of the electromagnetic wave, and remains constant of there. This result is consistent with the theoretical model for the propagation of the electric field and the magnetic field, in the near field of the dipole electric oscillating, that Walker obtained of the electrodynamics standard theory. Due to the similarity between the theoretical model of the dipole electric oscillating and that of two oscillating masses that radiates gravity waves, in the sense of Einstein, Walker foresees that these waves, in the near field, propagate, also, with a superluminal speed [24]. This result agrees with those obtained by Dr. Gunter Nimtz in his experiments with evanescent waves. In both cases, there is no phase change.

> If in the propagation of the wave of gravity in the near field, the contradictory results, obtained by Kopeikin and Walker, are formally analyzed, we find that the experiments produce the result according to the theoretical model used. Thus, the fundamental thing in the measurement of the speed of gravity is the theory in which the same it base.

In the "Symposium on General Relativity and Gravitation" realized in Kazan, Russian Federation, 1-6 November 2010, the Dr. Dieter R. Brill, Ph.D. Princeton, 1959, professor of physics at the University of Maryland, "Gravitation Theory Group", and member of the "Maryland Center for Fundamental Physics" presented his work "The beginnings of black hole horizons", published in "Contributed Papers", pages 82-90, of "Petrov 2010 Anniversary Symposium" and "Zapiski Kazanskogo Uchenye Universitet", journal of Kazan University, which was discussed in APS (American Physical Society) Meeting, April 30-May 3 2011, Anaheim, California. In this work, the scientist Dr. Brill, presented his discovery about the existence of Kink superluminal propagation regions. On this cuestion, in Kazan, the author learned in the words of this great scientist, of extraordinary simplicity. The Dr. Brill says: “The beginning of a black hole horizon is the set of points where generators enter the horizon. Several properties of this ``entry set" and the early horizon near it are shown: It is the locus of the horizon's self-intersections, and it is spacelike of dimension zero, one or two, where this is defined. It is connected but can bifurcate in possibly complicated ways. On spacelike surfaces the entry of generators manifests itself in a kink in the horizon. The kinks propagate at superluminal speed until they ``run out of steam," slow down to light speed and

disappear. Kinks generally run from the main collapse region to secondary collapse events until no more new generators enter the horizon. This is illustrated by collapse of two mass concentrations, and by the case of a large number of particles.“.

6 Witch is speed of gravity waves?

The General Relativity, with their conception of pseudo force of gravity and the Quantum Mechanics, with their conception of the other fundamental forces like real interaction forces, are incongruous and incompatible theories. The bridge that unfruitful has tend between both is the quantum gravity. Nowadays it is had the theories of the gravidynamics quantum (QGD) for the force of gravity in the quantum scale and General Relativity for the gravity in the scale of the macrocosms.

But, neither in the terms of the theory of General Relativity, nor of the alternative metric theories, nor of the quantum gravity theories as the theory of Supergravity, with base in the quantum field, and in the theories of All the Things, with base in the superstrings, an integral and universal quantum theory of gravity exists at the moment. Therefore, a true quantum theory does not exist either about the gravitational wave, is to say of the real graviton in spite of the quantization in real gravitons of the gravitational radiation of geometric origin, predicted by General Relativity

In the 2001, the scientific Valery Nesvizhevsky of the Institute Laue-Langevin found, by first time, quantum effects of the neutron gravity that moved through jumps, from a height to another one, in a field of gravitation, as it is predicted by Quantum Gravity theory [25]. And in the 2006 NASA planned the launching and its terrestrial orbit collocation of Gamma-Ray Large Area Space Telescope whose intention is to measure the interaction between the virtual graviton and the gamma rays during its trip in the space [26]. This telescope is now operative with INTEGRAL, launched into orbit in October 2002, by the European Space Agency, with the collaboration of the Russian Federation, the Czech Republic and Poland.

The experiment of Nesvizhevsky says that the static gravitational field is quantized. As the quanta of this field is the virtual graviton is therefore indirect evidence of its existence. However, with the discovery in 1834,of the soliton (solitary wave), by engineer John Scott-Russell, who found that this class of waves have particle properties [25a], in the 1960's began a current of the scientific thinking that leads the disappearance of wave-particle duality, the fundamental law of the structure of matter, that is replaced

only by the wave, in which case the particles would be excited states of the wave, also, there is a reverse current that recognizes only the existence of the particles. With the scientist Stefano Gusman, in ResearchGATE, of who we are members, we had a dialogue of this matter and we are agree that the duality goes, with the recognizing that the static gravitational field is compound of virtual gravitons. Indeed, the existence of the field-quanta duality (the same wave-particle) allows by way of observation and / or experiments, develop partial visions that reduce the duality, to one of its aspects [25b].

Dialogue between Stefano Gusman and Alfonso Guillen on virtual graviton. '

Let us suppose that the gravity is also like the other three fundamental forces, an interaction force and consequently the gravity is a real force and not a pseudo force.

"Two particles are attracted gravitationally because continuously they interchange virtual gravitons". Therefore, the gravitational interaction between particles occurs through the infinitesimal virtual graviton that all existing particle, from its mass-energy, produces and with which it tends to occupy to the infinite all the points of the three-dimensional space at all instant of the time, giving rise to the static field of gravitational vectorial force.

With base in the ideas about quantum gravity of the scientific Andrei Saharov, M Vasiliev, and K Staniukovich, in Bogota, Colombia, in 1969, I formulated and published my theory about that the speed of gravity is superluminal. The foundations updated of this theory are:

1. All the existing particles in the nature have inertia, that is, according to cuadri-vector-momentum, the particles of the matter with mass greater than 0 and the particles of the energy (real particles) and of the forces (virtual particles) with mass closed 0 (It is assumed, mass 0).

2. The inverse dependency of the speed of particles of the magnitude of its inertia is a law of the nature.

3. The inertia of particles of energy of the waves is not just like the inertia of particles of the matter. Inertia in the matter is caused by the action-reaction law between the mass of particles of the matter and the vacuum. While that the inertia of energy is due to the law of absorption-emission between the vacuum and the

energy of massless particles that make up the electromagnetic and gravitational waves and the inertia of the virtual particles of the forces is due to the law of annihilation-creation between these particles and the vacuum (Dated November 16, 2011, Nature 479 online, published for the first time, experimentally the generation of real photons out of the quantum vacuum. [26a], [26b]). The particles interact with the vacuum because the vacuum is filled with free fields of its sources. However, in standard quantum theory, the photons and gravitons do not interact with the vacuum and, therefore, always travel at the speed c. That is, in the theories of Relativity and Quantum Physics the virtual and real packs of energy interact with matter but not to each other. However, paradoxically, the graviton is of ! Spin 2! and no particle escapes the gravity including the graviton itself. Also, according to the Maxwell equation, the speed of the light is in function of the properties of the vacuum of the permeability and permittivity, that are connected only to the properties of the charged particles (all other properties of the particles like mass-energy and spin is totally neglected). In addition, in General Relativity, the speed of the light in vacuum is in function of gravity ($c \approx c [1 - 2Gm/c^2r]$).

4. The inertia of the energy depends of the frequency of the absorption-emission during the propagation of waves in vacuum. The process of absorption is the pass of real particles of the waves to the virtual particles of the vacuum. While the process of emission is the return of the real particles from the virtual particles. The absorption-emission consumes time that contains the passage of the waves. This mechanism of interaction of the electromagnetic and gravitational waves with vacuum and its effect on the speed of propagation of these waves is similar to mechanism of the interaction between the electromagnetic wave with atoms of the matter, that reduces its speed c. In several experiments has been managed take it zero. The pioneering scientific Lene Hau, in February of 1999, in Cambridge, Massachusetts, USA, pull the light down to 17 meters by second and in the 2001, light was stopped by two different groups of scientists, in the universities of Harvard and Colorado in Boulder, USA. The contention of the waves by the vacuum is inverse dependent of the frequency of the absorption-emission between the waves and the vacuum. This inertia is increased so much with the greater energy of component particles of the waves that increases its frequency of interaction with vacuum, like with the greater density of the energy of the vacuum that increases its interaction with the waves. Consequently, the interaction of the electromagnetic and gravitational waves with the fields of the vacuum is dependent of the energy of photons and gravitons. Also, the virtual particles (virtual bosons, virtual gluons, virtual photon and virtual graviton) interact with vacuum and they are subject to process of absorption-emission although in the form of annihilation-creation. Therefore, according to this thesis of the author, all

particles in the universe are subject to interaction, and interaction is a universal law. This thesis of the author, is formulated in a similar form, in other authors, particularly by the scientific Petar K. Anastasovski. In your paper, "Superluminary Relativity Related to Nuclear Forces and Structures" (1998), he says: "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 witch allow the possibility for v > c". This thesis is a result of his remarkable investigations in nuclear physics where it finds one better understanding of the nuclear phenomena if one admits speeds majors that c. Moreover, Anastasovski solve the mathematical problem of the Lorentz transformation to reformulate for v > c (in this case,$x'=\sqrt{(1 - c^2/v^2)}\ (x + vt)$, $y'=y$, $z'=z$, $t'= 1/\sqrt{(1 - c^2/v^2)}\ [t + \sqrt{(c^2(v^2-c^2)/v^4}\ x]$) and obtain other equations for his theory of Superluminary Relativity. Thus, c is nature constant for all inertial observers.

5. In the 2001, in the phenomenon of the electromagnetic energy, the group of scientists, Dimitri Nanopoulos of the Theoretical Physics Division of the Academy of Athens, Nikolaos Mavromatos of King's Collage, in London, and John Ellis of the European for Center Particle Physics (CERN), in Geneva, discovered a new expression for the speed of light, the that depends on its frequency, that is to say, of their energy according to greater energy, minor speed. This discovery will be confirmed in project GLAST.

6. The maximum value of the equivalent energy in mass of the real photon is less that 10^{-51} grams, in agreement with its more recent calculation of the 2003, made by the scientific Jun Luo and its colleagues in the Huazhong University of science and technology in Wuhan, China and the maximum value of the equivalent energy in mass of the real graviton would be less that $4.5\ 10^{-66}$ grams, considered by the scientific S S Gershtein, A A Logunov and M A Mestvirishvili, in 1997, with base in the observed parameters of the expansion of the Universe.

7. The speed of the real graviton is greater than the speed of the real photon because the graviton is less inertial than the photon. Also, the speed of the virtual graviton is greater than the speed of the real graviton and speed of the virtual photon is greater than the speed of the real photon by the same cause. Particle in nature with the least mount of energy must to have the highest speed.

8. For the vacuum, with refractive index = 1, the speed of gravity is maximum 2.2222 * 10^{10} * c, in agreement with the equation of Cramer-Collins, the considerations of Schaefer for the speed of photon and the measurement of Tom Van Flandern for the speed of gravity (Calculation of the author).

9. Since 1992, in the University of Colony, Germany, the scientific Gunter Nimtz has produced very weak electromagnetic waves that propagate up c. Doctor Nimtz explains them like virtual photons. These are evanescent waves, because its number of wave is an imaginary value. These waves it generate by the pass of microwaves through of dielectric photonic barriers that are of two types. The first type of barrier is constituted by the central part of the guide waves, which is a sufficiently narrow section, less than half of the wavelength in both directions, perpendicular to the propagation, through that only pass the waves of very low frequencies. The other type of barrier is the double prisms in which the microwaves undergo total reflection inside the entrance prism. The very low remainder, that is refracted, pass through a hollow of air, to the exit prism. The evanescent waves in their pass by the barrier do not spend time, since they do not present change of phase, that is the cause of their superluminal speeds. In both cases, the refraction has the maximum limit of .001 from the energy of the source waves. The Doctor Nimtz has found that the virtual photons have superluminal speeds that surpass several times the speed c of the real photon. Also, the scientists Matt McIrvin, in 1994, and Steve Carlip and Matthew Wiener, in 1996, established that the speed of the virtual photon and virtual graviton is superluminal, since that at least the virtual photon escapes from black holes, since the field internal static electromagnetic acts beyond the event horizon. In this phenomenon, no doubt, we know that the physical condition to be fulfilled is that of speed greater than c. [33a].

10. On 9 July 2005, in the Canary Islands, the gamma ray telescope MAGIC registered the peaks F (<0.25 TeV) and F (> 1.2 TeV) from a spectrum, probably at the same time issued by the blazer in the center of the galaxy Markarian 501 (Mrk 501), about 500 million light years from Earth. The gamma ray of F (> 1.2 TeV) arrived 4 + / - 1 minutes after the gamma ray of F (<0.25 TeV). Thus, it showed that the highest energy radiation travels at a slower speed for lower energy radiation. This result was confirmed, in September 2008 by the Fermi telescope in Earth orbit, of the GLAST project of NASA, with the register of the gamma radiation from GRB 080916C, with the strongest and longest duration detected, to near of 12 billion light years in the early universe. The photons of low energy arrived more soon, with a time difference increased with increasing energy of photons of higher energy, the maximum energy was of 13GeV

(www.arxiv.org/abs/0906.3731v2), according to analysis by Giovanni Amelino-Camelia (Dipartimento di Fisica, Universita "La Sapienza" Roma, Italy) and Lee Smolin (Perimeter Institute for Theoretical Physics, Caroline North, and Waterloo, Ontario, Canada). However, on 10 May 2009, Fermi registered a short burst, of gamma rays, from GRB 090510, with two peaks and a difference of energy of a million times, generated by the explosion in the collision, astronomers believe, of two neutron stars in a galaxy to near of 7,300 million light years from Earth; the two rays arrived with only a difference of exactly 9 / 10 of second; the photon of higher energy arrived first, then the photons of lower energy; hence, the scientists of the Fermi team said that the two types of photons traveled at the same speed.

Therefore, to May 2009, there are three records on gamma radiation, that are based on facts very different, with the first two consistent results but they are inconsistent with the third.

The record of Magic, 3 years later, was used to test the possible interaction between electromagnetic radiation and gravity, according to some alternative quantum theories, which provide different speeds in different energy photons; the result is “The probability of the zero-delay assumption relative to the one obtained with the ECF estimator is P = 0.026. The observed energy-dependent delay thus is a likely observation, but does not constitute a statistically firm discovery.“.

The author finds that the Fermi records is strongly affected by the expansion of the universe, therefore, by changes in the density of vacuum energy [a], and probably changes in physical constants [b]. Such changes affect the registration of MAGIC much less.

This will allow speculate, in favor of the alternative theories that finally, after all, are hoping that standard theories do not become dogma and the process of scientific knowledge continues. For example, the author speculates that significantly Fermi registration is subject to that the photons interact with the vacuum in two ways, ie photon-vacuum and vacuum-photon. Thus the lower energy photons, from GRB080916C, would have traveled faster during certain time, unknown, following the Big Bang, more precisely after the Planck era, during the early Universe, which has not been periodized as era, then the higher energy photons traveled faster than photons of less energy, as a result of their inertial interaction [c] with the energy density of the vacuum during the era of the domain of the matter[d]. But the higher energy photons traveled slower than photons of less energy in the last 500 million years, during the era of the dark energy[e] and perhaps in the most recent period, during decreased of the energy density of vacuum[f], during the now possible era of phantom energy domain. But the race result is that the photons of higher energy arrived just 9 / 10 of a second

before that the photons of lower-energy according to the third register while the photons of lower energy arrived clearly earlier than the photons of higher energy according to the second record.

Of other hand, the scientists Amelino-Camelia and Smolin did not consider significant the second register of Fermi, due to its brevity, while the former was abundant in radiation. The conclusion is that it requires new registers. Would be truly magical and tragic that the theories, now standard, of the early twentieth century, are final.

Notes:

[a] Today, we discuss whether we are in the era of dark energy or in the era of phantom energy, which would be states of the energy of the vacuum, according to the state equation: Pressure = wρ that depends of the parameter w, more than of a fifth essence, as some theories say. Where ρ is the density of vacuum energy.

[b]Such as: permittivity and permeability of space. Probably, in the vacuum, the speed of electromagnetic waves change in function of the time, due to its interaction with the energy density of the vacuum, of way diferent between the photons of high energy and the photons of low energy. In some segments of the time, the photons of high energy traveled most fast that the photons of low energy while in other segments of the time, the photons of low energy traveled most fast that the photons of high energy. In the last 12.000 millions of years and in the last 500 millions of years the result is that the the photons of low energy traveled most fast that the photons of high energy. But, in the last 7.300 millions of years the result is that the photons of high energy traveled most fast that the photons of low energy. This is indicated by the results of the records of MAGIC and Fermi that are contradictory . While the gamma radiation from the blazer traveled during the era of dark energy (perhaps also in the era of phantom energy.), the gamma radiation from the collision of neutron stars, in addition traveled for 2,300 of million light years in the era of dominion of the matter and 4,500 million light years in the dark energy era prior to the time they began the journey of the blazer radiation. For its part, the gamma radiation, which Fermi registered in September 2008, traveled with relation to the rays from the collision of neutron stars near of 4,700 million years more during the era of dominion of the matter.

[c] This is the effect of electromagnetic radiation as a particle. This effect is ignored, in standard theories of relativity and quantum physics. Probably, the speed of the particle is inversely proportional to the magnitude of its energy and proportional (perhaps directly to very high values and inversely to low values?) to the magnitude of the density of

vacuum energy. As wave, its speed, in the classical sense, depends only on the electromagnetic characteristics of the vacuum of permittivity and permeability, ie electro-magnetic properties the propagation medium, without taking into account the density of vacuum energy, also property of the medium of propagation, that must be included to complete the analysis. Of other hand, although by trend (the law always work as a trend), the interaction of the particle with the vacuum energy will be directly proportional to the magnitude of the density of the energy of the vacuum althought no always because, when such magnitude is excessively high as the values at the Panck era, may be that the particles with more energy, penetrate much more (in distance) to that it produces its interaction with the vacuum.

[d] Era with parameter w = -1, ie, with constant energy density, and therefore, the speed depends only on the photon energy and the permittivity and the permeability of the vacuum.

[e] Era with parameter -1 <w ≥ -1 / 3. In this era the dark energy, density begins with a value very close to that of the previous era of dominance of matter down to reach the value w <-1, beginning the era of phantom energy.

[f] Era with parameter w <-1. This era is the follows to era of the dark energy.

11. On 1 December 2009, according DW-tv, scientists from the University of Dusseldorf, Germany, announced that they will undertake an experiment to rigorously test, the fundamental postulate of special relativity of the constancy of the speed of electromagnetic wave in the vacuum. Ie, this speed is independent of the direction of expansion of the wave, both in time and space. The reason for the experiment are several indications about the falsity of the assumption, among which is the record of MAGIC.

The experiment will be realized using a satellite in elliptical orbit, with a half-day period and rotation on its axis. This satellite will have two pairs of mirrors. Between each pair will travel electromagnetic waves. While passing from one mirror to another and bounce, the waves will travel several miles. The result will be measuring the speed of electromagnetic wave by different directions, with an accuracy of 17 decimal digits.

However, the author contacted the University of Dusseldorf, and author could not confirm that will be held the previous experiment.

The Nobel Prize in physics (1982), Dr. Kenneth Geddes Wilson, based on observations of the electromagnetic spectrum from different regions of the space has said its velocity is variable according to space. Also, the scientists Drs. John Moffat, Giovanni Amelino-Camelia and Joao Magueijo have said that this speed varies with time and was much

higher than the current after the Big Bang, in the early Universe. The research scientist at the University of Nantes, Yves-Henri Sanejouand (2011) has stated that it has found evidence that this speed it is decelerating.

12. During one of the breaks in the talks of Petrov's Symposium, the scientific Erico Tanaka me ask: "Do your theory on spacetime is fundament of superluminal speeds?". Sure, in my theory about that the spacetime is the geometric structural property of the matter in motion (For the Substantialism the spacetime is the continent of the matter while for the Relationism is a relational quality of the matter, hence a category of the thinking) and , also, in the Relationism, in the Universe only exists the matter. Therefore, according to the theory of Big Bang necessarily the inflation occurred in the first instants with one fantastic superluminal speed. However, this do not violate Relativity because is superluminal speed of spacetime and spacetime is not matter. But, in my theory, the spacetime is only the geometric property of the matter (matter in restricted sense and energy). Therefore, during Big Bang the matter traveled to fantastic superluminal speed. The particles of the matter traveled to superluminal speed.

13. Also, with the scientific Erico Tanaka, we talked about the various scales of material existence and the geometries associated with them. I said that below the Planck scale, due to the extreme weakness of gravity, time should be independent of the other three dimensions and, therefore, of Euclidean geometry (in the Macrocosm of the semi-Riemann geometry. In the scale of the atom of the Minkowski geometry), which forms the geometric condition for superluminary speeds in the quantum scale (although, alternatively could be the Minkowski for v> c). Indeed, the physicist Petr Horava, professor at the University of California, Berkeley, with a great initial success has formulated "a quantum gravity theory that sends space and time back to their Newtonian roots because in quantum mechanics, time retains its Newtonian aloofness, providing the stage against which matter dances but never being affected by its presence". Horava says "The solution is to snip threads that bind time to space at very high energies, such as those found in the early universe where quantum gravity rules. I am going back to Newton's idea that time and space is not equivalent. At low energies, general relativity emerges from this underlying framework, and the fabric of spacetime restitches". Gia Dvali, a quantum gravity expert at CERN, remains cautious. A few years ago he tried a similar trick, breaking apart space and time in an attempt to explain dark energy. But he abandoned his model because it allowed information to be communicated faster than the speed of light. Scientific American (Dec. 2009).

Bibliography

[1] Hawking Stephen. Historia del tiempo – Las partículas elementales. Colombia.

1989,

[2] Waner Stefan. Introduction to differential geometry and General Relativity. USA. 2005.

[3] Hubert F. M. Goenner. On the History of Unified Field Theories.

http://www.livingreviews.org/lrr-2004-2

[4] Physics 4213/5213 – Introduction. USA. 2002.

http://www.nhn.ou.edu/~pls/phys4-5213/lectures/lec01/lect_01.pdf#search='Physics%20%204213%2F5213%20Introduction'

[5] Gill Douglas. The photon, graviton, electron, and quark. USA. 2004.

http://www.pathcom.com/~douggill/1.8.pdf#search='Gill%20Douglas%20The%20photon%2C%20graviton%2C%20electron%2C%20and%20quark'

[6] Harokopos Efthimios. Virtual graviton and the duality of reality.

http://philsci-archive.pitt.edu/archive/00001392/01/VirtualGravity.pdf

[7] Van Flandern Tom. The Speed of Gravity - What the Experiments Say. (USA) 1998.

http://www.intalek.com/Index/Projects/Research/TheSpeedofGravity-WhattheExperimentsSay.htm

[8] Klacka J. The Poynting-Robertson effect and secular changes of orbital elements. Slovak. 2002.

http://arxiv.org/PS_cache/astro-ph/pdf/0211/0211472.pdf

[9] Solar system formation.

http://www.astromia.com/solar/formasistema.htm

[10] Schutz B F, Gravitational wave astronomy. Germany. 1999.

http://chaos.swarthmore.edu/courses/Phys130_2004/Papers/q91b07.pdf#search='Einstein%20when%20at%20least%20exists%20a%20quadrupole%20mass%20system'

[11] ESA. Gravitational waves – ‘dents’ in space-time. Europe. 2004.

http://www.esa.int/esaSC/SEMLY2T1VED_index_0.html

[12] Östlin Göran, and Gustafsson Bengt, The discovery of the binary pulsar. Sweden 1993.

http://nobelprize.org/physics/educational/poster/1993/discovery.html

[13] Reinhard R. LISA – Detecting and Observing Gravitational Waves. Netherlands. 2000.

http://www.esa.int/esapub/bulletin/bullet103/reinhard103.pdf#search='gravitational%20waves%20lowest%20order%20is%20proportional%20to%20quadrupole

%20moment

[14] Shrikumar Aditi. The observability of gravitational radiation from binary X-ray pulsars. 2003.

[15] Finn Lee, and Sutton Patrick. Bounding the mass of the graviton using binary pulsar observations. USA. 2002.

http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=PRVDAQ000065000004044022000001&idtype=cvips&gifs=yes

[16] Schewe Phil, Riordon James, and Stein Ben. A New Limit on Photon Mass. USA. 2003.

http://www.aip.org/enews/physnews/2003/split/625-2.html

[17] Gershtein S S, Logunov A A, and Mestvirishvili M A Gershtein. Upper limit on graviton mass. Russia. 1997.

http://dbserv.ihep.su/~pubs/prep1997/ps/97-57a.pdf#search='The%20upper%20limit%20on%20the%20graviton%20mass'

[18] Kopeikin S, Formalont E. General relativistic model for experimental measurement of the speed of propagation of gravity by VLBI. Germany. 2002.

http://arxiv.org/PS_cache/gr-qc/pdf/0206/0206022.pdf

[19] Kopeikin Sergei. The speed of gravity in General Relativity and theoretical interpretation of the Jovian deflection experiment. USA. 2004.

http://arxiv.org/abs/gr-qc/0310059

[20] Marmet P and Couture C. Relativistic Deflection of Light near the Sun Using Radio Signals and Visible Light. Canada. 2001.

http://www.newtonphysics.on.ca/ECLIPSE/Eclipse.html

[21] Steve Carlip. Model-dependence of Shapiro Time Delay and the “Speed of Gravity/Speed of Light” Controversy. USA. 2004.

http://arxiv.org/abs/gr-qc/0403060

[22] Clifford Will. Has the Speed of Gravity Been Measured?. USA. 2003.

http://wugrav.wustl.edu/people/CMW/SpeedofGravity.html

[23] Faber, Joshua. The speed of gravity has not been measured from time delays. USA. 2003.

http://www.arxiv.org/abs/astro-ph/0303346

[24] Walker William. Experimental Evidence of near-field superluminally propagating electromagnetic fields. Sweden. 1999.

http://arxiv.org/ftp/physics/papers/0009/0009023.pdf

[25] Nesvizhevsky Valery, Börner Hans, Petukhov Alexander, Abele Hartmut, Baeler Stefan, Rue Frank, Stöferle Thilo , Westphal Alexander, Gagarski Alexei, Petrov Guennady, and Strelkov Alexander. Quantum states of neutrons in the Earth's gravitational field. USA. 2002.

Quantum states of neutrons in the Earth's gravitational field

[25a] Napóles Valdes Juan E, González Thomas Arturo. Solitones, una no-linealidad no tan solitaria. Argentina. 2005.

Solitones'

[25b] Gusman Stefano, Guillén Alfonso. GR doesen't explain bodies weight and gravity. (Researchgate). USA. 2011.

Diálogo entre Stefano Gusman y Alfonso Guillén sobre el gravitón virtual (favor leer en el orden cronológico, es decir, de la cola a la cabeza) '

[26] Johnson Neil. Gamma Ray Large Area Space Telescope. USA. 2005.

http://www.nrl.navy.mil/techtransfer/exhibits/pdfs/Info%20Sheet%20pdfs/Space%20Info%20Sheets/glast.pdf#search='GammaRay%20Large%20Area%20Space%20Telescope%202006'

[26a] Wilson C. M., Johansson G., Pourkabirian A., Simoen M., Johansson J. R., Duty T., Nori F. and Delsing P.Observation of the dynamical Casimir effect in a superconducting circuit. 2011.

Nature 479, 16 November

[26b] Dalvit Diego A. R.Quantum physics: Shaking photons out of the vacuum. 2011.

Nature 479, 16 November

[27] Guillen Alfonso. A speed greater than the speed of light. Colombia. 1969-1970.

http://www.alfonsoleonguillen.net/velograveng.htm

[28] Ridgely Charles T. On the nature of the inertia.Galilean electrodynamics.USA. 2000

http://www.ridgely.ws/inertia/nature_inertia.pdf

[29] Setterfield Barry. The vacuum, light speed, and the redshift.2001.

http://www.setterfield.org/vacuum.html

[30] Haisch Bernard y Rueda Alfonso. Geometrodynamics, Inertia and the Quantum Vacuum. Institute for Physics and Astrophysics. USA. 2001.

http://arxiv.org/PS_cache/gr-qc/pdf/0106/0106075.pdf

[31] Guillén Alfonso. The law of the inertia of energy and the speed of gravity.

Colombia. 2004.

http://www.alfonsoleonguillen.net/inertiaenergy.html

[32] Nimtz Gunter, Haibel A. Basics of Superluminal Signals. II.Physikalisches Institut, Universitat Koln. 2001

http://arxiv.org/PS_cache/physics/pdf/0104/0104063.pdf

[33] Vetter R.-M, Haibel A., Nimtz Gunter. Negative phase time for Scattering at Quantum Wells: A Microwave Analogy Experiment. II.Physikalisches Institut, Universitat Koln. 2000.

http://arxiv.org/PS_cache/quant-ph/pdf/0006/0006131.pdf

[33a] Carlip Steve, Wiener Matthew. How do Gravitons escape from a Black Hole?. USA. 2005. 1999.

http://arxiv.org/PS_cache/gr-qc/pdf/9905/9905048.pdf

[34] Nanopoulos Dimitri, Mavromatos Nikolaos, and Ellis John. Search for Quantum Gravity. 1999.

http://arxiv.org/PS_cache/gr-qc/pdf/9905/9905048.pdf