Are the waves detected by LIGO the waves according to Einstein, Pirani, Bondi, Trautmann, Kopeikin or what are they?

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Abstract
From the geometric formulation of gravity, according to the Einstein-Grosmann-Hilbert equations, of November 1915, as the geodesic movement in the semirimennian manifold of positive curvature, spacetime, where due to absence of symmetries, the conservation of energy-impulse is not possible taking together the material processes and that of the gravitational geometric field, however, given those symmetries in the flat Minkowski spacetime, using the De Sitter model, Einstein linearizing gravitation, of course, really in the absence of gravity, in 1916, purged of some mathematical errors in 1918, he introduced "gravitational waves" as disturbances in the curvature of space, and in the absence of knowing physically what spacetime is and philosophically in dispute, that previously in 1936 and definitively in 1937,

Einstein showed they did not exist. It was through the works arising from the dynamics of academic discourse, from the perspective not of Einstein but of Weyl, that Bondi, Pirani, Robinson and Trautman, in the 1950s, after Einstein's death, "gravitational waves" were reintroduced and led to experimental search. In 2002, from Sergei Kopeikin's VLBI experiment, its supposed speed was established, without obtaining unanimous recognition from the community of scientists but rather dividing them. And it was in February 2016 that the aLIGO-aVirgo collaboration announced that they had detected them for the first time. In this work, the history that led to this supposed discovery is presented and it is stated that the waves detected are really from the quantum vacuum in which everything that exists is immersed, the author's thesis exposed immediately in response to that 2016 announcement.

Introduction

The acceptance of the so-called "general relativity" by the scientific community was undoubtedly very difficult, especially during the first two years that followed when Einstein in November 1915 presented to the Royal Academy of Sciences in Berlin, as a member of her, the equations that would go down in history, geometrizing gravity. Of course, even for an academic of undoubted enormous prestige for being the recognized author of special relativity where the speed of light in a vacuum acquired the character of an absolute constant at the cost of space and time ceasing to be, accepted for millennia as such, in the sense that their measurement was independent of observers in different reference frames. But, it is that it was about dethroning Newton, nearly two centuries consolidated in his conception of gravity as a force while Einstein now held the opposite and even worse when in search of the generalization of relativity originally valid only in inertial frames to all types, that is, to frames subject to acceleration and gravitational ones, Einstein had, in 1907, communicated to the four winds his "happiest thought of his life" about the equivalence between all kinds of movements in the light of his idea about the free fall of bodies, by virtue of the equivalence between their inertial and gravitational masses that, therefore, cancel each other out, that in Zurich, working with Grossmann, since July 1912, on the Entwurf theory, presented in 1913, found this equivalence was only valid in what he called punctual gravity, really absence of gravity, which as extended gravity, true gravity, cannot be eliminated by a simple change of the coordinates between different frames of reference and, consequently, gravity should be a material effect similar to electromagnetism, instead of being a simple effect of coordinates. But, in November 1915, he backed off by claiming gravity is a geometric effect of curved spacetime and not a physical effect in the material sense.

What had happened? To the bad of Einstein in view of Lorentz, who as a scientist was his paternal authority, whom he kept abreast of his advances and setbacks, of his contradictions, always relying on his wisdom from a superior being, whom he revered. Since they do not correct the anomaly of Mercury's orbit, nor do they have the properties of general covariance and do not coincide in the limit with those of Newton, the equations of the Entwurf theory, which resulted from the application by Grossmann of the tensors in Minkowski spacetime, they were abandoned and, to make matters worse, Einstein had prevented Grossmann who, as a mathematician, saw no other alternative than to use them in the Riemann spacetime manifold, since Einstein as a physicist understood that he would have had to give up his explanation material of extended gravity, having to end his association with Grossmann, at the beginning of

1914, by having Einstein move to Berlin to take up the post at the Academy. Lorentz through a letter had congratulated him on his Entwurf theory. In the reply to Lorentz, on August 14, 1913, a frustrated Einstein commented on the general non-covariance of his equations: "Unfortunately, the gravitational equations themselves do not have the property of general covariance." However, two days later, on August 16, Einstein in a new letter told Lorentz: “that he has given up the belief that covariance is impossible: <Only now, when that ugly black spot seems to have been removed, the theory is pleasurable to me>”.

In Berlin, Einstein only faced the harsh confrontation with Hilbert, the best German mathematician of the time, which began in July 1915, after in his lectures at the University of Gottingen, the previous June, Einstein informed him of the state of development of his research, now facing him precisely in the field of this, in which Einstein was not a professional since his undergraduate degree, in 1901, and his Ph.D, in 1905, had been obtained in physics. Through extensive correspondence, Einstein and Hilbert kept informed of each other's work, with Hilbert taking the lead who, applying the tensors in the Riemann spacetime manifold, which had prevented Grossmann, forced Einstein to continue achieving it 5 days earlier, which has been confirmed, despite the recent controversy against it, the system of equations of the so-called "general relativity", which in a more elegant version Einstein presented to the Prussian Academy of Berlin.

In this adverse scenario, Lorentz learned of Einstein's unexpected change of conception between the materiality of gravity extended in the Entwurf theory and its geometrization, which he immediately rejected in accordance with the letter dated June 17, 1916, in which Einstein answers a letter-article from Lorentz of June 6, 1916, and it follows that he invited him to accept the ether as the g_{uv}, quantities that characterize the gravitational field, determining rulers and clocks, replacing Newton's potential gravitational scalar. Almost immediately, Einstein adopted g_{uv} = aether, under the relativistic aether, in some way, even if figuratively, recovering the materiality of gravity and wrote to Lorentz: “I agree with you that the general theory of relativity admits an aether hypothesis as well as the special theory of relativity [despite having ruled out the aether at the time]. But this new theory of the ether would not violate the principle of relativity. The reason is that the state g_{uv} = ether is not that of a rigid body in a state of independent motion, but a state of motion that is a function of position determined by material phenomena. Einstein must have been even more excited when De Sitter proposed the mathematical expression of linearized gravity that took him out of the horror of Riemann's geometry and returned him to Minkowski where he could materially treat gravity due to the symmetries it possesses, in addition, answering the question of Max Born, made in 1913, of the speed of propagation of gravity, certainly valid at that time, since extended gravity is a material phenomenon analogous to the electromagnetic field, therefore, gravity is one of the forces existing in nature as it Newton had posited.

Einstein 5 days after his acceptance of the relativistic aether in a short article he introduced the "gravitational waves", June 22, 1916, which Poincaré, in 1905, had predicted. Einstein did it, with the ingenuity of someone who was not a professional mathematician, of having equations in the linearized version equivalent to those found in Riemann, not realizing that in Minkowski's spacetime there is no gravity and the perturbations are only as Eddington predicted. will clarify, in 1922, the expression of the construction of an undulating Minkowski spacetime. Einstein spent nearly two years refining his "gravitational wave" equations that he delivered in 1918, probably pleased that he had reconciled with Lorentz and himself in his Entwurf theory.

A year later, at the urging of the highly influential Sir Eddington, Einstein's crowning glory maker: "The distinguished members of the Royal Geographical Society, Britain's most venerable scientific institution, joined their colleagues from the Royal Astronomical Society on the evening of November 6, 1919, at Burlington House in Piccadilly, as Isaac Newton gazed out at them all from a towering portrait hanging in the great room. "The whole atmosphere of tense interest was exactly that of a Greek tragedy," Whitehead would note. We were the choir commenting on the designs of destiny... and deep down Newton's portrait reminded us that the greatest of scientific generalizations was now going to receive, after more than two centuries, its first modification ». The Royal Astronomer, Sir Frank Dyson, had the honor of presenting the discoveries" (Isaacson, 2007), of the supposed confirmation of the theory of the so-called "general relativity" thanks to the Eddington expedition and its phenomenal effort that was imposed on the result that did not favor him of the other expedition of Brazil, however, due to the atmospheric conditions of the place where it was carried out, better than his. “Eddington discarded the lowest value, from Brazil, on the grounds that the equipment was faulty, and with some bias in favor of his own fuzzy results in Africa, he got a mean of just over 1.7 arcseconds, which coincided with Einstein's predictions. That was not exactly the clearest confirmation possible, but it was enough for Eddington” (Isaacson, 2007). But, let us see how conclusive the so-called “general relativity” was at that date: “The skeptic Silberstein, addressing Eddington, said that people thought that there were only three scientists in the world who understood general relativity, and that he they had said that one of them was Eddington. The shy Quaker remained silent. "Don't be so modest, Eddington!" Silberstein told him. "No, nothing like that," he replied. I was just wondering who should be the third” (Isaacson, 2007).

The author in his work “Einstein and "gravitational waves"”, March, 2021, dealt with this story in detail until his denouement in 1937.

This new work on the highlights of the history of "gravitational waves" begins by reviewing the end, nearly two decades after they were formulated, in 1937, in his article "The gravitational equations and the problem of motion" Einstein with Infeld and Hoffman showed that from his 1915 equations, it was impossible to derive "gravitational waves", ratified by Rosen who independently, in a published article, while in Russia did the same, once as his assistant and co-author a year ago when they denied them for the first time, however, prevented by having been crossed by the influential Princeton University through Professor Robertson, as a peer censor in the journal where they had sent it for publication. In this article Robertson as an assistant had to tacitly admit that he lacked a fundamental reason, rather his ignorance of "general relativity", for vetoing Einstein and Rosen's 1936 paper.

Within the scenario of the emergence and evolution of geometry, the Riemann tensor is presented, since the Einstein 1915 field equations are expressed in tensors, which are quantities, defined by arrangements of components, whose properties are invariant with respect to the reference frame in which are applied. And, in particular, in these equations the Einstein tensor, G_{uv}, is of great importance, constructed from the Riemann tensor that in differential geometry completely describes the curvature of a manifold, measuring in which the metric of the manifold differs from the euclidean metric. The Riemann tensor for the spacetime manifold has 20 components of which Einstein took only 10, which constitute the Ricci tensor and correspond to the part of the curvature that gives the volume reduction with the passage of time. The remaining ten components of the Riemann tensor were omitted until 1919 when they were represented by the Weyl tensor which gives the changes in shape with translation between points on a geodesic line. In Einstein's work on "gravitational waves" completed in 1918 only the Ricci tensor was used, albeit in the linearized de Sitter version. Therefore, when in 1937 its non-existence was demonstrated, it was with respect to that tensor.

The following topic deals with how, after Einstein's death, a new theoretical-mathematical framework was developed using the Weyl tensor by Bondi, Pirani, Robinson and Trautman with which they justified the reintroduction of "gravitational waves", however, arbitrarily name of "general relativity" with which the real relationship is that the Weyl tensor Einstein ignored it, while these authors, contrary to what Einstein did, ignored the Ricci tensor by setting it equal to 0, that is, making its 10 zero components and in return, they reduced the Riemann tensor only to the Weyl tensor. On the other hand, however, being the Weyl tensor like the Ricci tensor characterizations of geometric properties of the Riemann spacetime manifold, also as Einstein had done with the Ricci tensor when solving its equations in the absence of matter, that is, making the energy-impulse tensor zero, unjustifiably the Weyl tensor, they assimilated it to the electromagnetic field as plane waves that propagate to infinity, although unlike these in the absence of sources. Thus, their work belongs to the exploratory academic genre, in this case rather speculative, their contribution being having rescued the subject of "gravitational waves" and placing it in the experimental setting, beginning their search.

Next, the experiment of Sergei Kopeikin and Formalont is exposed in detail along with his critics, in which by means of VLBI, radio-interferometry technique, which used a network of eleven combined intercontinental radio telescopes to detect the deflection of radio rays from an extragalactic source, identified as the quasar J0842+1835, in the gravitational fields of the Sun and Jupiter, during the visual alignment, which occurred on September 8, 2002, between this planet and the quasar. The experiment designed by Kopeikin from a scalar tensor model of gravity although metric alternative to "general relativity", trying to solve the problem of non-locality of the energy of the gravitational field, but still pending, according to later work where he searched again work it out. Kopeikin introduced into Einstein's equations, that is, both on the side of the Einstein tensor and on the impulse-energy tensor, the speed of gravity, of a system that, through the nearby gravitational field, would be emitting "gravitational waves" in the distance, consequently, transmitting a force produced by being this finite speed that does not exist in Einstein. Thus, the deflection of the radio electromagnetic wave coming from the quasar would not only have depended, as in Einstein, on the local gravitational field, in this case the gravitational field of Jupiter, but also on the force due to the finite speed of transmission of the gravity which would have allowed him to measure it approximately coinciding with 1.06 c. However, the scientific community was divided between those who reject having been measured and those who accept it. The arguments against it are very strong, especially that the sensitivity of the instruments could not measure disturbances of the order v^2/c^2 that were required to be detected, but only of the order v/c, which Kopeikin and Formalont ended up admitting, although they did not clarify whether the experiment had really succeeded.

Finally, the alleged detection of "gravitational waves" is presented, in 2015, by the aLIGO-aVirgo collaboration, a few months after having improved the sensitivity of the laser interferometer between three and four times, basically according to the Michelson- Morley, 1887, which at that time gave rise to the discovery of the constancy of the speed of light in a vacuum, and today after nearly fifteen years, in the version of its first generation, they unsuccessfully searched for it , although serving them to make their empowerment. Of course, the accumulation of experience incorporated into the measurement technology to detect new kinds of waves had to produce results that in the light of the theory of "general relativity" allowed them, in the most general terms, to make monotonous then at the same time, they detected quadrupolar waves, produced in the fabric of the quantum vacuum (author's thesis), generated in the merger of a binary system of obscured stars (Logunov's thesis), and in their particular terms, the detection of "gravitational waves" in the fabric of spacetime due to the merger of a binary system of "black holes".

The paradox is that the authors of the design of the experiment verified the detection of quadrupole waves, by the Hanford, Washington, and Livingston, Louisiana, stations of aLIGO, aVirgo did not participate because it was in updating, using the equations, 1918 , derived from Einstein's linearized gravity according to the De Sitter model, 1916, that is, taking the Ricci tensor in one of its solutions for the vacuum, which was shown not to exist, in 1937. Of the works with which the "gravitational waves" were reintroduced, from the Weyl tensor, during the 1950s, they only used the Bondi-Sachs-Trautman equations to calculate the mass, called Bondi mass, according to them, of the "black hole" fusion resulting the gravitational waves.

But what is most paradoxical is that they do not know that it is "physically the fabric of space-time" as I am aware of having asked, outside the auditorium, one of the most prestigious scientists who had just given a lecture related to the subject: What is the spacetime? His answer was "I don't know", thanking me for my assistance that probably others did not like, at the "Fifteenth Marcel Grossmann Meeting – MG15", held between July 1-8, 2018, at the "University of Rome "La Sapienza" , where DE1 Parallel Session Chairs A - B - C - Dark Energy and the Accelerating Universe: Ph.D. Alexei A. Starobinsky, A. D. Sakharov Gold Medal of the Russian Academy of Sciences, 2016, and Ph.D. David Polarski, who works in the field of cosmology, accepted my contribution: "Are dark matter and dark energy opposite effects of the quantum vacuum?" for oral presentation, as an auditorium lecture.

1. In "general relativity" there are no "gravitational waves"

Einstein together with the Polish-born semite physicist Leopold Infeld and the British physicist, mathematician Banesh Hoffmann in their article "The Gravitational Equations and the Problem of Motion", little known and much less adopted as a reference by normal science, which was received by "Annals of Mathematics" on June 16, 1937 and published in Volume 39, No 1 of January 1938, pages 65-100 [1], and which had the secondary collaboration of the American physicist, mathematician Howard Percy Robertson who made the integration of the equations of motion of two gravitating bodies found by them, in that work, and presented it in his article-note, which appeared after theirs, with the title: "Note on the preceding document: The problem of the two bodies in "general relativity"", pages 101-104 [2], put an end to the existence of "gravitational waves" in the so-called "general relativity", supported by the Einstein-Grossman-Hilbert equations, presented before the Prussian Academy of Sciences of Berlin, in the conference whose paper was "The field equations of gravitation", of November 25, 1915 [3], and which support that static gravity is the movement geodesic, that is, free of forces of the bodies in a spacetime of positive curvature, therefore, equivalent to the inertial motion in a Minkowski spacetime, which is the same, of zero curvature. The fundamental difference between a curved spacetime and the plane is that while the first lacks symmetries, the second does, which is crucial for the formulation of the energy-impulse conservation laws since the plane allows it while the curved one does not. At the end of the article Einstein-Infeld-Hoffmann thanked Robertson for having performed the integration of the equations that give the relativistic motion of two massive gravitating bodies found by them, that is, for having performed a minor task. On the other hand, Robertson had to tacitly accept that there were no "gravitational waves", which is of great significance if one takes into account his famous cylindrical "gravitational waves" and, furthermore, state: "I am indebted to these authors for the opportunity to see your article in manuscript and for stimulating discussions".

Also, in this way the confrontation that arose between Einstein and Robertson, between the Institute for Advanced Study and Princeton University, was elegantly and overwhelmingly overcome in favor of Einstein and the Institute, due to his article co-authored by his assistant, the semite physicist, born in Brooklyn, New York, United States, Nathan Rosen: "Are there "gravitational waves"?", the original of which does not exist today, sent on June 1, 1936, to Physical Review, whose editor was John T. Tate, and where two other articles had been published without revision, which they had written together. But, this time "The editor of Physical Review sent the manuscript to Robertson, who examined it carefully and made several negative comments" [4]. John Tate, in turn, wrote to Einstein on July 23 asking him to respond to his reviewer's comments. Einstein's reaction was anger and indignation, replying to Tate on July 27, 1936: "We (Mr. Rosen and I) had sent you our manuscript for publication and had not authorized you to show it to specialists beforehand." that it be printed. I see no reason to address the comments, in any case erroneous, of his anonymous expert. Based on this incident, I prefer to publish the article elsewhere" [4]. On July 30, John Tate responded to Einstein that he was very sorry for the paper's withdrawal, saying, "I could not accept for publication in Physical Review an article that the author was unwilling to show our Editorial Board before publication." [4], which is why Einstein never sent his articles to "Physical Review" again.

Tate's unexpected decision was probably influenced by the rivalry between the "Institute for Advanced Study", where Einstein worked, founded as a private entity, in 1930, by semites for semites, although it also admitted others, and the "University of Princeton", founded in 1746 as the "College of New Jersey", which institutionally did not accept semites, where Robertson was a professor, while Einstein never was, although some have falsely affirmed the contrary, although he was sometimes a lecturer, both established in the city of Princeton, in the State of New Jersey, a few blocks away.

It should be noted that the peer reviewer was anonymous, as is the rule, and Einstein did not know who this character was, which turned out to be the highly influential Robertson, a Caltech graduate who, at the end of a sabbatical year there, had returned to Princeton University, where the strong anti-semite current was jealous of him and did not like Einstein.

Einstein quite successful in handling social interrelation, on this occasion he failed, as can be seen, which caused him, as usually happens when someone with power is challenged and angered, that they organized the respective retaliation, maybe, with the complicity of some of his colleagues from the Institute, who, as we must insist, was totally alien to Princeton University, but not to the power structures. Thus, Infeld, who had just arrived from Poland, in search of a great future at the Institute, which he achieved in part since he went down in history, alongside his ethnic compatriot the famous Einstein, as his assistant, in replacement for Rosen who had traveled to Russia. On the same day that Infeld introduced himself to Einstein, who in a generous gesture of appreciation and trust gave him his article, he became incredibly friendly with Robertson, to make matters worse, showing it to him as soon as he could, it is said immediately [5], although others have claimed that it was Robertson who sought out Infeld and after a few days befriended him [6].

Leopold Infeld, (1898, 1968), semite physicist, born in Krakow, then of the Austro-Hungarian empire, today Poland, where he studied at the Jagiellonian University and between 1920-1921, at the University of Berlin where he entered with the help of Einstein, who by supporting Zionism helped the semites. Upon his return to his university in Krakow he obtained his Ph.D from him and it can be stated “that Einstein acted as his thesis advisor” [6]. Between 1933-1935, Infeld studied at Cambridge, England, on a Rockefeller Foundation fellowship, where he met Rutherford and Dirac and collaborated with Max Born on Born-Infeld electrodynamics. Once back in Poland he found himself faced with the imminent Nazi threat, so he corresponded with Einstein, who suggested that he apply for a scholarship to enter the Institute for Advanced Study in Princeton and with his support he got there [7].

Infeld agreed with the mathematical error that Robertson, from his restricted view, had found as a peer. Days later, Infeld, acting as Robertson's messenger, appeared before Einstein to tell him that they had found the notorious error, letting Einstein know who had been his anonymous reviewer. Einstein got ahead of his treacherous mission, either because he was warned or on his own account discovered the mischief, and told him that he had found an error in his article. Could it be for this reason that during the two long years that he worked as Einstein's assistant (1936-1938), Infeld did not earn any honorarium at the Institute or was it because Einstein's assistants did not have it?, although the famous Walther Mayer, called the Einstein calculator, yes. Infeld, in order to obtain an income, proposed to Einstein to write between them the brilliant book: "The physical adventure of thought", of whose economic benefit he obtained half, which the author in its Spanish edition of 1961, read in his adolescence in the Luis Angel Arango Library in Bogota.

Infeld participated in the mafia punishment meted out to Einstein, in which usually the gang who did not want one, are given two as a lesson, in this case his article was twice submitted to Robertson's scrutiny and to his full delight, displaying of his power, he acted not as anonymous but by sending him his rude missive with whoever was going to be his assistant. Why was Infeld more friendly with Robertson and betrayed Einstein? Could it be him because he was a fellow of the Rockefeller Foundation? Perhaps because he studied at Cambridge and became friends with the English?

Well, as Einstein rightly warned Tate, when he did not know who his reviewer was, and what his error was, he should not know the context and so it was, that is, Robertson overlooked Einstein's geometric conception of gravity, unfortunately as a consequence of his 1915 equations, which should have been the true source of his critics and the reason for the non-existence of the "gravitational waves" that Einstein presented in his article, but not a gross mathematical error as Robertson could find, that if it had been corrected within the proper context, it should have confirmed Einstein's result and not postpone it, which in the end was what Robertson achieved. The mathematical error originated from the very difficult handling of absolute differential calculus, which was not exactly the talent of Einstein as it was of Grossmann and Hilbert, moreover, given their quality as professional mathematicians.

Although Einstein redid the 1936 article, admitting the existence of "gravitational waves", Nathan Rosen, his co-author, from the Soviet Union, where he lived for a time and then returned and worked for the rest of his life in Haifa (Israel), disagreed with the paper's turn with Einstein and published his own version in Phys. Z Sowjetunion in 1937, reaffirming that "gravitational waves" did not exist (Rosen, 1937).

For his part, also in 1937, in a formidable work on the equations of motion, together with Infeld and Hoffmann, Einstein definitively resolved that "gravitational waves" could not be obtained from his model of the phenomenon of static gravity understood as geodesic motion, which extends Galilei's inertial motion in three-dimensional space of zero Euclid curvature to four-dimensional spacetime (three spatial and one temporal), of positive Riemann curvature, thus explaining gravity as inertia and excluding any possibility of the generation of "gravitational waves" that would carry gravitons. That is, gravity as geodesic motion, in its purported real existence as extended gravity in a spacetime of positive curvature or in its illusory manifestation as punctual or homogeneous gravity in a Minkowski spacetime, really inertial motion.

Einstein had tactically introduced "gravitational waves" on June 22, 1916, 5 days after the Dutch physicist, Nobel Prize winner in 1902, Hendrik Antoon Lorentz did not accept gravity as an effect of the geometry of spacetime and did, that he had, confer physical reality and introduce the so-called relativistic ether. Einstein's strategy was not to wear himself out in unwinnable fights by giving him reason, on the contrary, albeit temporarily, so as soon as he could return to his original thesis. Einstein had recommended it to his friend Paul Ehrenfest, a semite physicist from Vienna who, because of his ethnic origin, felt disadvantaged and ultimately chose to commit suicide [8]. Lorentz died in 1928 and Einstein's influence finally extinguished, tentatively in 1936, after the setback with Robertson, and definitively in 1937, he put an end to "gravitational waves" and immediately, in 1938, to the relativistic aether.

On june 22, 1916, Einstein had presented the short 8-page paper: "Approximate Integration of the Field Equations of Gravitation" to the Royal Academy of Sciences in Berlin, taking up the problem about the existence of "gravitational waves" that in, 1913, in the Entwurf theory Max Born had proposed the speed of propagation of gravity, certainly valid because Einstein's then conception of extended gravity as a material phenomenon analogous to the electromagnetic field, therefore, gravity is one of the existing forces in nature as Newton had proposed, but not in the so-called "general relativity" of 1915, which is the effect of gravitational potentials locally event by event of the geometry of spacetime, that is, of the geodesic movement in the geometry Riemann's overview.

In the Entwurf theory the question was obvious: what is the speed of propagation of the gravitational force? Newton had answered that it was infinite, not acceptable in the special theory of relativity, of 1905, since one of its fundamental principles was the universal limit of the speed of the electromagnetic wave in a vacuum: c. It should be noted that Newton's model of gravity as a force propagating with infinite speed does not present an inconsistency in celestial mechanics and, instead, is necessary in order to maintain stable the static gravitational coupling of the stars within the systems of the macrocosm such as it is verified in the solar, remembered, argued and highlighted only at the beginning of this 21st century by the American scientist Tom Van Flandern. Let us note that the differences in Newtonian celestial mechanics with respect to those observed, such as, for example, the anomalies of the orbits, especially that of Mercury, the deflection of the electromagnetic wave in the proximity of the Sun, the Shapiro retardation or the gravitational lenses etc. they can be explained as a consequence of the effects of the curvature of the quantum vacuum in its gravitational interactions with colossal mass macrostructures (author's thesis) such as the solar one, etc.

Poincaré, who preceded Born to pose the problem of the speed of gravity, had proposed c, that is, although the gravitational wave is different from the electromagnetic wave with the same speed, violating the principle of differentiation observed in nature between magnitudes that are peculiar to the qualitatively different existing physical phenomena. Einstein in February of that year, had considered that in gravity there would not be a gravitational wave similar to the electromagnetic one, but without completely ruling it out. A gravitational wave in gravity as a geodesic effect? Yes, it could be since the geodesies would not belong to the frozen Universe of Parmenides but as a consequence of the dynamism of material existence they should be reconfigured in time, of course through a wave movement, but that should be of the material field, that Einstein believed that it determined the curvature of spacetime, since, according to him, it is the matter (impulse-energy tensor) that gives the geodesies and not these in themselves determine their configurations.

Conclusively, Einstein in 1915 had excluded the gravitational field from the material fields by not being able to assign it an energy-impulse tensor in Riemann's geometry, but rather a pseudo tensor that leads to non-localizable energy. In 1916, Einstein said: “We denote everything except the gravitational field as matter. Therefore, our use of the word includes not only matter in the ordinary sense, but also the electromagnetic field” [9].

However, it was in that June 1916 that influenced by Lorentz to introduce the relativistic aether and by the Netherlander mathematician, physicist and astronomer William De Sitter who suggested linearizing the equations of the gravitational field to which doing so could find the solution of "waves". gravitational" transporting energy. Of course, when Einstein used the linearized expression of gravity, he abandoned Riemann's geometry and returned to Minkowski's geometry which, because it possesses symmetries, in which Einstein had formulated the Entwurf theory, if it is possible to confer to the gravitational field a tensor of energy-impulse, thus, de Sitter's solution was spurious and Einstein's work implementing it was useless.

In 1937, despite this magnificent trio of scientists: Einstein-Infeld-Hoffmann, who worked on the subject of motion, they did not seek to find an exact solution but rather an approximate one, which is why they continued using Willem De Sitter's model of empty space, coming from that June 1916, when Einstein had introduced "gravitational waves", where matter is treated as singularities, although adopting the nomenclature now usual:

$g_{uv} = \eta_{uv} + h_{uv}$

hence, the flat Minkowski spacetime in wave coordinates as established by Arthur Eddington, in 1922, in his paper "The propagation of "gravitational waves".

Einstein-Infeld-Hoffmann wrote in the introduction to their paper "The Gravitational Equations and the Problem of Motion":

“Which relativistic equations of gravitation determine the motion of ponderable bodies?

At present, the only existing equations are those of empty space and it is necessary to know if they alone determine the movement of bodies. In classical physics there are examples for and against. Maxwell's equations for empty space, in which electric particles are considered point singularities of the field, the motion of these singularities is not determined by the linear equations of the field.

In this work it is shown that the equations of gravitation for empty space are sufficient to determine the motion of matter represented as point singularities of the field. The equations of gravitation are non-linear [so gravity interacts with itself and creates more gravity, The author], and due to the necessary freedom of choice of the coordinate system, they are such that 4 differential relations exist between them so that they form an envelope given system of equations. The overdetermination is responsible for the existence of equations of motion and the non-linear character for the existence of terms expressing the interaction of moving bodies.

Two essential steps lead to motion determination.

1. By means of a new approximation method especially suitable for the treatment of semi-stationary fields, the gravitational field due to moving bodies is determined.

2. It is shown that for 2-dimensional spatial surfaces containing singularities, certain surface integral conditions hold to determine motion.

In the second part we calculate the two non-trivial stages of the approximation. In the first of these the equations of motion take the Newtonian form. In the second the equations of motion for two massive bodies take a more complicated form but do not involve third or higher derivatives with respect to time” [1].

It is important to highlight that for Einstein, in exchange for the quantum vacuum, without a doubt a material state, there was empty space, that is, space devoid of matter, therefore, giving space existence in itself as Newton had done. This misconception endures by scientists of the supposed "gravitational waves" derived from Einstein's equations, 1915.

Einstein-Infeld-Hoffmann introduced a new method to solve the equations of gravitation by means of successive approximations dependent on a parameter l and to obtain the equations of motion, to any desired degree of precision. In the approximation l=0 there is a total absence of matter and its solution is trivial leading to the Galilean case. For l>0 all the successive approximations correspond to the presence of matter in the form of singularities, in which negative masses cannot be excluded that would exert repulsive gravitation, in exchange for Newton's points, turning the field into Galilean infinity , that is, at infinity the model ceases to be $g_{uv} = \eta_{uv} + h_{uv}$ and becomes $g_{uv} = \eta_{uv}$, which is the metric of a totally empty space. The h_{uv} represent the deviations of spacetime from flat spacetime and, in general, the h_{uv} are small relative to unity, but Einstein-Infeld-Hoffmann did not make assumptions of the order of magnitude. Matter is treated as singularities in the field. Such singularities, which produce the h_{uv} deviations from the metric, are mass point bodies of spherical symmetry, therefore, infinitely small spheres whose centers are the singularities, independent of the spatial coordinates but not of the temporal one. All calculations are made only for two bodies of similar mass that make up a bipolar system. The approximation l=1 has a Newtonian character. In the approximation l=2, Newton's equations of motion are obtained and Lorentz's equations for the movement of electric particles can be obtained, that is, the electric charge is added to the mass of the singularities, giving rise to the electrostatic force. In the l=3 approximation, the Lorentz force is fully obtained along with the relativistic mass correction by introducing the main deviation from Newton's equations of motion, resulting in the relativistic motion of two gravitating massive bodies. Einstein-Infeld-Hoffmann considered the generalization to p bodies to be easy.

Since the singularities are independent of spatial coordinates, and the differentiating functions of the equations of motion used by Einstein-Infeld-Hoffmann depend only on the distance between the position of the singularities, that is, on the distance r, as is characteristic of theories based on the concept of action at a distance, there is no gravitational radiation, that is, "gravitational waves". It should be noted that, in general, since static gravity is responsible for celestial mechanics, a consequence of geodesic motion, according to the Einstein-Grossmann-Hilbert equations of 1915, the supposed attraction between gravitating massive bodies is as if it will act under the action at a distance and, therefore, also as in Newton this theory was subjacent to them, since being the static gravity consequence of the space-time geodesies its connection with the singularities would be instantaneous, with being of the limit c of the speed, formulated by Einstein in Special Relativity.

Following from the introduction to their paper, Einstein-Infeld-Hoffmann wrote:

"In the determination of the field and the equations of motion non-Galilean values at infinity and singularities of the type of dipoles, quadrupoles and higher poles, must be excluded from the field so that the solution is unique. It is important that our equations of motion do not constrain the motion of singularities any more strongly than the Newtonian equations, but this may be due to our simplifying assumption that matter is represented by singularities, and this may not be the case if we could represent matter in terms of a field theory from which singularities were excluded.

The representation of matter by singularities does not allow the field equations to fix the sign of the mass, so that, as far as the present theory is concerned, it is only by convention that the interaction between two bodies is always an attraction. and not a repulsion. Possible clues as to why the mass can be only positive can be expected from the theory that gives a singularity-free representation of matter.

Our method can be applied to the case where Maxwell's energy-momentum tensor is included in the field equations and, as shown in Part II, leads to a derivation of the Lorentz force.

In Maxwell-Lorentz electrodynamics, as well as in the previous approximation method for the solution of the gravitational equations, the problem of determining the field due to moving bodies is solved by integrating the wave equation by retarded potentials. The sign of the flow of time there plays a decisive role since, in a sense, the field expands in terms of just these waves moving towards infinity.

In our theory, however, the equations to be solved at each stage of the approximation are not wave equations but simply spatial potential equations, since equations such as those for the gravitational and electromagnetic fields are actually invariant under a reversal of the sign of time, it would seem that the method presented here is the natural one for its solution. Our method, in which the direction of time is not distinguished, corresponds to the introduction of standing waves in the wave equation and cannot lead to the conclusion that in the circular motion of two point masses the energy is radiated to infinity in wave form" [1].

It is evident that in an empty space there are no quadrupole material structures, since they would be created by a strong gravitational field, which, according to the current that led to their supposed detection, would produce quadrupole waves for which the same for that reason alone are excluded, but also , unlike the electromagnetic field where the field expands in waves that advance towards infinity, as it is a material field, in the case of a geometric field, such as gravitational, the equations are not wave equations but spatial potential equations, the main reason to discard the aforementioned "gravitational waves" and, finally, in the circular motion of two point masses, which in no way corresponds to their geodesic motion that would be rectilinear, as Wald very well clarified, there is no radiation of energy, and consequently "gravitational waves".

This practically unknown article, or perhaps recast in the references controlled by normal science, was rescued by the Israeli historian Galina Weinstein, who has done an outstanding job of preserving the original scientific thought of Einstein. Presenting her in a larger context, Weinstein adds:

“In 1938, Einstein, Infeld, and Banesh Hoffmann wanted to create a unified field theory that encompassed both gravity and electromagnetism. The problem was that Maxwell's ordinary equations for empty space were linear field equations, in which the electric particles were considered as pointlike singularities of the field. However, the motion of these singularities was not determined by these linear field equations. Furthermore, the vacuum field equations of "general relativity" were not linear and determined the motion of material points represented as singularities in the field.

There are three possible approaches when approaching the task of solving Einstein's field equations: the gravitational field is weak, it is static, and material particles move slowly.

In 1916 and 1918, Einstein considered the gravitational field to be weak, as were the equations of linear electromagnetism. This approximation does not limit the acceleration of matter particles and, in fact, accelerated points of matter produce "gravitational waves".

In 1938, Einstein proposed a new approximation method to determine the gravitational field of a moving particle: he chose a weak field approximation and considered very low accelerations. In the 1938 paper with Infeld and Hoffmann, Einstein considered the weak field approximation and placed a limit on the acceleration of material particles. This is called the post-Newtonian approximation.

Einstein with his assistants Infeld and Hoffmann computed the first two stages of this approximation and found that in the first stage the equations of motion take Newtonian form (Einstein, Infeld, and Hoffmann 1938, 65-66). In this approximation, if we consider very low accelerations, then the exact equations of motion take Newtonian form and we get a material particle that cannot radiate. In this state of affairs, we have revived the old assumption that there could be no "gravitational waves"” [5].

2. The Riemann tensor

Geometry is a formal science different from physics which is a factual science. Such a division arises from its object of study, that in the case of geometry, just like logic and mathematics, its objects belong to thought, for which they are ideal objects, while in physics, the natural and social sciences, its objects are concrete, therefore, existing in reality. However, in both formal and factual science, its object of study is provided by means of a mental model and in both cases primitively, when it had not yet become a science, the model arose from the world, so that in its origin it is deeply rooted in it, through a productive practice, in the historical development of man, in the relationship with his existence on Earth and the Universe as producer of an economy within a social-economic formation.

Scientific updates, in each crucial event, give rise to a new model, which arises from a specific scientific practice, which advances knowledge to a later moment, according to a theoretical discourse, subject to a method, always producing an abstract entity, in the factual sciences, as a consequence of solving problems, before the appearance of anomalies in an old model, leaving the new one more and more connected to the essence of the material phenomenon of study, which it both reveals and hides; to be accepted the new model must be verified by experiments. Or in the formal sciences, the new model presents a superior logic, supported by a great conceptual severity, of an object of study, itself abstract.

In order to understand the qualitative difference between the scientific practice that provides us with the necessary knowledge for the elaboration of technologies and its necessary changes to keep productivity growing in front of the productive practice that supplies the goods and services that we consume, either as intermediate or final, we will refer to when their qualitative difference is extreme, present between the scientific practice in the factual sciences and the productive manufacturing practice. In this, the form of matter is changed, such as the forms of the object and other intervening raw materials, to the form of a good that previously existed as an idea, it is the passage from the abstraction of an entity to the concrete of this, the transformation material of reality according to a mental model until the ideal entity becomes real, with which man achieves his own vital purpose. On the other hand, in scientific practice, man does not achieve his end, but rather that of an ideal object of knowledge, which in the case of factual science, through research, is more closely adapted to the essential aspect of the real object it represents, which is the passage from one generality to another generality through a closer approximation to the concrete, using in the case of the formal sciences as means of work a generality that is the wealth of scientific and technological knowledge (Althusser's thesis of the three generalities). Thus, in the factual sciences, man transforms his thought according to the purpose of a material existence, it is the process of subjectivation of the objective.

Geometry originated in the solution of problems of productive practice related to measurement, based on empirical knowledge, typical of the primitive understanding of the spatial shape of our planet, on the length, area and volume in a flat space, incorporated into certain height of its development, about six centuries before our era, to the practical knowledge of measurement in the Babylonian culture, mainly since “the belief in a flat Earth is found in the oldest writings of humanity. In early Chaldean mythology, the world is depicted as a flat, round disk floating on the ocean, and this formed the premise for early Greek maps, such as those of Anaximander and Hecataeus of Miletus” [10].

It was in ancient Egypt, in the third century before our era, that the geometry developed by the Greeks was formulated as a formal science, as the branch of mathematics dealing primarily with the properties of space, and subsequently assimilated to the latter of time with the introduction of the four-dimensional space-time manifold, applied in the various metric determinations of the Earth and the Cosmos, however only the first recognized in its name because the "measurement of the earth" "was an elaboration, for part of the Greeks, of the measurement schemes inherited from the Egyptians” [10] and omitted the astrometry that preceded it necessary for primitive economic life, through which “various ancient civilizations (Babylon, China and Mesoamerica in particular) they developed a high capacity for numerical calculation without actually doing geometry” [10]. With astrometry they were able to determine eclipses, conjunctions and oppositions of the planets and elaborated precise calendars and catalogs of dates of key events. “Ten thousand years ago, parts of North Africa and Asia became deserts. The tribes that hunted in these territories had trouble getting water and food, and were forced to stay close to the big rivers. The Nile in Egypt, the Tigris and the Euphrates in Babylon, witnessed one of the greatest changes in the history of mankind: tribes become sedentary, build cities, domesticate animals, and agriculture is born. Although this solved the feeding problem, new problems arose. You couldn't avoid changing seasons or floods by migrating; the appropriate seasons for planting had to be predicted; it was necessary to redefine the roles of each one in the new societies, distribute goods and land (either for their possession, or for work). Man would need greater precision in the measurement of time, distances, areas, and volumes”. “For the measurement of time during the day, they built sundials, which they used to anticipate the arrival of the seasons of the year and know their duration. They studied the constellations and traced the apparent path of the Sun through the zodiac” [11]. "His astrometric calculations formed the basis of the angular measurement system later used by the Greeks" [11].

Turned geometry into science, its spatial objects were represented as ideal entities, and defined as a geometric model based on the relationships between its elements of the point, the line, the plane and the angle. The model was that of a three-dimensional space of zero curvature, known as Euclidean geometry. It was therefore the author, who exposed it, Euclid, based on his 5 postulates, presented in his work "The Elements", namely: 1 between any two points a straight line can be drawn. 2 any line segment can be extended indefinitely in the same direction. 3 with any point taken as center and any radius a circle can be drawn. 4 all right angles are equal to each other. 5 through any point external to a straight line, one and only one parallel straight line can be drawn.

The transition from geometry to a formal science made it independent of the physical phenomenon, for which, despite the fact that also in that third century before our era, it was discovered that the Earth was spherical, non-Euclidean geometries were not introduced at the same time, such as the of the model of the space of positive curvature derived from the spheroidal shapes of the stars. “This conception was defended by Pythagoras, who argued that all other astronomical objects were themselves spherical. Aristotle presented evidence for the spherical shape of the Earth through observations of him noting that travelers traveling south saw the constellations of that hemisphere rise in position on the horizon. That's only possible if that horizon is at an angle to someone's horizon further north. Therefore, the shape of the Earth could not be flat. Also, the edge of the Earth's shadow on the Moon during the partial phase of a lunar eclipse is always circular, no matter how high the Moon is above the horizon. Only a sphere can cast a circular shadow in any direction” until the 3rd century BC., when Hellenistic astronomy established the sphericity of the Earth as a certain fact, thanks above all to the empirical measurement of Eratosthenes” [10].

So astonishingly sustained was the separation between geometry and the world, from which it had originated, that in practical problems of measurement, where "according to the Pythagorean theorem, suppose we stand on something, if necessary, in such a way that our If our eyes were two meters high, looking at the horizon, on a day with very good visibility of about ten kilometers, our line of sight would reach approximately 6.00000033 kilometers, that is, the same distance, from a luminous buoy, only six kilometers from the shore of a beach, but that it could not detect because it was below the straight line that would connect it from the beach, due to the effect of the curvature of the Earth, for which we could not see the buoy beyond of a distance of 5.0509 kilometers" [10], therefore, the geometry of Euclid fails even in such short distances, not even when on October 12, 1492 Christopher Columbus arrived in America, believing he had arrived to India, and later Fernando de Magallanes and Juan Sebastián Elcano in their circumnavigation of the world expedition (1519−1523) verified the sphericity of the Earth and that the maps of it, which cannot be obtained with Euclidean geometry, are necessary for any long-distance traveler, without the science of geometry being aware of it and updating it, needless to say that from the very beginning of our era the saddle was trivially known, invented by the warriors of the Asian steppes, which made possible geometry for a space of negative curvature was introduced early.

It was the nineteenth century, after twenty-two centuries, as if it were a magical birth, as the acts of creation appear to us, that the great revolution in the science of geometry occurred, placing itself ahead and subjugating the science of physics. It is likely that it was due to the systemic accumulation of scientific knowledge that the dialectical leap in geometric thought occurred. After the long delay of the Middle Ages, perhaps a very important factor was due to the assimilation of the children of the serfs, endowed with the highest intelligence quotient or artistic talent, when detected by the educational institution, created by the Christian church, they remained under the protection of the feudal nobility, thus depriving the dominated class of its revolutionary potential. Everything changed from the fifteenth century: "the Renaissance meant a reunion with ancient classical culture; but this time it was not with the formal logic or the abstract and non-empirical speculation that the scholastics had carried out, but with something fundamental: the relationship with the world and the practical investigation of nature, the vital meaning, humanism. It was a time when everything was questioned and, with it, an extraordinary period began in the intellectual and cultural production of Western society. With the Renaissance, which started in Italy and then spread to other parts of European soil, a true revolution of ideas and a new attitude towards society, nature and man began; revolution that we affirm constitutes one of the main foundations of the modern world. The reunion with classical Antiquity was important, but it was not the only factor that had weight; various economic, political and social conditions were a real breeding ground to enhance the cognitive results of antiquity that "re-entered" the Western world. "The Renaissance did not produce great results in mathematics, which was not the case in other parts of cultural life, for example, in literature and art. But the reality is that at this time the infrastructure was being created to take the leap that was made in the 17th century and that we can synthesize with the name of Scientific Revolution". "From this time, the names of some mathematicians come to mind: Nicholas of Cusa (1401-1464), Regiomontanus (1436-1476), Luca Pacioli (1445-1514). It is also necessary to mention that the important Works in algebra (which, as we shall see, would be fundamental in the new period) were associated with the Italians Hieronymus Cardano (1501-1576), and Niccolo Tartaglia (c. 1500-1557). Other mathematicians of the time were: Robert Recorde (1510-1558), Georg Rheticus (1514-1576), Pierre de la Ramée (1515-1572), Johannes Werner (1468-1522), Albrecht Dürer (1471-1528), Gerard Mercator (1512-1594), and Francesco Maurolico (1494-1575)". "The changes that occurred in this period of history were extraordinary. With regard to the methods of science, the ideas of Francis Bacon (1561-1626), René Descartes (1596-1650) and Galileo Galilei (1564-1642) had a fundamental impact. "With his work he supported the development of experimental and empirical methods, and the use of mathematical and mechanical descriptions in the understanding of nature" [12].

As far as geometry is concerned, the revolution brought with the Renaissance occurred in three stages:

The first of preparation, started in the 18th century with the works of: “Euclides Liberated from Every Defect”, 1733, by the Jesuit scholastic philosopher and Italian mathematician Giovanni Saccheri; “Effort to Demonstrate the Fundamental Theory of Parallel Revision”, 1763, by the German mathematician and physicist Georg Klügel and the “Theory of Parallel Lines”, 1766, by the Franco-German mathematician, physicist, astronomer and philosopher Johann Lambert.

The second stage of realization: passed in the XIX century. Precursors of non-Euclidean geometries appeared at the beginning of this century, the works: “The theory of parallel lines, together with the suggestion of their banishment from geometry”, 1807, by the German jurist-mathematician Ferdinand Schweikart and the “Theory of Parallel lines. With stone tablets”, 1825, by the also German mathematician, Franz Taurinus. But it was in the first half of the 19th century that the great revolution in geometry took place, the work of a group as if each one were the same, although behind the backs of each other, but formed in the precursors and united around Gauss, who established the first non-Euclidean geometries, for homogeneous spaces in which the curvature of the space is the same at each point. The Russian mathematician Nikolai Lobachevsky is recognized as the father for having published it before the rest, with his works "On the foundations of geometry", 1829-1830, and "New Foundations of Geometry with a Complete Theory of Parallels" , 1835-1837, exposing his conception for spaces of 2 and 3 dimensions [13] and the Hungarian mathematician, János Bolyai, co-author with his work "Absolute Science of Space", 1831-1932, which he believed had been plagiarized by Lobachevsky. They demonstrated the fundamental theorems of hyperbolic geometry of negative curvature and sum of angles less than 180 degrees, with an infinite number of parallel curves; however, the German mathematician, astronomer and physicist Carl Friedrich Gauss, an undoubted super genius, called the "Prince of the mathematicians", preceded them more for not having proclaimed it, he did not take the award, which would have caused greater promptness, his precocity dates back to when he was 15 years old; in a letter to Taurino in 1824, Gauss mentions: “The assumption that the sum of the angles [of the triangle] is less than 180◦ leads to a curious geometry, quite different from ours [the Euclidean] but completely consistent, which I have developed to my entire satisfaction. The theorems of this geometry seem paradoxical and, to the uninitiated, absurd, but calm and constant reflection reveals that they contain nothing at all impossible” [14]. With posterity, the German mathematician Georg Bernhard Riemann is attributed in his work "On the hypotheses that lie in the foundations of geometry", 1854, the elliptic geometry, generalized for spaces of any number of dimensions, but it was also Gauss who first formulated, though, for a two-dimensional space of positive curvature in which the sum of the angles of a triangle is greater than 180 degrees and there are no parallel curves; from which in particular the spherical geometry results, which is based on the surface of a sphere and not on the surface of an ellipsoid, that is, when the three semi-axes of the ellipsoid are equal, this being generated by the rotation of an ellipse with respect to one of its two semiaxes, instead the sphere by turning a semicircle around its diameter. All of them conserved four of Euclid's postulates and disputed his fifth, known as the parallels, which in vain through such an extensive period was the purpose of mathematicians to derive it from the others, a task that those who wanted to update the Hellenistic planimetric conception of classical Greece, turned into science in the mouth of Euclid, incredibly sacrificing the spheroid world, before forever preserving its first coherent and systematic geometric abstraction of an axiomatic nature, that is, based on self-evident propositions that do not require demonstration, perhaps made possible by the nulldimensional existence of the ideal entity and possessing the attribute of entelechy. That like a glove was used by politics since "tragically science becomes political in the face of interests, which is the true core of the reigning power over humans, because as Aristotle said, man is a political animal, in the sense in which man cannot be conceived outside of his relationship with the State in his condition of belonging to it. The scientist, as no man can get rid of this condition, nor that the product of science is trapped in the political structure, which through the paradigms underlies the power, which seeks to keep them in force forever "[15].

The new geometries did not gain sufficient prominence to become part of nineteenth-century mathematical thought until the 1854 work of Riemann, though published in 1868, Gauss's student at the University of Göttingen, who, based on the 1827 paper, of his professor "General investigations on curved surfaces", for the first time, carried out with support in differential geometry, which integrated it to the differential and integral calculus created by the British Newton and the German Leibnitz, in the eighteenth century, he was able to study the properties geometric variables that vary from point to point impossible without it, and create the differentiable manifold, as a set of points distributed in n dimensions, which allowed Riemann to study space not as a whole but by pieces, originating the concept of local space. Thus, Riemann universalized geometry to an infinity of possible geometries, whose postulates differ in at least some of those of Euclid, therefore, including non-homogeneous geometries such as the geometry of the Einstein-Grossman-Hilbert equations of 1915, known as "general relativity", its intrinsic curvature varies from one point to another, which is a case of general Riemannian geometry, with homogeneous geometries: Euclidean, hyperbolic and elliptic particular cases. In addition, through manifold, Riemann generalized n-dimensional geometry, whose precursors had been the Germans Immanuel Kant with his Euclidean spaces of more than 3 dimensions, Hermann Grassmann who in 1844 worked with n-dimensional spaces and the British Arthur Cayley who had used this concept in 1843.

The Third Stage of Complementation and Consolidation occurred at the beginning of the 20th century, carried out by the semite mathematicians Hermann Minkowski with his space-time structure and the "geometrical thought and method" of the German mathematician Felix Klein's Erlangen program on the new geometries, who, together with the Italian mathematician Eugenio Beltrami, between 1868-1872, assuming the consistency of Euclidean geometry, had demonstrated the consistency of other geometries, giving rise, in 1908, to a geometric version of the special relativity of Einstein and Marcel Grossmann who he learned and trained Einstein in the use of absolute differential calculus, which applied to spacetime as a Riemann manifold, in 1915, concluded the Erlangen program, taking gravity out of physics and placing it in geometry, by explaining it as an effect of geodesic motion.

According to the Einstein-Grossman-Hilbert equations, matter represented by the energy-momentum tensor causes a non-homogeneous positive curvature directly proportional to its value, including a constant factor, in the geometry of spacetime, represented by the metric curvature tensor of the Riemannian manifold of four dimensions, spacetime, which is perceived as the gravitational field, under whose action material entities follow the shortest paths between their points, which are called geodesic lines.

A Riemannian manifold is a differentiable manifold, that is, to which the notions of differential calculus can be applied, together with a metric tensor, in which curvature, distance, length, area, volume, etc. can be measured by means of the metric. Therefore, the pair (M,g) where M represents the manifold and g the metric. "In his research Riemann concluded that to study space it should be done locally and not as a whole. That is, the space had to be analyzed by pieces. Applicable results could not be given for the whole space. This was precisely what the so-called differential geometry did when studying the properties of curves and surfaces in space. Using Gauss's results on the geometry of surfaces in Euclidean space, Riemann generalized this type of result to manifolds of any number of dimensions. A differential manifold was precisely one of those pieces under study, composed of points, therefore differentiable. Riemann then formulated a geometry of n dimensions (although the case of greatest interest was that of three dimensions). A manifold is composed of points with n coordinates (x_1, x_2, x_3, x_4 . . x_n). The set of points forms a manifold. Riemann shows that physical space is a specific case of a manifold, and so he concludes that the geometry of space cannot be deduced from the set of general properties of manifolds. For Riemann these properties that distinguish physical space from other varieties of three dimensions must be obtained through experience. Put another way: it is experience that must decide whether the specific properties that Euclidean geometry synthesizes correspond to reality or not. The axioms of Euclidean geometry may or may not correspond to the reality that surrounds us. Discovering that, said Riemann, is not a matter for geometry but for physics" [16]. Correctly, Riemann distinguished space as a model, geometric abstraction, and physical space, although without even suspecting that it was a geometric property of matter. For Riemann, the geometry of a space is the metric that we assign to it, depending on the curvature that must be obtained from the physics of space, that is, from reality, but he did not know: what is physical space? mystery that persists to this day.

The mathematical representation of a manifold is by means of a tensor of order n. A tensor "is a mathematical entity, represented by arrays of components, whose properties do not vary with respect to the reference frame in which it is chosen to be placed. As an example, we recall scalars, vectors and matrices: tensors of order zero, one and two, respectively" [17].

In theoretical, that is, purely mathematical terms, Riemann generalized the Gaussian curvature for the surface in two-dimensional space to the surface in an n-dimensional manifold, universally to an n-dimensional manifold.

In Gauss the curvature is a real number K_i, or simply a scalar, which gives the intrinsic curvature, that is, the extent to which the metric deviates at a point i of a surface with respect to the 0 of the Euclidean metric, that is, its deviation from its tangent, which for the set of points that make up the surface constitutes a scalar field. This Gaussian curvature generally varies from point to point on the surface. A particular case is the spheroid surface, that is, something like a hollow shell, but take into account an ideal object for being spatially only two-dimensional, that has the same curvature at all its points and that as a geometric object is different from the surface of a sphere existing in three-dimensional space, although both are of constant positive curvature. The surface of a sphere not of Gauss but of Riemann, however, take a good look also an ideal object, although spatially having 3 dimensions, according to "experience", there is a corresponding one in the physical world. It must always be remembered that all geometric objects are ideal.

In Riemann the scalar, tensor of order 0, of the Gaussian case, becomes a tensor of order n. Therefore, the Riemann tensor assigns to each point p of the manifold M a tensor of type (1,3), that is, 1 times contravariant and 3 times covariant, represented by R^i_{jkl}, which gives the curvature of the manifold in that point p, constituting the set of tensors corresponding to all points, for the entire surface, section of a manifold or universally space, a tensor field.

The geometric object that contains all the information on the curvature of a point p is the Riemann tensor, which for a tensor of order 2 or 3 the curvature is completely determined by the Ricci tensor, which results from the first contraction of the tensor of Riemann, equating the first contravariant index i with the third covariant k.

But, for manifolds of order > 3, the curvature of a point is only completely determined by the Riemann tensor, which algebraically can be represented as the sum of the Ricci tensor found, in 1903, by the Italian mathematician Gregorio Ricci, via the tensor of Einstein, and the Weyl tensor, "which is basically the Riemann tensor with all its possible contractions removed" [18], obtained, in 1919, by the German mathematician Hermann Weyl.

In a 4-dimensional spacetime manifold, of the 20 independent components of the Riemann tensor, ten of them are represented by the Ricci tensor that gives the volume reduction over time, while the remaining ten are represented by the tensor of Weyl that gives the changes in shape with the transfer between the points of a geodesic line, known as "tidal forces", which have nothing to do with waves of curvature, strange to the Riemann tensor, but simply a complementary geometric property of the geodesies.

In the case of the spacetime manifold, the algebraic structure of the Riemann tensor can be analyzed by taking independently of each other its two complementary components: the Ricci tensor and the Weyl tensor. Einstein gave the first tensor a physical meaning by empirically relating it to the momentum-energy content from Newton's equation of gravity, according to the formalism of Poisson's equation. With which Einstein enabled interpreting the second tensor, that is, the Weyl tensor as a "curvature of emptiness", that is, of the curvature of the empty spacetime manifold of matter, whose presence indicates to what extent spacetime is not conformally flat, but keep in mind that it is an interpretation since, in pure terms, the Riemann tensor decomposed into the Ricci and Weyl tensors, these fix simple geometric properties of an ideal geometric object: a four-dimensional manifold of positive curvature.

Based on Poisson's Equation, in which the scalar gravitational potential, as Newton's gravitational force, is equal to the scalar density of mass according to the differential equation: $\nabla 2\varphi = 4\pi G\rho$, in 1915, Einstein replaced the first term by the $Ricci_{il}$ tensor, for the Riemannian spacetime manifold and the second term by the local energy-impulse tensor T_{il}. Thus, Einstein gave the Riemann tensor a physical meaning that henceforth his followers give. Understand that Poisson's equation is Newton's expressed as a differential equation.

Such a procedure resulted in the set of 10 equations in exchange for the single amount of Newton to measure the gravitational field, which are reduced to 6 through the 4 Bianchi identities. These equations, in differential geometry, are nonlinear tensor partial differential equations, the well-known Einstein field equations: $G_{uv} = k\ T_{uv}$

In purely geometric terms, Einstein obtained G_{uv} by subtracting from the Ricci tensor half the product of the Ricci curvature scalar multiplied by the metric tensor, that is, $G_{uv} = R_{uv} - ½\ Rg_{uv}$. Riemann had previously used the g_{uv}, of the metric tensor to determine the distances between points on a manifold, while Einstein used them to personify the gravitational field; the Ricci tensor and scalar are the two possible contractions of the Riemann tensor, the Ricci tensor as the first and the scalar as the second. On the other hand, on the other side of the equations with clear physical content, Einstein obtained $k = 8\pi G/c^4$, where G is Newton's gravitational constant and c is the speed of the electromagnetic wave in the quantum vacuum that he multiplied by the energy tensor-impulse of a local configuration of matter in place of the density scalar of a local mass. The uv subscripts are a simple nomenclature change from the il subscripts. Thus, in Einstein the spacetime manifold is defined by the pair (M, g), where M is the differentiable manifold endowed with the Lorentzian metric tensor g.

For Einstein, the formulation of the field equations took 7 years of hard work. From the author's point of view, there were three major problems that Einstein had: The first was to generalize Galilei's principle of relativity, restricted to inertial motion, to all kinds of motion, that is, accelerated and gravitational, maintaining a physical theory of gravity that it did not achieve. The second, despite dealing with the generalization of Gauss's concept of curvature, so easy to understand, the great operational complexity of handling tensors in a 4-dimensional Riemann manifold, which, because it is based on a geometry of positive curvature, led him to accept the gravitational movement as well as geodesic movement, finally reaching what had initially been proposed to generalize inertial movement but forced to explain gravity as a geometric property of movement, renouncing recognizing it as a physical phenomenon, analogous to electromagnetism. The third when he had to console himself with giving the geometric explanation of gravity a physical meaning, accommodating it to the Poisson model in which the energy-impulse tensor determines the curvature of the space-time manifold and this determines the geodesic movement of matter, conceived as gravitational motion (Wheeler).

Einstein's mistake in 1915, subjected to strong pressure from Hilbert between July and November of that year, was to have geometrized gravity, giving up his correct conception of 1913, when working with Grossmann, they produced the Entwurf theory, conceiving gravity extended, as a material phenomenon analogous to electromagnetism, impossible to annul by changing coordinates between reference frames of different observers, this is true gravity since such punctual gravity is truly absence of gravity, which he obtained from the "best thought of his life" when he introduced the principle of equivalence between inertial, accelerated and gravitational movements, since it was the mirage of the one who travels in the desert under the rigor of the hot sun and the unbearable thirst of the absence of water, in the case of Einstein looking for generalization of special relativity under the harshness of your world's historical constraints. Let us remember that in 1913 Einstein did not accept Grossmann, who saw as a mathematician that in order to solve the anomaly of celestial mechanics based on Newton present in the orbit of Mercury, the tensors had to work in the semi-Riemannian space-time manifold, and he as physicist understood that by giving up working on the tensors in Minkowski spacetime, he did so with the materiality of the gravitational field. The author is the one who corrects the error, which still persists today in all theoretical physicists on gravity that explain it totally (the Einsteinians) or partially (Logunov) from the curvature of the spacetime manifold. No, the author maintains that what is curved is the quantum vacuum, due to the action of mass structures, where celestial mechanics and the propagation of the electromagnetic wave occur. The gravity that is responsible for the gravitational movement is totally a real force, therefore, gravity is a totally material phenomenon [19], [20].

3. The "gravitational waves" return

Between 1959 and 1960 "gravitational waves" were reintroduced, under some influence from Sir Arthur Eddington, by the Cambridge University group of scientists: Ivor Robinson, Herman Bondi, and Felix Pirani, surprisingly connected to Canada, of where it passed to the scientists of the United States and over the years to most of the planet, leaving the legacy of Einstein at his death in 1955, in the English-speaking world. They were practically coincident with Andrzej Trautman at the University of Warsaw under the mentorship of Leopold Infeld. All convinced they did it within the framework of the so-called "general relativity". Although unlike when, in two articles, between 1916 and 1919, Einstein had formulated the so-called "gravitational waves" in the linearized version of his equations for empty spacetime, according to the De Sitter model, instead they from of the Weyl tensor. Although they considered when Einstein's tensor became equal to zero, for which his equations were presented as solutions of Einstein's in such a limit, more properly as his solutions for a spacetime manifold empty of matter. In such a context, one could claim the Einstein-Grossmann-Hilbert equations of 1915 would be when the Weyl tensor was zero, which it was not. Actually, Einstein took the Ricci tensor and the Cambridge group took the Weyl tensor from the Riemann tensor. That is, Einstein for the four-dimensional spacetime manifold took the first ten independent components and Cambridge and Trautman took the remaining ten independent components of the Riemann tensor. In this sense, neither the Ricci tensor nor the Weyl tensor have to do with matter or its absence, they simply express geometric properties of a four-dimensional manifold of positive curvature that Minkowski, 1908, within the context of Special Relativity, had introduced as spacetime.

Leopold Infeld after the work done, in 1938, with Hoffmann and Einstein on the equations of motion, ceased to be his assistant and left the Institute for Advanced Studies, leaving for Canada, where he became a national. With the help of Percy Robertson, his sudden and unusual friend made upon his arrival at Princeton, he entered the University of Toronto [21], serving as a professor between 1939 and 1950, having to leave because of his militancy in a peace movement, emerged as a reaction to the launch by the United States of the Hiroshima and Nagasaki bombs, for which he was accused of being a communist, and chose to return to Poland, his country of birth, at which time it was incorporated into the Union of Socialist Republics Soviets. Accused of being a traitor, his Canadian nationality was withdrawn. Thereafter until his death in 1968, Infeld worked at the University of Warsaw as director of the Institute of Theoretical Physics, he was also a member of the Presidium of the newly formed Polish Academy. In 1959, Infeld tutored Polish physicist and mathematician Andrzej Trautman, 1933-present, on his work on "gravitational waves" leading to his Ph.D., who had studied at the Institute, even though Infeld had thoroughly discarded them, but that at the request of Jerzy Plebański, considered the unofficial tutor, for whom the existence of "gravitational waves" was obvious, and who proposed "gravitational waves" as the topic of Trautman's doctorate, Infeld allowed it to be done as a a simple degree work and the freedom of your supervisee to choose the topic. Plebański was a Polish physicist, 1928-2005, specializing in "general relativity", Ph.D. at the University of Warsaw, where he was deputy dean of the Faculty of Mathematics and Physics, 1958-1962, and co-author with Infeld of the book “Motion and Relativity”, 1960, finally emigrant in Mexico where he joined the Center for Research and Advanced Studies until his death.

In that same year of 1959, Ivor Robinson, 1923-2016, physicist and mathematician, specialized in "general relativity", semite born in Liverpool, England, later nationalized in the United States, belonging to the University of Cambridge where he studied. Together with Bondi and Pirani he published: "Gravitational Waves in General Relativity III. Exact Plane Waves" and, in 1960, with Trautman, "Spherical Gravitational Waves". Robinson was also mainly recognized for pioneering null electromagnetic fields, for the Bel-Robinson tensor, creating the mathematical framework of the twistor theory developed by Sir Roger Penrose, and being one of the organizers of the first Texas Symposium on Astrophysics. Relativist, 1963, held every two years at sites around the world. Robinson worked at the University College of Wales, King's College London, the University of North Carolina, the University of Hamburg, Syracuse University, Cornell University, the Southwest Center for Advanced Studies, now the University of Texas at Dallas, where he retired in 2000, being professor emeritus in the Department of Mathematical Sciences [Wikipedia], [22].

Hermann Bondi, 1919-2005, was a semite physicist, mathematician and cosmologist born in Vienna, Austria, naturalized in the United Kingdom in 1946, who despite having arrived at Cambridge in 1937, at the initiative of Sir Eddington, seeking refuge from the progressive antisemitism, in his country, when the Second World War broke out, he was taken prisoner and confined in the Isle of Man and then in Canada, for coming from a country allied with Germany. In 1941, he was released to work on a radar system with the British astronomer, mathematician and physicist Fred Hoyle, 1915-2001, shared Nobel Prize in 1983 with Subrahmanyan Chandrasekhar, for the stellar synthesis nucleus. Bondi settled in Cambridge, where he studied at Trinity College, belonging to the University of Cambridge and under the supervision of Sir Eddington obtained his Ph.D, where he was Professor of Mathematics, 1945-1954. In 1948, Bondi with Hoyle and the Austrian astrophysicist, astronomer and engineer, later nationalized in the United States, Thomas Gold, at the height of a student at the University of Cambridge, elaborated the theory of the Steady State of the Universe, an alternative to the theory of the Big Bang with very little acceptance after the discovery of the cosmic microwave background. His best work was on so-called "gravitational waves". He was Professor at King's College London, 1954, Appointed Emeritus, 1985. He was Secretary of the Royal Astronomical Society, 1956-1964. He held important positions including Director General of the European Space Research Organisation, 1967-1971, later European Space Agency, President of the British Humanist Association, 1982-1999, and President of the Rationalist Press Association, 1982-2005. He was one of the signers of the Humanist Manifesto. Among other honours, he was a Fellow of the Royal Society, 1959; Knight Commander of the Bath, 1973; recipient of the Einstein Society Gold Medal, 1983, the Institute of Mathematics and Applicants Gold Medal, 1988, and the Royal Astronomical Society Gold Medal, 2001; GD Birla International Award for Humanism [23], [Wikipedia].

Felix Pirani, 1928-2015, English immigrant theoretical physicist with his family in Canada where he completed his undergraduate studies at the University of Western Ontario, 1948, his master's degree at the University of Toronto, 1949, and the first Ph.D at Carnegie Institute of Technology, Pittsburgh, 1951, contributing to one of the attempts to formulate a quantum theory of gravity, then earned his second Ph.D, in cosmology and "general relativity", 1956, under then mathematics professor Hermann Bondi, meeting as faculty at King's College London, 1958. King's College London is a public university, a member of the Federal University of London and academic organizations including the Association of Commonwealth Universities, the Association of European Universities and the Group Russell. King's was founded by King George IV and Arthur Wellesley, 1st Duke of Wellington, 1829, has had 14 Nobel Prize winners, among his alumni and staff. Pirani specializing in "general relativity", joined Bondi's research group at King's, 1955, where he made a highly original application of Petrov's work to gravitational radiation theory; when Bondi left King's, 1967, Pirani became the head of the group and supervised a large number of research students, becoming Professor Emeritus at the University of London and Visiting Senior Research Fellow in King's Department of Mathematics. His great work was with Bondi, 1959-1989, on the so-called "gravitational waves." For the rest, Pirani stood out for his leftist political activity, decades of 1970-1980, opposing the use of science for military purposes, being a member of the British Society for Social Responsibility in Science. Pirani, during an academic visit to the University of North Carolina, where he dealt with the problems of slavery and the American Civil War was punched in the face, on his return to England, he joined the Scientists of the Left and the Campaign for Disarm, founding the Science Forum as a group of scientists who met monthly to discuss the social problems of science. Pirani fought against the public belief that "science will solve the world's problems" which is an illusion because "funding for research comes from higher levels of the social hierarchy, who control the direction of scientific progress for their own purposes." ” [Wikipedia], [24].

The Cambridge trio took over Einstein's work on "general relativity", based on his arbitrary incorporation of the "gravitational waves" they established, thus remaining henceforth in the hands of English-speaking scientists, strangers to their full understanding of geometric terms in which it was originally formulated, in something similar to when the gravity of Newtonian physics passed to Riemann's geometry, although in reverse since in Riemann its materiality vanished and in Cambridge it reacquired it.

Unlike Einstein, both Trautmann and the Cambridge group worked on "gravitational waves" using the Weyl tensor according to Petrov's classification. It is often stated that their work is inscribed in the solutions of Einstein's equations for the empty space-time manifold of matter that are strictly found for when $R_{uv} - ½ g_{uv}R = 0$ that Einstein-Rosen-Infeld-Hoffmann worked on. It is not like that, they took the Weyl tensor from the Riemann tensor so that "these solutions reside, mainly, in certain formal analogies that they have with the plane-wave solutions of Maxwell's equations of empty space. But, just as the electromagnetic plane-wave solutions, these now called null gravitational field solutions, must be considered as an idealization, in the sense that both types of solutions are not related to any structural source, as would be required of solutions of wave produced by some material medium" [25]. However, others give such waves energy: "the kind of metric that obeys the Bondi-Pirani-Robinson definition of a plane gravitational wave depends on two free functions of one variable that can be interpreted as the wave amplitude and the polarization direction. Using these free functions, Bondi, Pirani, and Robinson obtained a sandwich wave, that is, a gravitational wave that differs from Minkowski spacetime only by a 4-dimensional strip moving in a given direction with the speed of light. They used this sandwich wave and analyzed what happens when it hits a test particle system. From this it follows that the wave affects its movement, which leads to the conclusion that the waves of the gravitational plane in the complete theory transport energy" [26], or from introducing sources of gravitational radiation distancing itself from the central idea of Bondi-Pirani-Robinson, according to its later development, by some, where new scientists have intervened: "The asymptotic behavior of "gravitational waves" near infinity approximates how gravitational radiation emanating from a fusion of distant "black holes" when observed by LIGO. Asymptotically, "gravitational waves" appear to be planar, in stretching and contracting directions perpendicular to the wave's direction of travel... in its further development let us consider the merger of two "black holes". Long before the merger, the total spacetime energy of two "black holes", the so-called ADM energy or "mass", named after their creators Arnowitt-Deser-Misner, is essentially the sum of the masses of the "black holes". "individuals. During fusion, the energy and momentum radiate out in the form of "gravitational waves." After the merger, once the waves have propagated out of the system, the energy remaining in the system, which is known as the Bondi mass, decreases and can be calculated through the formalism introduced by Bondi, Sachs and Trautmann. Gravitational radiation travels along null hypersurfaces in spacetime. Since the source is very far from us, we can think that these waves reach us (the experiment) at null infinity" [27].

The author had the high honor of attending in Kazan, Russian Federation, the centenary of the birth of Aleksei Zinovyevich Petrov, 1910-1972, in whose commemoration a symposium on "general relativity" and Gravitation was held, where the author participated with the work "Spacetime structural property of matter in motion", Kazan Federal University, 2010 [19].

Petrov, was born in a village, within twelve children. Orphaned of his father at the age of 5 and shortly after his house was destroyed by fire, his mother had to give him up for adoption to a paternal aunt, a teacher from the town, where he began elementary school which he finished in the provincial city of Melex, 1926. After the first year of high school, he had to work in Saratov as a carpenter. In 1931, he found work in Kazan building a thermoelectric power station. In 1932 he passed the high school final exam and entered the department of physics and mathematics at Kazan University, where on his return from Göttingen, Professor N.G. Chataev, together with N.G. Chebotarev, corresponding member of the Academy of Sciences of the USSR, transferred to Kazan, they carried out a famous program of mathematics that led to deep investigations carried out in Riemann's theory and spaces generalized by Professor P.A. Shirokov. These people became Petrov's mentors. Shirokov, one of the most prominent Soviet geometers, was closely acquainted with N. I. Lobachevsky and his ideas on the influence of matter on the properties of space, as well as the applications of Lobachevskian geometry. Shirokov suggested that Petrov make the monograph "Einstein's Spaces", which later became the subject of his doctoral thesis which, due to the Second World War, in which he participated in Moscow as commander of a mortar detachment, could only support it, thanks to a short leave, in January 1943. Demobilized, Petrov worked as an assistant professor at the Kazan Aviation Institute, where in 1945 he joined the Communist Party, in that year he moved to the Geometry section of the University. 1952-54 proved the existence of three types of Einsteinian spaces (called Petrov types) known as the "Petrov classification" which made him world famous. In October 1956, Petrov became a professor in the Chair of Geometry at the University of Kazan and headed the Chair of Theory of Relativity and Gravitation, as a co-founder, in 1960. In that year, Petrov was elected president of the section of the scientific council of the USSR dedicated to gravitational investigations and chairman of the Soviet commission of the international committee on gravitation and relativity theory, positions he held until his death [28].

Peroni, Bondi, and Robinson, aided by Trautman, based their work on the return to "gravitational wave" theory on Petrov's classification of the Weyl tensor, which according to the official normal science literature is also attributed to Peroni. affirming that he found it independently, although three years later, 1957, however, on this date, not only Peroni but all, including Trautman, record their very clear recognition of Petrov's 1954 work.

The Weyl tensor, in the use given by Pirani-Bondi-Robinson-Trautman, due to its symmetries, can be represented by a 6x6 matrix, under the following considerations:

- It provides curvature to the spacetime manifold in the absence of matter, that is, giving it intrinsic curvature, unlike Einstein's equations, which empirically relate the Ricci tensor to the energy and momentum tensor of matter, and make the classification of the Ricci tensor is equivalent to the classification of the energy-momentum tensor, thus, beyond the mere Riemann algebraic structure that also confers intrinsic curvature to this tensor.

- Arbitrarily associates states of gravitational radiation without taking into account their sources, that is, autonomously, totally dependent on the metric, to certain algebraic classes (Lichnerowicz, Bel, Pirani), and these classes allow analyzing the behavior with the distance of the gravitational field of bounded systems (Sachs, Bondi). Pirani, Bondi and Robinson rejected the restriction with which Rosen had worked plane waves that "all spacetime be covered by a non-singular coordinate system", a necessary condition for plane waves to fill all spacetime, for this they were based on Lichnerowicz's mathematical work. According to them “Rosen did not sufficiently distinguish between coordinate singularities (such as the singularity at the origin of polar coordinates) and physical singularities, which, in principle, could be discovered experimentally. At the time, the mathematical foundations of "general relativity" were not well developed, but Lichnerowicz has since put them in order in a series of papers now collected in a 1955 treatise. With that argument they argued: “Rosen's plane wave metrics are physically and mathematically acceptable, as two of us independently found (Robinson 1956, unpublished; Bondi 1957; see also Bonnor 1957). Meanwhile, a different application of the Lichnerowicz conditions, with some other considerations, led (Pirani 1957) to a general gravitational radiation criterion, which the plane-wave metric does in fact satisfy. But, they cautioned: “Unfortunately, plane "gravitational waves" do not exhibit their flatness as clearly as plane electromagnetic waves do, and published plane wave solutions have received some criticism”… “Our interest in plane waves Planar waves derive, of course, not from the expectation that such waves can exist in nature, but from the assumption that, at large distances from a finite source of "gravitational waves," these waves must appear approximately flat.

- It allows the classification of all the algebraic symmetries of the Weyl tensor, in each event in a Lorentz manifold, according to Petrov's classification, 1954, of the symmetries of conformal spacetime, that is, taken to infinity. Symmetry means invariant after any change and invariant "is an equality of the parts of a system under the application of any transformation, so it is essential that for said system to remain invariant everything has to be preserved" (Brading & Castellani, 2003). Pirani, Bondi and Robinson justified "gravitational waves" in a curved spacetime manifold in a vacuum as long as "they admit groups of movements", although lacking physical symmetries, but not algebraic symmetries according to Petrov, which by association can be called confer some sense of materiality like the one made by Einstein between the Ricci tensor and the momentum-energy tensor, arguing that: “Fortunately, we don't have to investigate empty spacetime metrics that admit groups of motions. This laborious task has been undertaken by Petrov (1957), who has listed all such metrics. According to his results (cited in Petrov I955), no empty spacetime except Minkowski spacetime admits a group with more than 6 parameters. There are several empty spacetimes that admit groups of 6 parameters; from the current point of view, they can be considered as special cases of the class of empty spacetimes that admit a group of 5 parameters. It is always possible to reduce the metric of this class over a finite region (although not necessarily over spacetime) to the form, sufficiently general for our purposes “…” given above (Bondi 1957). This form is locally equivalent to the one given by Petrov.

Petrov's classification, which is essentially algebraic, was conceived by Pirani, Bondi and Robinson from the relationship introduced by Einstein between the Ricci tensor and the energy-impulse tensor and introduced types of Riemann tensors of pure radiation, that is, in absence of the Ricci tensor. They supposed to find that radiation was always present when the Riemann tensor was type II or type III according to Petrov's classification. "As we shall see, the Riemann tensors of the plane wave metric are of type II." Plane electromagnetic waves, without real sources, constitute a field of pure radiation, thus plane "gravitational waves", also without real sources, constitute a field of pure gravitational radiation, which has a Riemann tensor of type II”.

Starting from the Petrov classification, Pirani-Bondi-Robinson-Trautman defined seven types of Riemann tensors, giving them the following physical interpretations, within the context of the classification of gravitational fields:

- D-type regions corresponding to isolated massive bodies such as stars fully characterized by their mass and angular momentum. The electrogravitic tensor (or tidal tensor) is very similar to the gravitational fields described in Newtonian gravity by means of a Coulomb-type gravitational potential. Such a tidal field is characterized by tension in one direction and compression in the orthogonal directions; If the star rotates around some axis, in addition to tidal effects, there will be various gravitomagnetic effects, such as spin forces on gyroscopes carried by an observer.

- Type III regions of longitudinal gravitational radiation and tidal forces have a shearing effect which is the resultant action of applied forces that causes two adjoining parts of a body or two bodies to slide relative to each other in a direction parallel to your contact plane.

- N-type regions of alleged long-range transverse gravitational radiation, which LIGO claims to have detected as "gravitational waves", corresponding to the so-called N-symmetry of the Petrov classification initially studied as the plane wavefront solutions (and cylindrical symmetry) introduced, by Einstein and his assistants, as necessary to study gravitational waves and radiation. This N-symmetry was used by Felix Pirani in 1957, thus excluding Einstein and Rosen's 1936 and Rosen's 1937 "gravitational wave" works, which were based on the Ricci tensor for a De Sitter spacetime. Pirani achieved that Einstein's equations could be written in a similar way with Maxwell's equations of electromagnetic theory, from giving a physical character to the Weyl tensor in itself eminently geometric, therefore, falsifying it, in addition, in a local environment that is paradoxical because although for those of us who believe in the theory of quantum gravity the gravitational field is local while the gravitational wave extends towards infinity similar to how the electromagnetic field is local and the electromagnetic wave is not, question known by them more when they were based on the alleged similarity between the plane gravitational wave and the plane electromagnetic wave that occurs at a very distant distance from a radiating source, but they wrote: "We have chosen to define the flatness of the" gravitational waves" demanding that they have as much symmetry as plane electromagnetic waves" and "With this information about the symmetry of the plane electromagnetic waves, we now turn to the definition of plane "gravitational waves". We have already assumed that a plane wave metric is a non-plane solution of the empty spacetime equations", furthermore, paragraphs later: “It is not necessary to consider a spacetime that is full of radiation everywhere. It is simpler and more illuminating to consider waves of finite duration, 'sandwich' waves, with non-zero amplitude only for a finite range...in the 'padding' of the sandwich. Elsewhere, spacetime is flat. Such a situation is permissible, because the Lichnerowicz conditions do not require that the components of the metric tensor be analytic functions of the coordinates, or that a coordinate system cover all of spacetime.

- Type II regions that combine the effects considered in types D, III and N in a rather complicated non-linear way.

- Conformally flat O-type regions due to the vanishing of the Weyl tensor whenever the Ricci tensor also vanishes, since otherwise the curvature will be maintained in the pure Ricci terms, but, according to the spurious relationship with the energy-momentum tensor empirically assigned by Einstein. “In a conformally flat region, any gravitational effect must be due to the immediate presence of matter or the field energy of some non-gravitational field (such as an electromagnetic field). In a sense, this means that no distant object is exerting a far-reaching influence on events in our region. More precisely, if there are time-varying gravitational fields in distant regions, the news has not yet reached our conformally flat region” [29].

Plane polarized "gravitational waves" were first introduced by Rosen, as an exploration of their possible existence. Rosen concluded that such waves could not exist because the metric would have to contain certain physical singularities. Taub and McVittie showed that there were no unpolarized plane waves, and thus favored that true plane "gravitational waves" do not exist in empty space in "general relativity". However, Bondi stated: “Scheidegger and I have expressed the opinion that there could be energy-carrying 'gravitational waves'. So it is interesting to note, as Robinson first showed and I have now independently proved, that Rosen's argument is invalid and that true "gravitational waves" do in fact exist. In addition, it is shown here that these waves carry energy, although it has not yet been possible to relate the intensity of the wave to the amount of energy transported” [30].

In 1959, Bondi, Pirani, and Robinson wrote: “Plane "gravitational waves" are defined here as non-planar solutions of Einstein's empty spacetime field equations that admit as much symmetry as plane electromagnetic waves, that is, a group of 5 parameter moves. A general plane wave metric is written and the properties of plane wave spacetimes are studied in detail. In particular, its characterization as 4 planes "is further justified by the construction of 4 sandwich waves" bounded on both sides by (null) hyperplanes in flat spacetime. It is shown that the passage of a sandwich wave produces a relative acceleration in the free test particles, and from this it is inferred that such waves carry energy” [30].

In this formulation they choose to limit the existence of plane "gravitational waves" to certain "corridors" of spacetime, according to the Weyl tensor, which they call sandwich waves, unlike Rosen who had studied their possibility of existence in spacetime conformal from the Ricci tensor. Also, they assimilate them to plane electromagnetic waves that propagate very far from the sources towards infinity with the being that in the Einstein-Grossmann-Hilbert equations in which they supposedly justify such existence of waves, the gravitational field, g_{uv}, is the curvature of the space-time manifold, therefore, of a geometric and non-physical character, as if it is the electromagnetic field in the radiation regions. They believe, given the lack of physical sources of gravitational radiation, to justify the waves by the equivalences between the algebraic symmetries of the Weyl tensor, via the Petrov classification, and the impulse-energy tensor. It is, of course, an argument that by relating an algebraic model with a physical model leads to the replacement of one by the other, impossible to accept as support for a physical theory, it is as much as claiming that a photo can physically replace what is represented in it, however, the algebraic equalities possible to establish.

With the results established by Hermann Bondi and Felix Pirani (Bondi, 1957; Bondi et al., 1959; Bondi et al., 1962), and with the fundamental contributions of Ivor Robinson and Andrzej Trautman (Robinson and Trautman, 1960), although a new theory of gravitational radiation was elaborated from the metric itself without considering its sources and although absent, assimilating them to the electromagnetic phenomenon that they dared to equate with the gravitational one because they wrote "just as plane electromagnetic waves, without real sources, constitute a field of pure radiation, which has exactly the self-conjugate form, thus plane "gravitational waves", also without real sources, constitute a field of pure gravitational radiation, which has a Riemann tensor of type II" [30], when the electromagnetic field really has physical and not geometric reality as it is implicit in the Ricci tensor used by Einstein, falsifying the original geometric character of the Riemann tensor, but, it was with a clear purpose of protecting new lines of research regarding "gravitational waves" in exchange for claiming their real existence, since Pirani, Bondi and Robinson concluded: "We have seen how plane "gravitational waves" can be defined by analogy with plane electromagnetic waves; the analogy depends on the symmetry properties of such waves. As noted above, we would not expect to find planar "gravitational waves" in nature, except as the long-distance limiting forms of waves from a finite source. Plane wave solutions, however, provide useful and interesting models for studying the properties of "gravitational waves"; hopefully its flatness is now seen to be beyond doubt: the existence of sandwich waves lying entirely between two surfaces that are flat in Minkowski spacetime gives the strongest possible support for this claim. The existence of sandwich waves also suggests that "gravitational waves" may not have gravitational mass. A gravitational wave with gravitational mass would necessarily possess a region behind it in which the effects of the wave region would make themselves felt as an ordinary (non-radioactive) gravitational field phenomenon. However, cylindrical waves do have ripples, so this may be a point where the plane wave model is unreliable and the argument cannot be considered conclusive. This is one more problem whose solution will be within reach only when exact solutions representing waves from a finite source are available. In the absence of such solutions, we have refrained from attempting to discuss the transport of energy by "gravitational waves". It follows from the relative acceleration gained by the test particles, as described in 3 and 4, that energy is transferred to the test particles by a plane wave, but this does not allow us to make quantitative statements about the energy transport in general. The current fluid state of the energy pseudo-tensor theory does not seem to justify a discussion of energy transport in terms of this concept" [30]. Not so those who use these authors to maintain that they proved that such "gravitational waves" supported by some of the Weyl metrics transport energy.

At the height of 1970, according to the classification of the Russian physicist Valerii Dmitrievich Zakharov, professor at Moscow State University, in his work "Gravitational Waves in Einstein's Theory" [31] there were the seven categories of works on "gravitational waves" following:

- The first deals with "the definition of "gravitational waves" in its purely geometric aspect, based on the algebraic properties of gravitational fields as defined in the Petrov classification (Pirani, Trautman, Lichnerowicz, Debever, Petrov, Ehlers and Sachs, Hely, Roy and Radhakrishna, Zakharov, Staruszkiewicz, Parizet, Zund and Levine, Misra and Singh, Maldybaeva, Sokolik and Konopleva, Aichelburg, Lukačević, Coburn, Yadav and

Nikolaenko)”.

- The second part “of a definition of the energy of the gravitational field and proceeds to define "gravitational waves". These works, in contrast to the geometric works of the first group, are physically focused (Infeld, Singer, Peres and Rosen, Arnowitt, Deser and Misner, Brill, Moller, Gutman, Shirokov and Bud'ko, Petrov, Wu T'han Khiet, Denisov, Signore, Isaakson, Rodichev, and Dozmorov, Zakharov). Certain authors (for example, Singer, Wu T'han Khiet, Moller (1961), Rodichev and Dozmorov, Denison, Gutman, Isaacson) generally use the covariant (or tetrad) definition of the energy of the gravitational field. In this respect (criterion covariance) your approach may just as well be classed with the former. A traditional "pseudotensor" approach was used by Peres, Rosen, Møller (1958). Finally, Araki, Brill, Geissler, Tredera, and Papapetrou determine the energy of the gravitational field in a specially chosen coordinate system.

- The third studies "waves of a specific shape (plane, spherical), or gravitational emission from isolated source systems (Plane waves: Rosen, Boardman and Bergmann, Bondi, Pirani and Robinson, Kundt and Ehlers, Weber and Zipoy, Kerr and Goldberg, Avez, Newman, Penrose, Chevreton, Johari; spherical waves: Robinson and Trautman, Cahen and Leroy, Foster and Newman, Marder; isolated system emission: Bondi, Stachel, Janis, Newman, Torrence and Couch, Hawking, Biéak , Van der Burg, Isaacson, Winicour and Derry, Le Denmat, Madore, Persides, Halliday and Janis, Sachs, Newman and Tamburino, Szekeres, Unti and Torrence, Collinson and French).

- The fourth includes "work on exact or approximate solutions of Einstein's equations that describe "gravitational waves" in the sense of a certain criterion (Einstein and Rosen, Takeno, Petrov, Weber and Wheeler, Marder, Lichnerowicz, Geissler and Treder , Kompaneets, Peres, Robinson and Trautman, Pandya and Vaidya, Sciama, Bonnor, Friedlander, Nordtvedt and Pagels, Krishna Rao and Pandey, Harrison, Leroy, Wyman and Trollope, Zakharov, Johari, Misra, Bartrum, Foster and Newman, Lal and Prasad, Dangvu, Hoffman, Dozmorov, Szekeres, and Aichelburg; approximate wave solutions are investigated in the works of Rosen and Shamir, Bonnor, Pirani, Peres, Lias, Mehra, Vaidya, and Kushwaha, Murenbeeldand Trollope; a general method for the construction of approximate wave solutions is given in the works of Choquet-Bruhat.)”.

- The fifth treats "gravitational waves" "by approximation methods: either using linearized equations of gravitation (Einstein, Eddington, Matte, Dirac, Vavilov, Gertsenshtein and Pustovoit, Bonnor, Carmeli, Cooperstock, Rotenberg, Campbell) or through the representation of the equations in an approximate form of a specified order of smallness (Bonnor, Fock, Infeld, Papapetrou, Tonnelat, Isaacson, and Winicour, Treder, Cooperstock, Unt, Zerilli, Vishveshwara, Couch, Kinnersley, and Torrence), or, finally, deriving the modified "Maxwellized" gravitational wave equation (Rumer, Kroki, Mavrides, Singer, Berger)”.

- The sixth studies gravity as caused by the emission of elementary particles initiated by Staniukovich and later De Witt, Kundt and Thompson, Halpern, Laurent and Desbrandes. "In view of the fact that Einstein's theory of gravitation is inapplicable to the description of microscopic systems, Staniukovich replaces Einstein's equations with ones involving a "constant" variable of gravitation".

- The seventh consists of “works dedicated to problems of experimental investigation of "gravitational waves", mainly detection. Workers in this field include Weber, Braginskii, Rudenko, Rukman, Gertsenshtein and Pustovoit, Kopvillem and Nagibarov, Bashkov, Mironovskii, Petrov, Forward and Berman, Heintzman, Winterberg, Zipoy and Bertotti, Dyson, Slabkii, Vodyanitskii and Dimanshtein, Lavrentev, Dautcourt, Melosh, Wick, Papini, Boccaletti, de Sabbata, Gualdi and Fortini. Several works in this category deal with estimates of the power of gravitational radiation from cosmic sources, and prospects for the laboratory study of the latter; these include the work of Wheeler, Fowler, Zel'dovich and Novikov, Thorne, Cooperstock, Carmeli, Weber, Boccaletti, de Sabbata, Gualdi and Fortini, Weinberg, Shklovskii, Greenstein, Kafka, Sciama, Field and Rees, Kaufman, Peters, Alladin and Sastry, Chandrasekhar, Ezawa, and Chau and Henriksen".

As can be seen, in the period 1916 - 1970, between Einstein and the followers of "gravitational waves" there was not a single theory about these, just as none was accepted as satisfactory and instead there was a spectrum of theories, from the purely geometry of Pirani to the purely physical of Staniukovich. In addition, a large number of works were carried out.

From a theoretical perspective, what was notable about the period was, on the one hand, the conviction on the part of Einstein, Rosen, Infeld and Hoffmann that from the Einstein-Grossmann-Hilbert equations of 1915 there are no "gravitational waves" and, on the other hand, the other side, the presentation by the Soviet physicists M. Vasiliev and K. Staniukovich of gravity as a state of material existence, in their work “The Cosmos and its seven states” [32], as sustained in the bibliographical references, with posterity to the Soviet physicist Andrei Dmitrievich Sakharov who in his proposal on induced or emergent gravity (1967) had approached the introduction of the theory of quantum gravity, although the author read their work in Spanish in a publication of the MIR publishing house in that same year, which refers the work in Russian to a previous year, so they would be the true precursors, either as authors or disseminators, since, in 1967, they explain the phenomenon gravitat Newtonian theory in terms of the graviton: "There are portions of gravitation, the so-called gravitons, which are spontaneously radiated by all bodies. The intensity of irradiation of gravitons is greater the higher the nuclear temperature (energy reserve inside the nucleus), as is the intensity of emission of light quanta or, more simply, the luminescence capacity of a body incandescent is so much higher, the higher its temperature. Now, the intensity of the radiation of the gravitons by the bodies does not depend on the temperature of the whole body, but on the internal temperature of the elementary particles, of their components, that is, on the degree of excitation. Since all elementary particles oscillate and these oscillations do not operate in a vacuum that does not exist, but in the field, that is, in a backpressure environment, it can be assumed that during each oscillation the particle delivers an extremely small portion of energy to the surrounding environment. We call the material equivalent of this energy portion the graviton mass and the radiated energy the graviton. In addition, it is convenient to assume that the amount of gravitons radiated, the degree of excitation being predetermined, is proportional to the mass of the particle that emits those gravitons” [32], placing the theory of gravity beyond

Einstein's equations of 1915, that is, breaking with him, that with Staniukovich's later work on the gravitational wave, allowed, over time, for some, to understand it as a manifestation of the dynamic gravitational field, endowed with the real graviton, which would be originated from the static gravitational field, provided with the carrier particle of the virtual graviton, thus understanding the gravitational phenomenon as a fundamental force, a Lorentz-type force, in total analogy with the electromagnetic field. In transition between the purely geometric to the physical consideration of "gravitational waves" they were gradually assimilated to electromagnetic waves. Of course, in such a multi-theoretical scenario about "gravitational waves" the experimental perspective of finding them would arise, it did not matter, however, with insufficient theories, but those who persevere searching, no matter what, end up finding something.

For a long period, 1958-2015, the experiments carried out did not yield the detection of the supposed "gravitational waves" sought from the models on them that followed the formulation of the gravitational field as a geometric effect of the positive curvature of the spacetime manifold semi Riemannian. But, the discovery of the binary pulsar PSR B1913+16, 1974, by American astrophysicists Joseph Hooton Taylor Jr, 1941-present, Ph.D, in astronomy from Harvard University, 1968, and Russell Alan Hulse, 1950-present, Ph.D, 1975, at that time his doctoral student at Amherst University, who carried out the observations, using the Arecibo radio telescope, in Puerto Rico, led to claims that radiation of energy that should produce "gravitational waves" had been detected as Einstein had predicted in 1918, for which these scientists won the Nobel Prize in Physics, 1993.

The PSR B1913+16 pulsar and its companion are magnetized neutron stars forming a binary system where they follow elliptical orbits around their common center of mass which varies over time, producing a quadrupole that has the energy ratio of four asymmetric angular momentum of two masses, causing its orbital period to speed up slightly and the orbit of this binary system to slowly shrink as it loses energy. The observed orbital decay rate of the binary pulsar PSR B1913+16 is about 0.3% higher than the rate estimated from the linearized "general relativity" equations, 1918, that is, according to De Sitter, of a flat spacetime, described as a perturbation of the Minkowski metric, which is a highly coincident value, however, that these equations lost all credibility for Einstein, 1937, for which those who cling to ignore their own creator, have presented them, since then, as indirect proof of the existence of waves that, according to them, would be gravitational. Also, it should be noted the total absence for Taylor-Hulse of requiring the support of Bondi-Pirani-Robinson-Trautmann and later who reintroduced "gravitational waves" from the Weyl tensor once Einstein-Rosen-Infeld-Hoffmann ruled out its possible origin from the Ricci tensor. The thesis to which the author accepts is that Einstein's work on discarding "gravitational waves" by him using the very smoothly undulating Minkowski spacetime, 1918, it is worth highlighting the quintessential scenario of electromagnetic waves, I take him behind his back to predict the existence of quadripolar electromagnetic waves that must occur from binary systems with elliptical orbits to some extent charged that, with a certain similarity, as is the case of the Earth, produce electromagnetic fields, although dipolar, that generate its magnetic field. Scientist Dr. Tom Van Flandern objected that the waves radiated by binary pulsars are "gravitational waves" but rather some form of electromagnetism, which he confirmed to the author via email on 11/1/2000.

On his part the author has established that the radiation of binary pulsars belongs to the electromagnetic spectrum. In linearized "general relativity" gravitational radiation estimation equations the real graviton with mass 0 is assumed in order to match the forecast exactly with the expected value of the model used in the absence of the graviton. But when the orbital decay rates of the binary pulsars PSR B1913+16 and PSR B1534+12 are combined, the real graviton mass is not zero but at most less than 1.35342 * 10^{-52} grams ($7.6\times10^{-20}eV/c^2$), with 90% confidence [33]. This upper limit for the mass of the real graviton was calculated, in 2002, by Lee Samuel Finn and Patrick J. Sutton of the Center for Gravitational Wave Physics, Pennsylvania State University, USA. The value of the assumed real graviton mass less than 1.35342 * 10^{-52} grams is very close to the value of the upper limit of the real photon mass which is less than 1.2 * 10^{-51} grams [34], in agreement with their most recent calculation from 2003, by Jun Luo and colleagues at the Huazhong University of Science and Technology in Wuhan, China. And very far from the upper limit value of the real graviton mass less than 4.5 * 10^{-66} grams [35], estimated by Gershtein, Logunov and Mestvirishvili, 1997, based on the observed parameters of the expansion of the Universe, and which is consistent with the value less than 0.5 * 10^{-65} grams estimated by Staniukovich and Vasiliev, 1967, based on the Einstein relation $E = m * c^2$ [32]. Therefore, the author has verified and confirmed what was stated by Dr. Tom Van Flandern that the radiation of energy by binary pulsars is really electromagnetism and coincides with that predicted by "general relativity" linearized by the author. He adds that without Einstein having understood it or having been his purpose, such a forecast truly corresponds to the radiation of electromagnetic quadripolar waves that propagate in a vacuum.

Tom Van Flandern, 1940-2009, was an American mathematician, Xavier University, 1962, astronomer, Ph.D, 1969, Yale University, American physicist, visionary, and science writer on controversial issues, specializing in celestial mechanics. Scholarship for his doctoral studies at the United States Naval Observatory, 1963, where he worked, as head of research and then as chief of celestial mechanics of the Office of the Nautical Almanac, retiring, 1983, due to his honest and courageous discrepancy with normal science that “when experimental evidence is incompatible with prevailing scientific theories, official science ignores them to avoid jeopardizing its funding”. With posterity, he dedicated himself to highlighting erroneous theses in physics and cosmology, formulating his own theories such as the one that the speed of gravity is at least 2 * 10^{22} times c, 1998, inscribing himself in the corpuscular theory of gravitation of the Swiss physicist Georges Louis Le Sage, although brilliant development of the author's thesis about the existence of speeds in nature greater than the speed of light, 1969-1970 [36], formulated based on the incipient quantum theory of gravity exposed by Staniukovich and Vasiliev, as well as the author's subsequent works proposing to measure the speed of gravity, 1991-1996 [36]. On the other hand, Van Flandern denied the Big Bang, proposed his conception of the formation and evolution of the solar system, and rejected the geometrization of gravity. Likewise, he promoted his heterodox scientific ideas on the internet and the online magazine “Meta Research Bulletin”, dedicated to presenting them as articles, in addition to his book “Dark Matter, Missing Planets and New Comets: Paradoxes Resolved, Origins Illuminated”, 1993, which in its chapter 24, it acquires a science fiction connotation by posing the origin of the asteroid belt between the orbits of Mars and Jupiter as the explosion of a planet that would have housed a civilization, which would have built, according to him, the "face in Cydonia" on the planet Mars, actually the effect of an optical mirage as was established with the data from the "Mars Global Surveyor" probe. In 2003, he developed the Van Flandern-Yang hypothesis with Xin-She Yang after observations made during the solar eclipse of March 9, 1997. Asteroid 52266 was named Van Flandern in his honor, in recognition of his work on the prediction and analysis of lunar occultations in USA and for his articles on the dynamics of asteroidal satellites. [Wikipedia].

4. Kopeikin's Spectacular Experiment

The next great event that concurs as a new experimental basis for the existence of "gravitational waves", prior to their alleged detection by LIGO, occurred in 2002 when, through a spectacular astronomical experiment, the Russian scientist Sergei Kopeikin claimed to have measured the speed of the "gravitational waves", dividing the scientific community between those who endorse it and the rest who deny having done so. Kopeikin like Taylor and Hulse ruled out Bondi-Pirani-Robinson-Trautman, therefore, he did not rely on the Weyl tensor to design his experiment. In addition, he departed from Einstein-Grossmann-Hilbert since his 1915 equations determine the gravitational field as only a tensor field and Kopeikin starts from a tensor scalar theory on gravity that, like the Brans-Dicke equation, gravitational interaction is mediated by a scalar field and caused by Einstein's tensor field, although together the theoretical frameworks of Kopeikin-Brans-Dicke-Einstein-others are called metric theories because they have in common that the generic spacetime is curved and, therefore, lacks space-time symmetries. According to the intercontinental radio-interferometry experiment, which combined several radio telescopes over a vast distance in order to obtain a joint image, conducted on September 8, 2002, by the team of astronomers led by Kopeikin of the University of Missouri, in Columbia, and Edward Fomalont, a radio astronomer at the National Radio Astronomy Observatory (NRAO), the speed of gravity would be 1.06 c, with an error between 10% and up to 20% [37]. This data was presented by Kopeikin and Fomalont, during the first week of January 2003, at the annual meeting of the American Astronomical Society, which was held in Seattle, USA.

In the radio-interferometry technique, called VLBI (Very Long Baseline Interferometry), two or more radio telescopes are combined to establish the direction of origin of a radio ray from the difference in arrival times of the rays of the electromagnetic wave to each of the radio telescopes, components of the network established for a given experiment. A radio wave emitted by a source travels in space forming a spherical front that expands around the emitter. The expanding wavefront moves in a radial direction away from the emitter. The rays of the electromagnetic wave when passing in the vicinity of the star, whose gravitational potential produces its deflection, suffer delays. In the case of the Sun or a star, the delay of the ray that passes furthest is minimum and that of the ray that passes closest to a star is maximum. In the case of planets, the delay of the ray that passes furthest is maximum and the delay of the ray that passes closest to a planet is minimum. Between these extremes, the delay of a ray is inverse or directly proportional to its distance from the star that causes the deflection. All the rays, once their deflection occurs, continue parallel and reach the radio telescopes at different times slightly apart. Fixing the direction of a beam is mostly accurate as a function of the distance between radio telescopes, so distant radio telescopes within the intercontinental scale are used.

In the Kopeikin experiment, the VLBI made it possible to measure the angular separation of two distant quasars with an error of less than 0.1 milliarcseconds. In addition, the VLBI was used to detect the deflection of radio rays from extragalactic sources in the gravitational fields of the Sun and Jupiter. In the case of the Sun, the deflection coincides with the value predicted by "general relativity" within a margin of error of 0.1%. But, keep in mind that this very high precision refers to the value of the deflection.

The VLBI is the current technology that makes it possible to measure with the greatest possible accuracy the value of the deflection suffered by electromagnetic waves, subject to gravitational fields, in accordance with Einstein's theory of relativity, that is, as a consequence of the interaction between electromagnetic waves and the curvature of the "fabric of spacetime" (which is not known [38]) caused by the mass of the stars. The mass-energy would not only affect space but also time and both at the same time. From the equations it follows that the greater the presence of the energy-impulse in a region of spacetime, the more it is curved and, therefore, the more its properties deviate from Euclidean geometry. The metric is given by the equations $ds^2 = g_{uv}\ dx_u dx_v$ (distances and angles) in Riemann's geometry for four-dimensional curved continua, internally composed of four intersecting curvilinear axes, where the sum of the angles of a triangle, inscribed on its surface , would be less than 180 degrees and the points that compose it would be the events.

Spacetime would be a dynamic structure such as the field-substance (matter) that determines it and to which spacetime gives its course and direction to its geodesic movement and is not the passive and independent fixed background (represented geometrically, by the mesh four-dimensional) of Newton on which matter moves which in turn would cause spacetime to move and even twist (gravitomagnetism).

As a consequence of its curvature, dependent on the energy-impulse, spacetime loses the absolute character that it has in special relativity and acquires the relative character, since it is determined by the physical conditions of what it contains. Curved spacetime implies that the time flow rate and length pattern is determined by the gravitational field tension (cuvature) at each event (point, position, instant). The curvature changes in time and space as a function of the changing energy-mass distribution. Space and time do not change independently of each other, but in close connection. In direct proportion to the density at rest, that is, to the density of matter, time expands and length contracts. Therefore, time flows at a rate of its own and there is a length pattern between every two contiguous events, since ds^2 is known as a function of x_v on finite intervals. Thus, the measurement of time and length changes from event to event in spacetime, requiring a clock at rest to measure the time, dt, and a metric rod of unit length at rest to measure the length, dx_1, at each event of a finite interval. The tangent spacetime, in each event, is the Minkowski spacetime where special relativity holds. For this reason, spacetime in "general relativity" is called a Lorentz or semi-Riemannian manifold, that is, because spacetime is curved in each differentiable event in flat spacetime.

As for the so-called fabric of spacetime, a term that has made a career in order to avoid the ontological problem of spacetime, and with which it is claimed to have resolved its nature, it comes from the works on quantum gravity from the approach of its unification with the so-called "general relativity", which ultimately places geometry as the origin of matter. Among other theories, in the loop theory of Abhay Ashtekar (Institute of Gravitational Physics and Geometry, Pennsylvania State University, 1985) and others, the fabric of spacetime is formulated "as a network of links that carry quantum information about the areas and volumes. These links can close on themselves forming loops. The loops are quantum and define a minimum unit area (the Planck scale unit area) in a similar way as quantum mechanics applied to a hydrogen atom defines a minimum energy state for its electron. This unit area cannot be curved too much, so curvature singularities cannot be produced like those predicted by Einstein's gravity inside black holes or in the Big Bang" (Francis, 2013). Rafael Sorkin (Perimeter Institute, Waterloo, Canada, 1987) and others proposed casual sets which "are mathematical points connected by causal links, connecting past with future" (Francis, 2013). In superstring theory, the fabric of spacetime is made up of punctual knots, called calabi yau, which result from the compactness of crossing a certain number of dimensions. Therefore, in these theories the nature of spacetime remains geometric but produces physical effects.

The Kopeikin-Fomalont experiment measured the angular distance between two quasars, stars that produce the entire electromagnetic spectrum, especially radio waves, and those with the greatest luminosity in the Universe, located in distant galaxies, during the visual alignment of September 8, 2002 between the planet Jupiter and one of those quasars, called J0842+1835. This alignment occurs once every decade. For this experiment, a network was used made up of the VLBA (Very Large Baseline Array), of the NRAO group, which are 10 25m radio telescopes, located in the United States, covering from Hawaii to the Virgin Islands and the 100m radio telescope of the Institute for Radio Astronomy "Max Planck", located in Effelberg (Germany).

The hypothesis formulated by Kopeikin, author of the design of the experiment, is that the gravity of Jupiter should cause a tiny shift in the position in the sky of the reference quasar. This phenomenon is known as the deflection of electromagnetic waves by gravity. Einstein explained the deflection as being caused by the rectilinear path of an electromagnetic ray changing from the quasi-flat spacetime continuum, which exists when the density of mass-energy distributions approach zero, to the curved spacetime created, for example, by a star with a great mass like that of the Sun. This deflection of the electromagnetic ray, by closely following the curvature of spacetime, alters the true position of the source, depending on the direction where the ray originated with respect to the star that causes the deflection.

The procedure Kopeikin used comprised the following steps:

1. He modified Einstein's equations to express them in what he called parameterized "general relativity":

$G_{uv}\,[cg] = 8\pi G/c^4\, T_{uv}\,[c]$

where [cg] is the speed of static gravity and [c] the speed of light.

Kopeikin assumed the presence of the velocity of gravity implicitly in the Einstein tensor for which “we have explicitly shown the presence of the velocity of gravity cg in the Einstein tensor, which must be used in the time derivatives of the tensor metric". “Einstein's theory of general relativity assumes that all time derivatives ∂0 of the metric tensor in Einstein's equations are coupled with c, that is, ∂0 = c − 1∂t. The current convention is to call the constant c "the speed of light". However, the metric tensor g_{uv} is not simply a geometric object, but represents one of the most fundamental objects in physics: the gravitational field. For this reason, the constant c in the Einstein tensor characterizes the speed of the gravitational field and has to be associated with the speed of gravity rather than the speed of light which has an electromagnetic nature and is physically irrelevant to the Einstein's tensor. On the other hand, the stress-energy tensor $T_{\mu v}$ is locally defined as a special relativistic object and cannot physically depend on the speed of gravity directly because the gravitational field is not localized. However, $T_{\mu v}$ can depend on the speed of gravity indirectly through the metric tensor $g_{\mu v}$. This dependency may be important at higher orders of the post-Newtonian approximation scheme. Therefore, we must take into account that the fundamental speed c that enters the (special relativistic) definition of $T_{\mu v}$ is the speed of light” [37].

2. He changed c to cg also in the energy-momentum tensor in order to achieve conservation of energy in conjunction with the Einstein's gravitational field fuss since it originally leads to non-localizable energy. “To preserve the law of conservation of the impulse-energy tensor, the parameter cg must be explicitly introduced on the right-hand side of the Einstein equations” [37].

However, Kopeikin wrote after the realization of his experiment where, starting from the belief about the gravitational radiation of the binary pulsars, whose propagation speed he supposedly measured, he recognized the persistence of the problem of the conservation of energy in the theories. metrics, when he worked on his proposal to solve it, 2017: “Until now, as far as we know, no monograph has been devoted to the discussion of the problem of construction of conservation laws in "general relativity" and in other metric theories, although several valuable reviews and chapters can be found in books that expose this topic” [39].

3. For the second time, he re-parameterized the equations to express them in the post-Newtonian scheme. “In the post-Newtonian approximation scheme, the Newtonian limit of general relativity is achieved for ϙ → 0. This is equivalent to the statement that the velocity of propagation of the gravitational interaction, cg, goes to infinity (cg = ∞) because in the Newtonian limit the gravitational field propagates instantaneously by definition. It is obvious that in this limit Einstein's gravitational field equations must be reduced (at least in a preferred framework) to partial differential equations of elliptic type which cannot contain time derivatives of the gravitational field variables (the metric tensor) at all. [37].

“From this consideration it follows that the parameterization is equivalent to the statement that the post-Newtonian parameter ϙ can be defined as ϙ = c/cg, where c is the speed of light and cg is the parameter of the speed of gravity going from cg = c to cg = ∞ (0 ≤ ϙ ≤ 1). The speed of light c belongs to all non-gravitational phenomena that take place in flat spacetime, while the speed of gravity characterizes the maximum rate of temporal variation of the gravitational field and the speed of its propagation. For this reason, from a physical point of view, it is natural to correlate each time derivative of the metric tensor g with the velocity of gravity cg. This is in agreement with the approach of general relativity as a self-interacting spin-2 field theory” [37].

“The development of the cg parameterization of general relativity requires that the post-Newtonian expansion of Einstein's equations with the parameter ϙ = c/cg going from ϙ = 0 (Newton) to ϙ = 1 (Einstein) must preserve all the geometric properties of general relativity: the Bianchi identity, the relationship between the Christoffel symbols and the metric tensor, the Gaussian invariance and coordinates of the left side of the equations of the gravitational field” [37]. The post-Newtonian parameterized equations became:

$$G'_{\mu\nu} = 8\pi\Theta_{\mu\nu} \quad (2.12)$$

The Bianchi identity assumes that:

$$\nabla'\Theta'^{\alpha\beta} = 0 \qquad (2.13)$$

4. Linearized the equations to obtain an approximate solution. Referring to the post-Newtonian parameterized equations he wrote: “This equation is in agreement with the flat spacetime conservation law for the stress-energy tensor of matter $T^{\alpha\beta}$. We introduce the weak field decomposition of the metric tensor

$$g_{\alpha\beta} = \eta_{\alpha\beta} + h_{\alpha\beta}, \ (2.14)$$

where $h_{\alpha\beta}$ is the perturbation of the Minkowski metric tensor $\eta_{\alpha\beta}$. In what follows we restrict ourselves to the linear approximation of the Einstein equations with respect to the metric perturbations $h_{\alpha\beta}$. However, we will keep all the powers of the parameter ϙ in the post-Newtonian expansion of the linearized theory” [37].

5. He solved the linearized post-Newtonian equations according to the retarded potentials of the Lienard-Wiechert tensor, similar to how Einstein had done in 1918, although not parametrized post-Newtonian the truly original of Kopeikin. Since, Kopeikin maintains that in the deflection phenomenon not only the Shapiro delay is produced, but additionally there is the delay due to the finite value of the speed of gravity.

In this way, Kopeikin ultimately generated a model of the gravitational field that is not that of "general relativity", insofar as it as such does not transmit a force nor, therefore, has speed. The Einsteinian gravitational field is precisely the absence of force. Measurements made in the past of the deflection by the Sun refer to the effect of the static gravitational field, that is, of the gravitational potential on an electromagnetic wave, that is, to the effect of the curvature of spacetime, which in its proximity causes a spheroid body, on the electromagnetic ray that inertially follows such curvature. This effect also produces a delay of the electromagnetic ray in front of when its trajectory is rectilinear, which for radio waves is known as Shapiro's delay, and consists, in general, that the greater the curvature of spacetime, of a determined region of the Universe, the rays that cross it take a longer time to appear before an observer placed in the distance. In other words, according to Shapiro, the pulses of the electromagnetic radiation currents suffer a delay directly proportional to the value of the spacetime curvature of the region of the Universe they cross.

Kopeikin started from Einstein's model of the static symmetric spherical gravitational field, modifying both the Einstein tensor and the impulse-energy tensor by adding the speed of gravity to both, justifying on the one hand the existence of a force and on the other the conservation of energy, expressing the equations according to a post-Newtonian parameterization, however conserving in all the Einsteinian formalism, to convert them to their expression in the solution of the linearized field equations, which according to their conception of the existence of one force proceeded to solve them using a delayed Lienard-Wiechert type. In all, truly a colossal work by Kopeikin that seduced the best astro physicists in the world and achieved his unrestricted support to carry out his spectacular experiment. Kopeikin convinced them that the phenomenon of deflection is not only produced by the curvature of spacetime, but also by the effect of a force that is the consequence of the propagation of gravity with a finite speed. In its post-Newtonian version, the speed of gravity could occur within the period (∞, 0) which, according to the term c/cg, used in the Kopeikin equations, can be between (0, 1).

Kopeikin wrote: “The gravitational field of the solar system causes a delay in the propagation of radio signals, the effect discovered by Shapiro. We note that the current accuracy of the phase reference VLBI measurements is good enough to detect a relativistic Shapiro time delay correction depending on the delayed orbital position of Jupiter caused by the finite propagation speed of gravity. We calculate this correction for Jupiter by making use of the delayed Lienard-Wiechert solution of Einstein's gravitational field equations for the perturbation $h_{\mu\nu}$ of the metric tensor "...the delay" is caused by the finite value of the propagation speed of gravity, cg, according to the causal nature of the Lienard-Wiechert solution of the Einstein equations” [37].

The amplitude of this displacement must manifest itself in the form of a slight deformation of the radio waves emanating from the quasar, which must depend on the speed of propagation of gravity. Dr. Kopeikin wrote: "If the speed of gravity were infinite the quasar would appear circular in the sky as Jupiter passed by. But, if the speed of gravity was finite the quasar should appear elliptical" [37]. That is, if c/cg = 0 then the quasar would appear circular; otherwise c/cg=1 the quasar would appear elliptical.

But what speed of gravity? According to the e-mail that the author received in response from Dr. Kopeikin, on January 11, 2003, 8:43 p.m., this speed is not that of the gravitational waves predicted by Einstein in 1918 and abandoned in 1937, but of the change of the gravitational field of Jupiter, along the path of the radio ray, between the quasar J0842+1835 and the barycenter of the solar system, as a consequence of its non-uniform accelerated motion with respect to this quasar.

Kopekin matched the supposed speed of gravitational propagation within the static gravitational field with the speed of "gravitational waves". Kopeikin, probably behind his back, took advantage of the strong analogy between electromagnetism, a material phenomenon, and static gravity, according to the "general relativity" geometric effect” giving it material meaning. Since, his reasoning was: “Ellis and Uzan [37] have suggested a classification scheme to avoid confusion between different c's that would facilitate a correct interpretation of experiments in fundamental physics. Extending the idea of Ellis and Uzan we define a set of c in an electromagnetic field theory

(i) cew - the speed of electromagnetic waves in a vacuum,

(ii) cl - the maximum speed of light (electrodynamic constant),

(iii) CM - the coupling constant between the electromagnetic field and the electric current,
and a set of c in a gravitational field theory

(i) cgw - the speed of "gravitational waves" in a vacuum

(ii) cg - the maximum speed of gravity (gravitodynamic constant),

(iii) cE - the coupling constant between the gravitational field and matter.

The physical meaning of the constants cl and cg is that they determine the maximum rate of change of electromagnetic and gravitational fields, respectively. It means that cl appears in front of the time derivatives of electric and/or magnetic fields, while cg will appear in front of the time derivatives of the gravitational field (the metric tensor)"

"It is probable that the most general theory of gravity should, in principle, also contain three constants: cgw, cg and cE to be different. Einstein's "general relativity" theory assumes that cgw = cg = cE and equates cg and c. These assumptions do not contradict the time observations of binary pulsars with an accuracy close to 0.4%. However, it does not mean that the pulsar timing measures the numerical value of cgw with this precision because the timing model of binary pulsar observations does not incorporate the constants cgw, cg, and cE explicitly. Much more work is required to incorporate these parameters into time observation processing software in order to measure them separately. We will continue our analysis of the VLBI experiment under discussion in the framework of "general relativity" by parameterizing its equations with a single parameter cg ≡ cgw = cg = cE. We note that the ratio G/c^2 in Einstein's equation is fixed by the correspondence principle of Einstein's equations with Newtonian gravity. Therefore, the parameter cg can appear on the left hand side of the Einstein equations as a coefficient in time derivatives of the metric tensor or on the right hand side of the Einstein equations in terms proportional to $G/(cv^2cg)$ and/or $G/(c^2cg^2)$. We call the parameter cg as the (ultimate) speed of gravity in close analogy with electromagnetic theory, where a similar unifying constant c is called the speed of light. We emphasize that the speed of gravity cg belongs to all time-dependent gravitational phenomena, but not only to the propagation of "gravitational waves" in a vacuum. Any gravitational field theory in which cgw ≠ cg ≠ cE will have equations with different mathematical properties than those of "general relativity". In any theory, Einstein's relativity principle requires cgw ≤ cg, so theories that violate this inequality must be considered invalid" [37].

In this way, Kopeikin reformulated the equations of "general relativity" by adding the aforementioned delay to the Shapiro delay. Kopeikin specified: “Einstein's equations are solved in terms of the Lienard-Wiechert tensor potentials that are used to integrate the light ray propagation equations. An exact analytical expression for the relativistic time delay in the propagation of a radio wave from the quasar to an observer is calculated under the assumption that the bodies that deflect light rays move with constant velocities. A post-Newtonian expansion of the time delay shows that in general relativity the time delay is affected by the speed of gravity already in the first order by 1/cg beyond the leading (static) Shapiro term.“ [37].

This reformulation allowed Kopeikin to design the experiment in question, very similar to the one that, in 1919, allowed verifying Einstein's prediction of the bending of a ray of light coming from a star due to the Sun's gravity, although in this case the star it was replaced by a quasar, the Sun by Jupiter, as it is the most massive planet, approximately one thousandth of the mass of the Sun, and the ray of light by a ray of radio waves. And his objective was not to establish the bending that the radio wave beam suffers due to gravity, but rather the speed of gravity. Kopeikin takes Jupiter in exchange for the Sun with the aim of counting, with respect to the geocentric frame, with the movement of Jupiter and, additionally, reducing the delay caused by the solar plasma when interacting with the photons that make up the rays of the electromagnetic wave. This delay is very difficult to measure as it was demonstrated by the Canadian physicist and inventor Paul Marmet, (1932, 2005), professor of physics at the University of Ottawa, and constitutes the main problem to obtain a reliable result of the deflection and for Kopeikin the of the speed of gravity. But, although Kopeikin attenuated this type of interaction, he could not, on the other hand, eliminate the interactions of the rays with the strong electromagnetic fields created by Jupiter when it rotates on its axis and moves in its orbit around the solar center of gravity.

What change of the gravitational field? Kopeikin's gravity model introduces a force, produced by something being transmitted, and in this sense Kopeikin makes a transition to quantum theory. Since in this model through the gravitational field moment is transmitted between Jupiter and the ray of radio waves. Then Kopeikin would have to reformulate "general relativity" keeping its geometric character and adding quantum terms to it! According to some dubious approximation since there is no satisfactory one.

The force that Kopeikin talks about is a kind of preformation, within the near gravitational field, of the gravitational wave that occurs far away. Therefore, this force, which does not move the celestial bodies in their translations around others, is the one that would originate with the speed cg in the static gravitational field. And as a preformation of the gravitational wave, it should have the same speed as this alleged cgw wave, which would be the Einsteinian gravitational wave that we remember was conclusively ruled out by its author. This was what Kopeikin set out to measure in order to confirm Einstein's relativistic theory. In other words, the preformation of the gravity wave refers Kopeikin to Einstein's gravity wave, which has nothing to do with the celestial mechanics model of the theory of general relativity and is also anachronistic and repudiated.

Sergei Kopeikin's experiment avoids facing what is really in scientific debate that at the current height in terms of the speed of gravity requires first resolving the debate between the theory of gravity according to Einstein and quantum physics without mixing both theories as Kopeikin did. And, second, a crucial experiment is carried out that establishes the speed with which the force of interaction between the source and the gravitational target is transmitted, which transports the static gravitational field, but not the gravitational wave, which is still well outside the technological reach reached, since the actual graviton according to Logunov's calculation exists on a much smaller scale than was accessed in LIGO's measurement of false "gravitational waves" for the first time in September 2015. The type of experiment to establish the speed of the gravitational force the author has been calling for it to be done since the early 1990s. The transmission speed, through the static gravitational field, of the gravitational force must be greater than c, as is possible in the experiments with superluminal speeds carried out from the decade of 1990, especially that of the theoretical-experimental physicist in elementary particles, Ph.D, American William Delany Wal ker, (1923, 2010), who worked at the American universities of California, Berkeley, Rochester, Wisconsin Madison and Duke and, once retired, at the Royal Institute of Technology, KTH-Visby, Department of Electrical Engineering, Sweden. Walker experimented with the electromagnetic wave in its preformation within the reactive zone, near field. And that of the German physicists Gunter Nimtz (1936, today), professor at the universities of Cologne, Montreal, Shanghai and Beijing and inventor and Alfons Stahlhofen, who at the University of Koblenz, Germany, generated evanescent waves.

Walker wrote: “A simple experiment is presented indicating that electromagnetic fields propagate superluminally in the near field next to an oscillating electric dipole source. To 437 MHz, 2 watt high frequency sinusoidal electrical signal is transmitted from a dipole antenna to a parallel near field dipole detector antenna. The phase difference between the two antenna signals is monitored with an oscilloscope as the distance between the antennas increases. Analysis of the phase vs. distance curve indicates that superluminal transverse electric field waves (phase and group) are generated about a quarter wavelength away from the source and propagate toward and away from the source. Upon creation, transverse waves travel with infinite speed. Outgoing transverse waves slow to the speed of light after they propagate approximately one wavelength from the source. Inwardly propagating transverse fields rapidly decrease to the speed of light and then rapidly increase to infinite speed as they travel toward the source. The results are shown to be consistent with standard electrodynamic theory” [40].

For their part, Nimtz and Stahlhofen wrote: “Feynman, one of the founders of Quantum Electronic Dynamics (QED), introduced virtual particles as intermediate states of an interaction process into his diagrams. Such virtual particles are not observable, however, from a theoretical point of view they represent necessary intermediate states between real observables. These types of virtual particles were introduced to describe the interaction process between an electron and a positron and for much more interaction complicated processes. Other candidates for virtual photons are the evanescent modes known from optics. The evanescent modes have a purely imaginary wave number, they represent the mathematical analogy of the tunneling solutions of the Schrödinger equation. Evanescent modes are present in total reflection optical processes and in undersized waveguides, for example. The most prominent example of the occurrence of evanescent modes is frustrated total internal reflection in double prisms. Sommerfeld, 1949, pointed out that this optical phenomenon represents the analogy of quantum mechanical tunneling. The evanescent and tunneling modes violate the special theory of relativity, obviously, they represent the exception that proves the special theory of relativity. We demonstrate the quantum mechanical behavior of evanescent modes with digital microwave signals at a macroscopic scale of the order of a meter and show that evanescent modes are well described by virtual photons as predicted by previous QED calculations. Evanescent modes or photonic tunneling like the tunneling solutions of the Schrödinger equation have a purely imaginary wavenumber. This means that they do not undergo a phase change when traversing space." "Experiments with evanescent modes revealed superluminal signal energies and velocities" [41].

Already in 1969, the author proposed the existence of superluminal speeds, one of which would be that of gravity, understanding it to be of a purely quantum nature, which must be the real gravity existing in nature, which today has the endorsement of Tom Van Flandern. The proposal to measure the speed of the gravitational wave in Einstein's terms is to ignore the essential debate in contemporary physics between whether gravity is a geometric phenomenon of spacetime or that of a fundamental force as proposed by quantum theory. It will be said: how can one propose to measure the speed of propagation of the static gravitational field? But, it is that this field is composed of virtual gravitons, which propagate and transport momentum, an issue that since 1969 I have claimed. And in Tom Van Flandern's terms, the static gravitational field is renewed every instant.

Kopeikin wrote: "All previous experimental tests of general relativity in the solar system have been based on the static Schwarzchild solution (Will 1993) and thus were not sensitive to effects entirely associated with the speed of propagation of gravity. It is worth noting that "gravitational waves" are inherent in the radiative (far) zone of a system that emits waves (Misner, Thorne, and Wheeler 1973; Barish and Weiss 1999). they do not propagate freely through the interior of a non-radiative (nearby) zone of the system. However, the process of generating "gravitational waves" produces delayed effects in the near zone leading to the appearance of the reaction force of the gravitational radiation in the relativistic equations of motion of extended bodies comprising a self-gravitating astronomical system (Damour et al. 1989).The existence of this force is a consequence of the finite propagation speed of gravity, as experimentally confirmed by Taylor (1994)" [42].

Kopeikin includes in his mathematical model the Shapiro delays due to the Sun, the Earth and Jupiter and, also, the delay due to the force that would originate the finite speed of gravity. That is to say, the Kopeikin experiment partially abandons the explanation given by Einstein of the phenomenon of deflection, which would be the simple consequence of the curvature of spacetime, and makes it also depend on a kind of momentum, which is transmitted by the static gravitational field, such as result of the finite speed of gravity wave preformation. In other words, Kopeikin, with his explanation of the deflection, elaborates a mixed model of the phenomenon of gravity, which would then be a geometric effect of the curvature of spacetime and a quantum effect of the gravitational wave. Therefore, this experiment not only entails the problem of scientific validation of the instrument used but, what is more dramatic, that the Kopeikin theory underlying its equations has the acceptance of the world scientific community, where the current that defends it already exists, within the quantum theory of gravity, in the variant that explains celestial mechanics as a consequence of the action of the gravitational force of the static gravitational field, which is transported by the gravitational field of quantum composition, the thesis that the velocity of gravity is greater than c. Kopeikin's theory, which seeks to pass as Einsteinian, actually takes a leap into the void in order to save itself, in its encounter with quantum theory, which, however, it tries to circumvent.

On the other hand, the author finds that the gravitational model used by Kopeikin is based on a spherical and symmetrical gravitational field for Jupiter, which exactly fits the static field of "general relativity", and that, as occurs with that of the Sun, it created is inappropriate, since in reality the solar system is a non-uniform accelerated system. That is to say, that field of Jupiter must produce a non-uniform acceleration and a force in the sense in which Tom Van Flandern intuits it, and which may be the one discovered by Taylor. But, I insist, from understanding the "static" gravitational field composed of virtual gravitons that spread and transport momentum.

The result of c for the speed of gravity, defended by Kopeikin, may actually correspond to a frequency of electromagnetic waves, radiated by the intense magnetic field of Jupiter as it moves in its orbit. Previously, due to Jupiter's rotation movement around its axis, electromagnetic radiation has been detected in the decimetric and centimetric radio wave bands. But, this thesis requires reworking our understanding about the phenomenon of deflection from quantum theory and the interaction between the different existing fields and within the same field between different notably different frequencies. In other words, we understand by deflection only the effect of the transmission of momentum by the different fields present in the region of the Universe with which the electromagnetic radiation interacts when crossing it. The author in his work "Superluminal Velocities" extensively develops the interaction of the electromagnetic wave with substantial phenomena, that is, the interaction of the electromagnetic wave with atomic structures, and presents the interaction of the electromagnetic wave with itself, which is the foundation of rephase phenomenon, which in the Princeton experiment, USA, carried out in 2000, allowed the electromagnetic wave to reach the group speed of 310c [43]. But, we still know very little about the interaction between the different fields existing in nature.

By E-mail dated May 15, 2003, 06:05 PM, Canadian scientists Paul Marmet and C Couture, from the Department of Physics at the University of Ottawa, who are the authors of a magnificent study on the deflection of radio-rays electromagnetic waves by the Sun's plasma, in response to my query as to whether this plasma affected Kopeikin's experiment stated: "We read that Sergei Kopeikin compared the speed of light near Jupiter with the speed of light after its delay due to the plasma near Jupiter. He found that the difference is too small to measure (same value of c). You should announce that currently what has been measured is the speed of light. This is not the speed of gravity" .

The American professor of physics at the University of California, Ph.D, Steven Carlip, (1953, present) recognized for his work on (2+1)-dimensional quantum gravity, wrote: “Fomalont and Kopeikin have recently succeeded in measuring the velocity-dependent component of the Shapiro time delay of light from a quasar passing behind Jupiter. While there is general agreement that this observation proves the Lorentz transformation properties of the gravitational field, controversy has arisen over the question of whether the results depend on the speed of light, c, or the speed of gravity, cg. By analyzing the Shapiro time delay in a set of "preferred frame" models, I show that this question is ill-posed: the distinction can only be made in the context of a class of theories in which c = cg, and the answer then depends on the specific class of theories chosen. However, it remains true that for a large class of theories "close enough" to general relativity, the main contribution to the time lag depends on c and not on cg; arguably, therefore, the observations are not yet precise enough to measure the speed of gravity" [44].

Canadian theoretical physicist, Ph.D, Clifford Martin Will, (1946, present) professor at the universities of Chicago, Stanford, Washington in St. Louis and Florida, recognized for his post-Newtonian expansions of approximate solutions to the field equation of Einstein, wrote: "We calculate the delay in the propagation of a light signal through a massive body moving with speed v, under the assumption that the propagation speed of the gravitational interaction cg differs from that of light. Using the post-Newtonian approximation, we consider an expansion in powers of v/c beyond the "Shapiro" time delay effect, while working in first order only on Gm/c^2, and show that the altered propagation velocity of the gravitational signal has no effect at all on the first order time delay in v/c beyond the leading term, although it will have an effect at second order and higher. We show that the only other possible effects of an altered velocity cg in this order arise from a modification of the parameterized post-Newtonian (PPN) coefficient α1 of the metric from the zero value predicted by general relativity. Current measurements of the solar system already provide strict limits to such modification. We conclude that recent measurements of the propagation of radio signals beyond Jupiter are sensitive to α1, but not directly sensitive to the propagation velocity of gravity" [45].

In 2009, seven years after the design of their experiment, Kopeikin and Formalont refined their calculations and accepted that Will's criticism was valid with those of 2002, but they did not say whether the experiment had sufficient sensitivity to have detected the effect they were looking. "Fomalont and Kopeikin in 2002 stated that with 20% accuracy they confirmed that the speed of gravity is equal to the speed of light in a vacuum. His work was immediately contradicted by Will and several other physicists. Fomalont and Kopeikin accepted that their measurement is not precise enough to detect terms of order v^2/c^2, which can experimentally distinguish Kopeikin's interpretation from Will's interpretation. They reported their measurements in 2009 and stated that these measurements are more precise than the 2002 VLBI experiment, but did not state whether v^2/c^2 order terms have been detected." [46].

The American theoretical physicist-mathematician, Ph.D, Stuart Samuel, graduated from Princeton University, was a member of the Princeton Institute for Advanced Study, professor of physics at Columbia University and at the City College of New York, recognized by his work on the velocity of gravity and for his work with Alan Kostelecký on spontaneous Lorentz violation in string theory, an author of significant contributions in field theory and particle physics, wrote: "Using a relatively simple method, calculate the gravitational time delay correction v/c for light passing through a massive object moving with speed v. It turns out that the v/c effects are too small to have been measured in the recent experiment involving Jupiter and the quasar J0842 + 1845 that was used to measure the speed of gravity.". Also, he clarified:

“The purpose of these letters is to point out an error in the theoretical formula used to analyze the Jupiter/quasar experiment and provide the correct result. For reference, a v/cg correction of the Shapiro time delay in the Jupiter/quasar experiment is found to be proportional to 1/θ2, where θ is the angle between the quasar and Jupiter. Since θ is small, an improvement occurs that makes the measurement feasible. However, using a simple method, this letter calculates the v/c corrections and finds no such term. The discrepancy between the formula of the current work and the one used in the experiment is understandable: the angle θ in the latter was not actually the observable one but an artificially defined angle” [47].

Japanese astrophysicist Hideki Asada wrote: “Einstein's gravity with extra dimensions or alternative theories of gravity might suggest that the propagation speed of gravity may be different from the speed of light. Such a difference may play a vital role in the primordial Universe. Recently Kopeikin and Fomalont claimed the first measurement of the speed of gravity by VLBI. However, the measurement has no bearing on the speed of gravity as it had been shown before the observation was made. It appears that our conclusion has been well established by re-examining recent articles with great care” [48].

"The experiment is wonderful, but it has nothing to do with the speed of gravity," says Kenneth Nordtvedt, a retired physics professor at Montana State University in Bozeman. Nordtvedt says the team is actually seeing a gravitational analog of the force of magnetism, created by electrons moving at close to the speed of light.". In the July 20 issue of the Astrophysical Journal Letters, physicist Hideki Asada of Hirosaki University in Japan calculated that the test would measure the speed of light, not gravity” [49].

"It's complete nonsense," says Peter van Nieuwenhuizen, a physicist at Stony Brook University in New York, who has spent much of his career studying gravity. "The experiment is wonderful, but it has nothing to do with the speed of gravity," says Kenneth Nordtvedt, a retired physics professor at Montana State University in Bozeman. Nordtvedt says the team is actually seeing a gravitational analog of the force of magnetism, created by electrons moving at close to the speed of light" [50].

Of course there are still more physicists who reject Kopeikin and Fomalont having measured the speed of gravity.

Finally, as I have done before regarding the great constellation of scientists referred to in this essay, I will expand the biography of the authors of the spectacular VLBI experiment that sought to measure the speed of gravity.

Sergei Kopeikin (1956-present) is a Russian theoretical physicist and astrophysicist, with two Ph.Ds, one in relativistic astrophysics from the Moscow Space Research Institute whose thesis was advised by Yakov Borisovich Zel'dovich and the other from Moscow State University. Moscow.

On the occasion of the dissolution of the USSR, through the Belavezha Treaty, December 1991, signed by the presidents of three of the fifteen republics of the union: Borís Yeltsin, from

Russia, Stanislav Shushkévich from Belarus, and Leonid Kravchuk, from Ukraine , behind the overwhelming will of the Soviets, 78%, expressed in the Referendum of March of that year, to maintain it and its president Mikhail Gorbachev, Kopeikin emigrated to Tokyo, 1993, to teach astronomy at Hitotsubashi University, where he was deputy staff member of the National Astronomical Observatory of Japan, 1993-1996, and visiting professor at the same observatory, 1996-1997. He lived in Germany, 1997-1999, where he worked at the Institute for Theoretical Physics at the Friedrich Schiller University of Jena and at the Max Planck Institute for Radio Astronomy. He settled in the United States, 2000, in Columbia, where he works as a professor and researcher of physics, at the University of Missouri.

Kopeikin theoretically and experimentally studies relativity and gravity from "general relativity" and other alternative theories, including the capabilities of the Lunar Laser Ranging (LLR) technique to measure dynamic features in lunar motion and the possibility of LLR to measure the interaction gravitomagnetic. In addition, he is a recognized authority in the field of astronomical reference frames and time metrology, relativistic geodesy and applications of atomic clocks for high-precision navigation and geodetic data, being responsible for the workshop on spacetime metrology, clocks and geodesy which is carried out at the International Institute of Space Sciences (Bern, Switzerland). "His general relativistic theory of post-Newtonian reference frames that he had worked out together with Victor A. Brumberg, was adopted in 2000 by resolutions of the International Astronomical Union as a standard for the reduction of terrestrial astronomical observation.", “Sergei Kopeikin has worked out a complete post-Newtonian theory of extended N-body equations of motion in the scalar tensor theory of gravity with all multipole moments of mass and spin of arbitrary order and derived the Lagrangian of the relativistic N-problem. Bodies”.

Kopeikin has published 198 scientific articles and 2 books and editor of two other books on advances in relativistic celestial mechanics. “His current research of him is focused on finding a theoretical explanation for various astrometric anomalies such as the Pioneer anomaly, the flyby anomaly, etc., which were discovered in the movement of planets and deep space probes. He is also working on the development of relativistic celestial mechanics in the conformal spacetime of the expanding universe. The ultimate goal of this research is to build a theory of generation, propagation and detection of "gravitational waves" that reach us from the time of the Big Bang” [51], [Wikipedia].

American astronomer Edward Fomalont (1940-present), researches radio galaxies, X-ray binary systems, astrometry, and general relativity using long-baseline interferometers to obtain high-resolution images of galactic and extragalactic sources, and to obtain precise positions of compact sources. Since 1970, he has worked at the National Radio Astronomy Observatory (NARAO) based in Green Bank, Socorro, and Charlottesville. Also, between 1997 and 2002, he worked with Earth-orbiting telescopes and spent 15 months working at the Aeronautics and Space Research Institute (ISAS) in Sagamihara, Japan for the VSOP project. And he was involved with the Russian Radioastron Project. Recently, he was part of a team at NRAO, JPL, and NASA to use the VLBI to track spacecraft en route to Mars (Phoenix) and orbiting the Saturn system (Cassini). He now works part time in Chile to support the ALMA effort. In 1975, Fomalont and Richard Sramek did a first radio-interferometric occultation experiment to test the theory of general relativity by measuring the bending of microwave radiation in the Sun's gravitational field. Fomalont has published more than 330 papers [52], [Wikipedia].

5. LIGO-VIRGO wave detection.

LIGO announced in February and then in June, 2016, to have detected during September and December, 2015, surprisingly, in both events, before and after, very close to the celebration of the centenary of the formulation of the Einstein-Grossmann-Hilbert equations, November 1915, for the first time "gravitational waves", despite the fact that from the Ricci tensor, the foundation of Einstein's tensor, there is no gravitational radiation as Einstein-Rosen-Infeld-Hoffmann established very well, 1936-1938, which reintroduced as the sandwich planar "gravitational waves" of Pirani-Bondi-Robinson-Trautman, 1956-1962, based on the Weyl tensor, their equations were not taken into account, since basically the linearized ones of Einstein, 1918, De Sitter´s according model, 1916, have been used, although their work paved the way for the experimental search for "gravitational waves" lacking theoretical support from the moment Einstein gave them up, nor for the questioned work on metric gravity, from the Kopeikin tensor scalar, leading to the spectacular VLBI experiment, Kopeikin-Fomalont, 2002, and that, in 1989, it was demonstrated that "gravitational waves" are not a corollary of "general relativity", by the theoretical physicist-mathematician, Ph.D, Russian Anatoli Logunov, 1926-2015, director since its inception of the Institute of High Energy Physics, 1971-2006, rector of Moscow State University, 1977-1992, vice president of the Soviet Academy of Sciences and author with Mestvirishvili, Petrov, Lokustov and others of the Relativistic theory of gravitation, a superior alternative to "general relativity" because its predictions are very similar regarding the movement of material particles, field and curvature equations and solutions in empty regions, but eliminate the singularities, assign an energy-impulse tensor to the gravitational field in a unique way and the gravitational field will have all the properties of a physical field, since it is a tensor gauge theory, compatible with the theories of quantum physics of the electromagnetic, weak and strong forces, which defines gravity as the fourth force existing in nature, as a static field endowed with the transmitting particle of the virtual graviton of spins 2 and 0, within the spirit of Galilei's principle of relativity, in his generalization of Poincaré's special relativity that allowed the authors to universalize that the physical laws of nature are fulfilled regardless of the reference frames where they are applied, although, integrated to the Entwurf theory of Grossmann-Einstein, 1913, preserving the energy-impulse and angular-impulse conservation laws together of the gravitational field and the other material fields existing in nature, in Riemann's effective spacetime, through its identity with the pseudo-Euclidean Minkowski spacetime, and differentiating gravitational motion from geodesic motion to sep plow the inertia of gravity [53].

In 1962 the Soviet physicists Mikhail Gertsenshtein and Vladislav Pustovoit proposed the use of laser interferometry, which in the early 1970s allowed the search for "gravitational waves" to begin with this technology, among other physicists professors, the German Rainer Weiss (1932, present) from MIT, who created a prototype, 1968, the United Kingdom's Ronald Drever, (1931, 2017), also builder of another prototype, and the American Ph.D Kip Thorne, (1940, present) from Caltech, specialist in the subject. Weiss and Thorne along with semite-American experimental physicist, Ph.D, Barry Clark Barish, also of Caltech, 1936-present, were awarded the 2017 Nobel Prize in Physics for their contributions to LIGO and the observation of so-called "gravitational waves".

But it was only in the early 2000s that the first-generation ground-based detector suite TAMA 300, forerunner of KAGRA operational as of February 2020, in Japan, GEO 600 in Germany, LIGO in the United States and Virgo in Italy, as well as LIGO-India that will be linked online in the 2020s, and those that use triangulated satellites such as LISA from ESA-NASA and the similar DECIGO from Japan and Taiji from China, all in implementation, operating around the 2030s.

The combinations of laser interferometry detectors, first generation, made joint observations from 2002 to 2011, without having achieved detections but setting limits for further development while evolving into a global network.

The LIGO experiment was funded by the National Science Foundation in the early 1990s, and designed by Caltech and MIT, with twin facilities, one in Hanford, Washington, and the other in Livingston, Louisiana, with null results during the first phase of operation. The sensitivity of the instruments was tripled to quadrupled, increasing laser power to reduce quantum noise, larger and heavier mirrors to reduce thermal and radiation pressure noise, better suspension fibers for the mirrors to reduce noise thermal suspension, among many other improvements with which it was passed to the advanced phase, second generation, of aLIGO and aVirgo that began to collect data in 2015 [54].

A few months later, since aVirgo was undergoing an update, only the two aLIGO observatories detected the signals GW150914, September 14 09:50:45 UT, and GW151226, December 26 03:38:53 UTC, associated with what that the project identifies as "gravitational waves" that would have been generated, in each event, in the coalescence of a binary system of "black holes", that is, its orbital inspiration, its merger, and subsequent final fall, in the first event 1.3 billion light-years away with masses of 36 (-4, +5) times and 29 ±4 times the mass of the Sun, resulting in a black hole of 62 ±4 solar masses, such that 3.0 ±0 .5 remaining solar masses correspond to energy emitted in the form of waves, according to Einstein's equation of equivalence between mass and energy and in the second event at 1400 million light years away with 14.2 (-3.7, +8 ,3) and 7.5 ±2.3 while the resulting black hole 20.8 (−1.7, +6.1) times the mass of the Sun, therefore, the mass converted in waves was about 4.6% of the initial total mass.

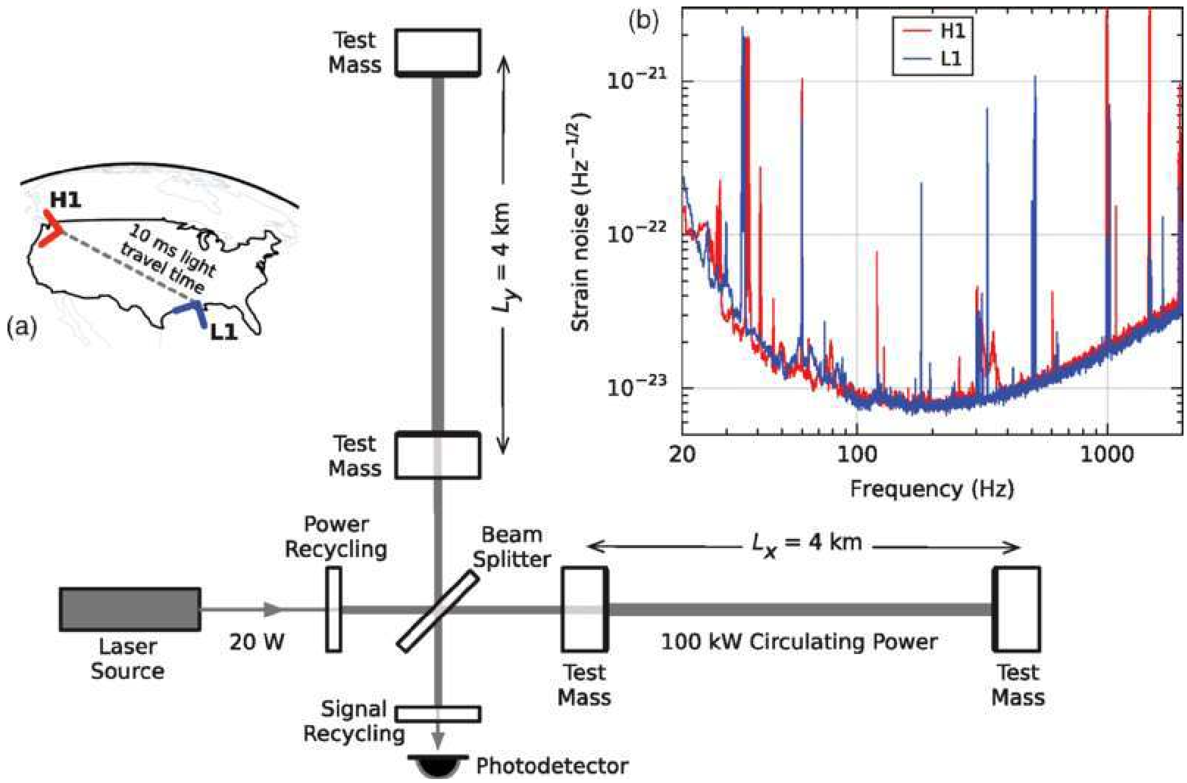
“Only the LIGO detectors were observing at the time of GW150914. With only two detectors, the position of the source is determined mainly by the relative arrival time” [54] the same happened with the observation of GW151226. However, aLIGO and aVirgo jointly announced that they had verified both detections.

Only until August 1, 2017, aVirgo joined the second observation period of aLIGO, between November 30, 2016 and August 25, 2017, and the signal GW170814 was detected, August 14, 2017 at 10:30:43 UTC, by automatic software that analyzes the data collected by the three advanced detectors, deducing “that the signal was consistent with the final moments of the coalescence of two stellar mass "black holes". Further analysis with all available information from all three detectors showed evidence that the signal was also present in the data from the advanced Virgo detector. This makes GW170814 the first confirmed gravitational wave event that has been seen by three detectors” [55].

The interferometer used by the detection network of the supposed "gravitational waves" is basically that of Michelson, its inventor, which was used to measure the different time that an electromagnetic wave affected by the drag of the ether should spend, a substance that was believed to exist, really the quantum vacuum (author's thesis), its means of propagation, which having speed would be its value ± added to the speed of the wave moving in the same direction, +, or against, -, of the movement of the Earth, applying the velocity addition equations of Newton's mechanics, in relation to another wave that, when moving perpendicular to the first, would lack such a component with the result that both waves used the same time, known as the Michelson and Morley experiment, 1887, by which determined the universal constancy of the speed of light in a vacuum, adopted as a principle of Einstein's special relativity, which earned him the Nobel Prize in Physics a in 1907, to theoretical-experimental physicist, Ph.D, Pole of semite origin, residing in the United States, Alberto Abraham Michelson, 1852-1931, educated at the US Naval Academy and at the universities of Berlin, Heidelberg , Collège de France and École polytechnique, professor of physics at the Case School of Applied Science in Cleveland, 1882-1889, Clark, Worcester, Massachusetts, 1890-1892, Head of the Department of Physics at the Chicago, 1893-1929, also, President of the National Academy of Sciences of the United States, 1923-1927, and member of the Mount Wilson Astronomical Observatory, he also perfected the technique of measuring the speed of light, 1926. The other author of the famous experiment was the American chemist and physicist Edward Williams Morley, 1838-1923, professor of chemistry at Western Reserve, Hudson, Ohio, 1868, Cleveland Medical College, 1873-1888, and at Case Western Reserve University, 1869-1906, but his major contributions were in physics and optics alongside Michelson, who never considered that their experimental findings refuted the hypothesis of the existence of the "luminiferous ether" [Wikipedia].

Michelson interfometer (Source: Wikipedia)

The interferometer to detect the supposed "gravitational waves" was rigorously isolated from external disturbances. The interferometer splits a laser beam into two sub-beams that travel through orthogonally arranged vacuum tubes, known as arms. They bounce each sub-beam off a flat mirror originally placed at an equal distance, in LIGO four kilometers away, and then back again to recombine. If the travel time of the sub-rays is the same, then the electromagnetic waves of the sub-rays recombine constructively, but if a quadrupole wave propagating in the fabric of the quantum vacuum (author's thesis [56]), not as intended in the fabric of spacetime (which they do not know what it is [38]), badly called gravitational wave, passes through the detector, then, during an infinitesimal period of time, the travel time of the sub rays is not the same since the distance of the fabric from the quantum vacuum while in one arm it contracts in the other it expands and, therefore, when combining the two sub rays an interference is produced, which requires measuring distances that are as small as 10^{-3} times the size of a proton in a baseline of 4 km [27]. The so-called "gravitational wave" interferometers are devices that use this interference process to measure small changes in the travel time of light very precisely to learn about the "gravitational waves" that produced them and, in turn, on the properties of the source of "gravitational waves"" [57]. The laser sub-beams to reach the mirrors that are suspended from cables, like a pendulum, during an infinitesimal period, travel distances in infinitesimals different than the laser interferometer measures directly as a metric perturbation through the Riemann tensor multiplied by the separation that occurs in the mirrors with respect to the point of division of the laser beam into the two sub-rays since in one arm the distance contracts and in the other it expands [27].



LIGO Interferometer Scheme (Source: Wikipedia)

LIGO Hanford Observatory (Source: Wikipedia)

The hypothesis on which laser interferometry experiments are based for the detection of "gravitational waves" is: ""gravitational waves" are waves in the curvature of spacetime that are emitted by violent astrophysical events and that propagate at the speed of light" [58], ""gravitational waves" are vibrations in spacetime that propagate at the speed of light away from their source" [27], "gravitational waves" are 'waves' in spacetime caused by some of the most violent and energetic processes in the Universe" [59], "A gravitational wave is an invisible (but incredibly fast) ripple in space. Gravitational waves travel at the speed of light (186,000 miles per second). These waves squeeze and stretch everything in their path" [60].

As can be seen for most sources, including Caltech, "gravitational waves" are spacetime waves in contrast to NASA for which they are space waves just as they appear in Einstein's 1918 linearized equations. The author showed, 2006, on the one hand, that according to Einstein they are really waves of space, later adopted by NASA, and on the other hand, that if they were waves of spacetime they would propagate in five dimensions without us being able to detect them from our four dimensions [61].

The "gravitational waves", according to the conception of the continuators behind Einstein's back, would be vibrations in spacetime that propagate at the speed of light away from their source. They can occur, for example, when "black holes" merge. Asymptotically, "gravitational waves" appear to be planar, with stretching and contracting directions perpendicular to the wave's direction of travel. This is what LIGO actually detected, but not from spacetime but from the fabric of the quantum vacuum. Of course, the immense amounts of energy and momentum generated in stellar processes such as the fusion of binary systems, maximum for the darkened stars ("black holes") should generate waves, in this event, quadrupolar waves in the middle of the quantum vacuum, container of matter in all its mass structures, constituted by the superposition of all kinds of fields such as Higgs, electromagnetic, quantum gravitational, etc (author's thesis). “Long before the merger, the total spacetime energy of two “black holes”, the so-called ADM energy” or “mass”, named after their creators Arnowitt-Deser-Misner [6], is essentially the sum of the masses of the individual "black holes". After the merger, once the waves have propagated out of the system, the energy remaining in the system, the so-called Bondi mass, decreases and this is calculated by applying the formalism introduced by Bondi, Sachs and Trautman, which is what the only one still in use among the works of Bondi-Pirani-Robinson-Trautman.

The aLIGO and aVirgo collaboration reported in February 2016, “the first direct detection of "gravitational waves" and the first direct observation of a system of binary "black holes" merging to form a single “black hole”. Our observations provide unique access to the properties of spacetime in the high-velocity strong-field regime and confirm general relativity's predictions for the nonlinear dynamics of highly perturbed "black holes" [54].

According to the professors, Ph.Ds, Swiss mathematician Lydia Bieri, director of the Michigan Center for Applied and Interdisciplinary Mathematics, University of Michigan, American physicist David Garfinkle, a researcher in numerical relativity to study extraordinarily strong gravitational fields, Oakland University, and the Argentine physicist-theoretician Nicolás Yunes founding director of the Center for Advanced Studies of the Universe, University of Illinois the main mathematical procedures, 2017, [27] used to verify that the measurements of aLIGO correspond to the detection of the alleged "gravitational waves Einstein's, 1918, were:

1. Linearized Theory.
Due to the fact that in the theory that would support the "gravitational waves" they would become weaker as they propagate far from their sources, linearized equations are worked on that would approximately describe the gravitational radiation for a large part of its propagation, which the author supposes occurred in the quantum vacuum and not in spacetime as it is conceived, and for its interaction with the detector.

“the wave detected by the aLIGO/aVIRGO team was so weak that it was treated as if it were a gravitational plane wave of the linearized theory” [62]. However, according to the author, when the wave comes into contact with the detectors, it would do so in a curved quantum vacuum due to its interaction mainly with the Sun.

In linearized gravity, the De Sitter-Einstein spacetime metric is used:

$$g_{uv} = \eta_{uv} + h_{uv}$$

where η_{uv} is the Minkowski metric and h_{uv} is <<1, very small.

What is new with respect to 1918 is that the equations are modified by applying the coordinate invariance of "general relativity" in what is called linearized gaussian invariance, by using the parameter ε of the Lorenz gauge condition, taken from electromagnetism, a material field, not so in relativity gravitational field. This condition was introduced by the Danish mathematician-physicist Ludvig Valentin Lorenz (1829-1891) to be used in the calculation of time-dependent electromagnetic fields through retarded potentials.

Harmonic coordinates made Einstein's vacuum equations look like the wave equation. To do something similar in linearized gravity, the Lorenz gauss condition is imposed:

$\partial_u \hat{h}_{uv} = 0$

where
$\hat{h}_{uv} = h_{uv} - (1/2)\eta_{uv} h.$

The linearized Einstein field equations become

$\Box \hat{h}_{uv} = -16\pi G T_{uv}$

where □ is the wave operator in Minkowski spacetime.

In a vacuum, ε can be chosen to impose the conditions that h_{uv} has only spatial components x, y, z without traces, while remaining in the Lorenz gauss, called the TT gauss, which allows the perturbations of "gravitational waves" to be inferred. They only have two polarizations h+ and hx.

From "general relativity" the gaussian metric TT has a physical interpretation given by the following formula for the linearized Riemann curvature tensor

$R_{itjt} = -1/2\ \ddot{h}^{T}_{ij}$

which generates the geodesic deviation equation and thus how matter would behave in the presence of such "gravitational waves". Combining this equation and the Halmiton-Jacobi equation, which allows finding the time evolution equations, an alternative to Lagrangian mechanics and Hamiltonian mechanics, being the only mechanics in which the movement of a particle and that of a wave are described in the In the same terms, the change in distance between two test masses in free fall can be calculated:

$\triangle d^{i}\ (t)=1/2 h^{T}_{ij}(t) d^{j}_{0}$

where dj_0 is the initial distance between the trial masses.

The gravitational wave h+ in space would stretch the x-direction while squeezing the y-direction, and hx vice versa. The interferometer used by aLIGO and aVIRGO by means of the two perpendicular arms detects this double and simultaneous distortion, really according to the author it would not be of space but of the quantum vacuum. Therefore, these offsets must be approximated to predict what the interferometer will see in various scenarios. [27].

2. The Post-Newtonian Approach
The post-Newtonian (PN) approximation for "gravitational waves" extends the linear study, discussed in 1, to higher orders in the metric perturbation, while assuming that the bodies generating the gravitational field move slowly compared to the velocity of light and when the objects described are not "black holes" or neutron stars with gigantic self-gravity. Thus, in general, the iterative PN procedure provides a perturbative approximation to the solution of Einstein's equations, to a given order, in the weak gravitational interaction and low velocity of bodies. However, Damour has shown that using the PN approximation, up to a given order in perturbation theory, it can still describe exceptions. Furthermore, recent numerical simulations of merging binary "black holes" and neutron stars have shown that the PN approximation is accurate even well into inspiration during merging binary systems, even when the objects are moving about one-third of the speed of light.

During the first part of binary coalescence, that is, the inspiratory phase, the shapes of the falsely emitted gravitational waves are accurately described by post-Newtonian analytic expansions of the Einstein field equations.

The NP approach was developed by Einstein, Infeld, Hoffman, Damour, Deruelle, Blanchet, Will, Schaefer, and many others.

In the harmonic gauss $\partial_\alpha(\sqrt{-g}g^{\alpha\beta}) = 0$ commonly used in PN theory, the expanded equations take the form

$$\Box h^{\alpha\beta} = -16\pi G/c^4 \, \tau^{\alpha\beta}$$

where $\Box$ is the wave operator and $\tau^{\alpha\beta} = -(g)T^{\alpha\beta} + (16\pi)^{-1} N^{\alpha\beta}$, with $N^{\alpha\beta}$ composed of quadratic forms of the metric perturbation.

These expanded equations can be solved order by order in the perturbation through the function methods of British mathematician George Green, circa 1830, used for solving inhomogeneous differential equations with specified boundary conditions, where the integral is over the past light cone of Minkowski space for $x \in M$.

When working with a sufficiently high order of PN, the resulting integrals can be divergent, which can be avoided by asymptotic matching methods (as in the direct integration method of Einstein's relaxed equations) or by regularization techniques (as in Hadamard, of Blanchet and Damour and the dimensional regularization approach). It has been shown that all the approaches used lead to exactly the same final result for the metric perturbation.

The metric perturbation is solved order by order, where at each order the previously computed information is used in the expression for $N^{\alpha\beta}$ and also to find the motion of the matter sources, leading to an improved expression for $T^{\alpha\beta}$ at each order. In particular, the emission of "gravitational waves" by a binary system would cause a change in the period of that system, and Hulse and Taylor used this change to indirectly detect the false "gravitational waves" through their observations of the binary pulsar. [27].

3. Numerical Relativity

When gravity is very strong and highly dynamic, as occurs in the merger of a binary system of "black holes", the only possible method is to use numerical relativity, which generates simulations of Einstein's field equations, through a program, which can be coded in Matlab, to run on a computer.

This is the scenario of the announced supposed first gravitational waves detected by aLIGO, 2015, since they would come from a merged binary black hole system that, according to Logunov's relativistic theory of gravitation, would really be obscured stars. While for relatively low-mass systems like stars, compared to neutron stars and "black holes", only the first part of binary evolution, inspiration, is accessible to aLIGO, for high-mass systems also the later stages, in particular the merger and the final black hole ring, are visible in the band sensitivity of aLIGO. The inspiral phase refers to the final seconds before the objects collapse, the fusion phase refers to the actual collision of the two objects. The ring phase is during which the final object recovers from the event by which it was formed. To obtain the waveforms for the final ring and merger stages, the full nonlinear solutions of the field equations are required, which are provided by numerical relativity that allows the mass and spin (rotational momentum) of the black hole to be determined. holdover, and to investigate systematic biases due to waveform modeling errors. Instead, post-Newtonian equations are used in the inspiratory phase.

Einstein field equations are differential equations, and the simplest techniques for simulating differential equations are finite difference equations. In the one-dimensional neighborhood, a function $f(x)$ is approximated by its values at equidistant points

$fi = f(i\delta)$ times $i \in \mathbb{N}$.

Then we approximate the derivatives of f using differences

$f' \approx (fi{+}1 - fi{-}1)/(2\delta)$

and

$f''(i) \approx (fi{+}1 + fi{-}1 - 2fi)/\delta^2$.

For any partial differential equations with an initial value, we replace the fields by their values in a spacetime lattice, and the field equations by finite difference equations that determine the fields at time $n + 1$ from their values at time n. Therefore, the Einstein vacuum equations are written as difference equations where the information from step 0 is the initial data set.

Instabilities of hyperbolicity, constraint damping, and splitting, insurmountable prior to 2005, can occur in simulations and were first solved by Frans Pretorius, who produced the first successful binary "black hole" simulation. Then, using different methods, by the two groups: one made up of Campanelli, Lousto, Marronetti and Zlochower and the other of Baker, Centrella, Choi, Koppitz and van Meter.

- Hyperbolicity. The equations are required to be strongly hyperbolic. However, Pretorius used generalized harmonic coordinates, as first suggested by Friedrich, because the coordinate of time is required, satisfying a wave equation with a source. The other groups implemented hyperbolicity using the BSSN equations (named after their inventors: Baumgarte, Shapiro, Shibata, and Nakamura). These equations decompose the spatial metric into a conformal factor and a unitary determinant metric and then evolve each of these quantities separately, adding appropriate quantities of the constraint equations to convert the Ricci spatial tensor to an elliptic operator.

- Damping by restriction. Since the constraints must be zero at exact solutions in practice unattainable, to approximate one is free to add any multiple of the constraints to the right-hand side of the field equations without changing the class of their solutions. In particular, with appropriate choices of multiples of the constraints on the right-hand side, it can be arranged that in new versions of the field equations, small violations of the constraints shrink with their evolution instead of growing. Carsten Gundlach demonstrated how to do it for evolution using harmonic coordinates and Pretorius implemented his method. On the other hand, from the BSSN equations there are some rearrangements of the restriction equations and their evolution. The particular choice of span and offset was found to have good constraint damping properties.

- Excision. Because in the standard theory nothing can escape from a black hole, nothing that happens inside can influence anything that happens outside. Therefore, when performing simulations of the merger of "black holes", using numerical relativity, it is possible to eliminate their interior from the simulation to establish what happens outside the "black holes". Thus, singularities are omitted. Cleavage was proposed by Unruh and Thornburg, implemented by Seidel and Suen, and used in the Pretorius simulations. The other groups achieve excision by other methods. One is the "puncture-in-motion method" which involves a second asymptotically flat endpoint inside each black hole, compacting to a single point. The region between the puncture and the event horizon of the black hole is greatly stretched, so the numerical simulation only covers the outside of the black hole [27].

6. The infrastructure used in RN by aLIGO.

In the aLIGO experiment, the estimation of parameters, to test the detection of the supposed gravitational wave, was carried out using the infrastructure created over the years for numerical relativity (RN) composed of generators of waveform models and the observatories that search for them and feedback, both supported by an information system based on a bank of waveforms and a library of search algorithms.

In previous theoretical exercises, in particular, hybrid binary black hole waveforms were constructed by combining an inspiral phase waveform with a resulting post-merger ring phase waveform. Theoretical models of inspiration, merger, and the resulting ring of "black hole" binary systems were needed to produce the bank of shapes for matching filter searches and to use as model signals to test both matching and non-matching filter searches.

Waveforms are treated as a "discrete" waveform approximation, which is obtained from the waveform bank while searches use algorithms from the aLIGO Algorithm Library (LAL).

Starting from the waveforms, simulations are carried out, in particular for the coalescence of a binary system of holes, for which the data related to the gravitational waveforms given as spherical harmonic modes obtained from the post-Newtonian equations are required, metadata that describe the simulation and identify the origin of the simulation in numerical relativity and optionally, additional information on the dynamics of "black holes".

The inspiratory part of the waveform was modeled using post-Newtonian (PN) analytical calculations, while RN numerical solutions of the field equations of general relativity were required to accurately model the ring and merger orbits. Before advances in numerical relativity in 2005, the shape bank and search tests used only inspiratory waveforms. Since 2007, RN waveforms have been used to calibrate analytical waveform models. As RN moved into new regions of space, parameters and waveforms were used directly to test searches using previously calibrated shapes, and the extent to which these searches proved insufficient prompted new shape models and additional simulations.

Let us emphasize that the waveforms, stored in the waveform bank, were created as hybrids by joining the inspiratory phase signal, calculated with known PN equations, and the fusion signal, estimated with RN numerical codes. The resulting simulated "gravitational wave" signals (injections) were supplied directly for analysis and parameter estimation at random times to astronomers who searched the observatories for them through algorithms.

Thus, according to the analysis of data obtained from LIGO, first generation, the progress in numerical relativity and the estimation of parameters in the Numerical Injection Analysis projects (NINJA-1, active since 2008, NINJA-2), whose the main objective was to study the ability to detect "gravitational waves" emitted by the coalescence of binary systems from binary "black holes" and to recover their parameters with state-of-the-art "gravitational wave" observatories. In operational terms, formal collaboration was established between scientists who working on numerical modeling of "black hole" collisions and scientists working on "gravitational wave" observatories. Those working on modeling gain experience in how their simulations are used in "gravitational wave" astronomy and gain insight into what binary system coalescence simulations will be performed in the future. For their part, those who work in the observatories receive the wave models they can find and they store them in the bank of waveforms and use them to increase the sensitivity in subsequent searches.

At the culmination of the NINJA-2 project, following NINJA-1, the ability to observe the coalescence of binary systems, in particular, of "black holes" successfully used in 2015-2016, was enhanced, for which seven simulated signals were created RN, with masses ranging between 14.4 M and 124 M, which were added to the data constructed from real data from the LIGO and Virgo detectors, first generation, taken between 2009-2010, but modified to have an equivalent sensitivity than expected in the first tests of the advanced detectors, second generation aLIGO and aVirgo. This new data was distributed to analysts who were aware that such "blind injections" were present but had no information on the number, parameters, or temporal location of these waveforms. This was similar to the blind injection tests performed by the LIGO and Virgo collaborations in their latest science runs. Using a search for unmodeled "gravitational wave" transients, they found that one of these signals bounced back, with an estimated false-alarm rate of 1 in 47 years. The remaining 6 signals were consistent. Using a filtering algorithm combined with a bank of waveforms, which were not calibrated with the NR signals used in NINJA-2, 6 of the signals were recovered with more importance than all the background events. This allowed upper limits to be set on the false alarm rate ranging from 1 in 5,000 years to 1 in 40,000 years for each blind injection. The remaining signal was not recovered because it had a low network signal-to-noise ratio and had a large anti-aligned spin, not modeled in the bank of waveforms used in the search [63].

NINJA-1 used a total of 23 numerical waveforms, which were injected into colored Gaussian noise, that is, through a random signal characterized in that its values at different times present statistical correlation and whose density function responds to a normal distribution, with the frequency sensitivity of LIGO and Virgo, first generation, data that were handled by nine analysis groups using search and parameter estimation algorithms. In the end, only 126 simulated signals were performed, which prevented detailed statistical studies of the effectiveness of the algorithms and the estimation. But, NINJA-1 led to a framework within which to perform injection studies using waveforms calculated by "general relativity" using numerical relativity.

The objectives of NINJA-2 were to improve NINJA-1 and systematically test the data analysis efficiency for the second generation detectors, initially receiving 60 RN waveforms prepared by 8 groups. These waveforms were matched to a set of length and accuracy requirements, providing the necessary PN inspiration signals to produce hybrid PN-RN waveforms that could be injected over the full range of physically relevant binary mass masses. In the Numerical-Relativity and Analytical-Relativity collaboration, a companion project to NINJA-2, 22 new RN waveforms were produced and rigorously analyzed, compared with the most recent calibrated analytical models, and it was found that the loss of event rates due to modeling was less than 3%.

The searches in both NINJA-1 and NINJA-2 were performed using the same methods used to search for signals from real "black hole" binary systems.

In the case of NINJA-2, it was determined with almost total certainty that six of the seven added signals, around 2014, were of the supposed "gravitational waves", according to the false conception of being disturbances in space, a geometric framework, instead from disturbances in the fabric of the quantum vacuum a state of material existence (author's thesis), the remaining signal was too far away to be recovered. They also carried out the first investigations to determine the confidence with which the masses and spins of "black holes" could be estimated. The tests carried out showed that, given the expected sensitivity of the second generation detector network, aLIGO and aVirgo would be able to detect the merger of two "black holes" at an observation distance of about 1000 times greater than the distance to the galaxy. Andromeda if the "black holes" are 10 times more massive than the Sun. Likewise, it was examined whether aLIGO and aVirgo could determine, from a gravitational wave signal that was detected, the properties of the binary system that emitted it: mainly the masses of the "black holes" which is possible, although not with certainty. absolute precision or certainty. [64], [65].

7. Conclusions

Within the theoretical-mathematical framework in which Einstein formulated the existence of "gravitational waves", between 1916-1918, in Minkowski spacetime, in undulating coordinates, gravitational radiation cannot exist because there is no gravity. The equations are of waves of quadrupole origin for the solution in a vacuum of Einstein's equations that refer us to the quantum vacuum since the existence of a naked spacetime is not acceptable, that is, existing in itself as was Newton's conception.

The author once knew, the alleged detection of "gravitational waves" by aLIGO-aVirgo intervened in the forums that were opened through the internet for the articles:

- The black-hole collision that reshaped physics, by Davide Castelvecchi, Nature, 531, pages 428–431 (2016).
- Here's the first person to spot those gravitational waves, by Adrian Cho, Science, 2016.
-The Gravity Wave Hunter, by Michael Segal, Nautilus, 2016.
- About Those Gravitational Waves, by Will Sweatman, Hackaday, 2016.

Of which only the “About Those Gravitational Waves” forum remains online and can be accessed at:

https://hackaday.com/2016/02/17/about-those-gravitational-waves/

In his speech, the author stated:

“General Relativity mathematically defines, through a dynamic geometric differential tensor model, the static gravitational field as the metric tensor of a Lorentzian manifold, which represents the curvature of a four-dimensional geometric entity known as spacetime, depending on the impulse-energy tensor. On the other hand, Einstein conceptually formulated spacetime as a structural quality of the gravitational field, that is, a circular definition between gravity and spacetime, Einstein also pointed out "Space and time are modes in which we think, not conditions in which we think." we exist” and “We denote everything except the gravitational field as matter”, therefore, space-time is nothing and the gravitational field is not a material field but in first approximation an effect of change of coordinates, and definitely a field geometric, that is, nothing. The mathematical model generates quantitative predictions matching observations to a high degree of accuracy without physical meaning. The philosophy of science has intervened General Relativity from two currents: in Substantivalism, spacetime is defined as existing in itself, storing all events, in order of situation and in order of succession, while in Relationalism as the metric relationships of coexistence and succession between events. But "spacetime remains an enigma for science and philosophy" (Lorente, 2006) because "we really don't know what spacetime is" (Odenwald, 2015). In such a way, the results of the black box, which is the mathematical model, within the context of the dominant scientific positivism, has supported the validity of General Relativity for a century, which in the absence of intrinsic physical meaning, is arbitrarily falsified. Due to his dynamic mathematical model, Einstein formulated, from quadrupole sources of energy, the formation of waves in spacetime that propagate as gravitational waves, traveling in space. On February 11, 2016, the LIGO Scientific Collaboration announced that they had detected for the first time, on September 14, 2015, gravitational waves from a pair of merging black holes. They say that they are waves in the fabric of spacetime, therefore, interpreting them according to Substantivalism, a conventional philosophical conception in dispute with Relationalism. Those waves detected by LIGO are truly quadrupole transverse quantum mechanical waves from the quantum vacuum—a physical medium; they carry energy but gravitons do not. ("Those are not gravitational waves", Alfonso Guillén, 2016)" source: Hackaday, 2016.

Of course, from the philosophical perspective, if the waves detected by aLIGO-aVirgo were gravitational waves, the Relationalist option would have ended, as was recognized by the epistemologist, philosopher and physicist, Ph.D honoris causa, Argentine of German origin, nationalized in Canada, Mario Bunge (1919-2020) who, having been an outstanding exponent of this philosophical current regarding spacetime in his work "The relational and objective theory of physical time", 1968, and his blunt statement: spacetime "far from existing on its own, is the basic plot of changing objects, that is, of material things", space-time exists "by virtue of the existence of material objects" and "if things vanished, space and time would also disappear" on the occasion of the announced the supposed discovery of gravitational waves, he converts to Substantivalism but not Newtonian but materialist, that is, spacetime is a material field even who identified it with the static gravitational field. Bunge used the following chain of propositions [66]:

P1. Detectors activated by gravitational waves.
P2. The detectors react only to specific material stimuli.
P3. LIGO has detected gravitational waves. Therefore, gravitational waves are material.
P'1. Gravitational waves are ripples in space-time.
P'2. Gravitational waves are material (first argument).
Therefore, space-time is material.

Bunge's mistake, of course, was to accept that the waves detected by aLIGO-aVirgo are gravitational waves.

As an anecdote through an e-mail I sent Bunge my article about my thesis that spacetime is the geometrical structural form of matter [19]. His laconic answer was: "gases have no form" with which I disagree since the form of the gaseous state is precisely the gaseous form.

The author's thesis that the waves detected by aLIGO-aVirgo are really waves of quadrupolar origin in the quantum vacuum generated by the extraordinary amounts of energy coming from the fusion of binary systems, especially from obscured stars (Logunov's thesis), in normal science: black holes, he presented it in his article "Wave detected by LIGO is not gravitational wave", 2016 [67].

Let us remember that in physics a quadrupolar structure is a field linked to a configuration of four forces originating from charges, electric currents or masses. The best known is the electric quadrupole. Or the one predicted for that matter, of a binary system of stars that gives rise to a radiant quadrupole moment of mass as long as it varies in time. What is wrong in "general relativity" is that the waves produced are perturbations of the curvature of spacetime in first approximation a geometric field since in "general relativity" spacetime has only metric which measures the space-time distance between events. A different thing is the time-varying quadrupole moment of two radiating masses of waves in the quantum vacuum. The linear polarization of these waves of quadrupolar radiation must cause their oscillations to simultaneously contract and expand the distance between two points orthogonally, forming a plane also perpendicular to the direction of wave propagation, according to the D'Alambert-Einstein wave differential equation, that is, in theory, like the supposed geometric wave of "general relativity" rightly ruled out in 1937. According to quantum field theory, interactions, including gravitational, are produced by the sending and receiving of quanta of energy, being its macroscopic effects, by the fourier expansion, analogous to a wave.

The exact value at every point in the void, which never disappears and whose minimum value is not zero. Therefore, the constitutive fields of the quantum vacuum are the Higgs fields, the electromagnetic field, also the static gravitational field, etc. The quantum vacuum is subject to quantum fluctuations and the appearance and disappearance of virtual particles from a creation-destruction process. In 1981, the authors of the theory of the Quantum Origin of the Structure of the Universe, working at the Lebedev Physical Institute in Moscow, the Russian cosmologists, Ph.Ds, Gennady Chibisov (1946-2008) and theoretical physicist Viatcheslav Mukhanov (1956-present) published their theoretical finding that the current structure of the Universe on the scale $\leq 10^{-27}$ cm are quantum fluctuations, which originally produced the spectrum of immogeneities, such as galaxies and their clusters, in the early Universe [68]. The numerous experiments, during the era of high-precision cosmology, characterized by the use of the COBE satellites, in 1992, WMAP, in 2003, and completed by the Planck mission, in 2013, in which temperature fluctuations were measured of the Cosmic Microwave Background Radiation, CMB, discovered experimentally, in 1965, by the Nobel laureates, Ph.Ds, physicists and cosmologists, the German, Arno Penzias (1933-present) and the American Robert Wilson (1936-present), working at Bell Laboratories in Holmdel, New Jersey. These fluctuations are very much in agreement with the predictions of Mukhanov and Chibisov that the world community of scientists accept as definitively confirmed, and which assure us that everything in our Universe originated from quantum fluctuations. CMB measurements have strongly demonstrated the quantum origin of the structure of the Universe, independently of any alternative theory to inflation [69]. From the author's perspective, the most remarkable thing about the work of Mukhanov and Chibisov, moreover, is their correct understanding of the great division of physical existence: into bosonic matter (quantum vacuum and radiation) and fermionic matter (the rest), setting the quantitative limit between the two and deducing the existence of the second from the first, that is, without quantum vacuum there would be no fermionic matter.

The detection of waves of quadrupolar origin by aLIGO-aVirgo is also not surprising since, as it is the result of the use of an interferometry technology of extremely high sensitivity, progressively greater, to detect disturbances of course of quadrupolar order, aspects of matter had to appear unknown, although insufficient to detect the true "gravitational waves" radiated by the masses through a quantum gravitational field due to its extraordinary weakness whose graviton Logunov estimates would have a mass below the order of 4.5 10^{-66} g. Tom Van Flandern had already announced it when he analyzed the radiation of the binary pulsar PSR B1913+16, discovered by Hulse-Taylor, although he said they should be a kind of electromagnetic wave.

LIGO Scientific Collaboration and the Virgo Collaboration reported that in the analysis of event GW170104, recorded on January 4, 2017 at 10:11:58.6 UTC, by the two twin detectors of aLIGO, with a network signal-to-noise ratio of 13 and a false alarm less than 1 in 70,000 years, supposedly corresponding to a gravitational wave signal produced by the coalescence of a binary system of "black holes" whose estimated masses were 31.2 + (+8.4,−6, 0) M and 19.4 +(+5.3 −5.9) M (at the 90% credible level) at a source luminosity distance of 880 +(+450 −390) Mpc corresponding to a shift red of z = 0.18 +(+0.08 −0.07), and under the assumption that gravitons disperse in the vacuum as massive particles, the mass of the real graviton in milligram-energy ≤ 7 was estimated, 7×10^{-23} eV/c^2 [70], equal to the mass in milligram-energy ≤ 7.6×10^{-23} eV/c^2 (in grams ≤ 1.35342 * 10^{-52}) calculated, in 2002, by Lee Samuel Finn and Patrick J. Sutton of the Center for Gravitational Wave Physics, Pennsylvania State University from the orbital decay rates of the binary pulsars PSR B1913+16 and PSR B1534+12 by Hulse and Taylor [33] and which is very close to the upper limit value of real photon mass ≤ 1.2 * 10^{-51} grams [34], according to the 2003 calculation by Jun Luo and colleagues at Huazhong University of Science and Technology in Wuhan, China. But, very far from the upper limit value of the real graviton mass ≤ 4.5 * 10^{-66} grams [35], estimated by Gershtein, Logunov and Mestvirishvili, 1997, based on the observed parameters of the expansion of the Universe, and which is consistent with the value ≤ 0.5 * 10^{-65} grams estimated by Staniukovich and Vasiliev, 1967, based on the Einstein relation $E = m * c^2$ [32].

Tom Van Flander was right to propose that the radiation of binary pulsars is rather a kind of electromagnetic wave. Thus, the mass of that false graviton-photon would be about 10^{15} stronger than the mass of the true graviton estimated by Logunov. It is obvious that if it were true that the mass of the graviton was of the order of the mass of the photon, we would not exist, since the gravitational force coming from such a mass would have prevented our appearance, since the Lorentz force of the static gravitational field would be close to that of the static electromagnetic field, which does not correspond to our well-established knowledge about the extreme weakness of gravity. The waves detected by aLIGO-aVirgo are not gravitational waves.

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