Is it time for a new paradigm in physics?

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Abstract. The fact that the two main pillars of modern Physics are incompatible with each other; the fact that some unsolved problems have accumulated in Physics; and, in particular, the fact that Physics has been invaded by weird concepts (as if we were in the Middle Ages); these facts are quite sufficient to confirm the need for a new paradigm in Physics. But the conclusion that a new paradigm is needed is not sufficient, without an answer to the question: is there sufficient sources and resources to construct a new paradigm in Physics? I consider that the answer to this question is also yes. Today, Physics has sufficient material in experimental facts, theoretical achievements and human and technological potential. So, there is the need and opportunity for a new paradigm in Physics. The core of the new paradigm of Physics would be the nature of matter. According to this new paradigm, Physics should give up on wave-particle dualism, should redefine waves, and should end the mystery about light and its privilege in Physics. The consequences of this would make Physics more understandable, and - more importantly - would make it capable of solving current problems and opening up new perspectives in exploring nature and the universe.

1. Introduction
Quantum Physics and the theory of relativity are the ‘two main pillars’ of modern Physics. It is a well-known fact that these two theories are not compatible [1-3]. Many efforts have been made, and continue to be made, to make the two theories compatible [4,5]. A new theory has been created which claims to bring both to its bosom – string theory [3]. However, there is still no experimental basis for this theory, because the theory itself has not made any prediction [3].

In science in general, and thus for Physics too, it is normal to have unsolved problems. But it is not normal for fundamental problems to remain unsolved for a long time. Such problems would include the issue of the nature of matter during its observation and measurement, the issue of the unification of ‘fundamental forces’, and the issue of ‘dark matter.’ It is also not normal that within the realm of a theory which is considered to be the product of ‘genius’ there should be unsolved problems as is the case with the General Theory of Relativity (GTR). The solutions to some problems, which Physics lists as solved, are built on strange terms (ideas and concepts) which sound like they have come from past centuries: phlogiston for fire, calories for energy, cold substance for low temperatures; terms which already sleep in the museum of the history of Physics. For example, one such contemporary term, among many others, is the ‘massless particle’, which exists only because it is said to exist in an equation which is itself part of a theory. So, the fact that Physics has been invaded by weird concepts (as if we were in the Middle Ages) shows that something is not right with Physics. So all these facts are quite sufficient to confirm the need for a new paradigm in Physics.
But the conclusion that a new paradigm is needed is not sufficient without an answer to the question: are there sufficient sources and resources to construct a new paradigm in Physics? I consider that the answer to this question, is also yes. Today, Physics has sufficient new experimental facts and theoretical achievements, and there is also human and technological potential. Today there are tens of thousands of trained physicists and very advanced technology able to carry out very delicate measurements, both at the micro and macro level. Because of that, I consider that there is both the need and the opportunity for a new paradigm in Physics.

The core of the new paradigm of Physics would be the nature of matter. According to this new paradigm, Physics should give up on wave-particle dualism, should redefine waves, and should end the mystery about light and its privilege in Physics. The consequences of this would make Physics more understandable and - more importantly - would make it capable of solving current problems and of opening up new perspectives in exploring nature and the universe.

Usually at the base of new paradigms there are new ideas and concepts – not heard or seen before. But can a new paradigm be built without such ideas and concepts? Yes, I consider that it can. The current case of Physics is an example of this. A new paradigm of Physics can be developed with some existing ideas and concepts. But what can such a paradigm offer, and in general can we call something a new paradigm if it is a combination of existing ideas and concepts? Yes, I consider that we can. It is sufficient for there to be a recombining and redefining of some existing ideas and concepts for a new paradigm to be ready, with all the properties of a paradigm, with a huge capacity for bringing about great positive change in Physics and in those areas of technology associated with Physics. Of course, the creation of a new paradigm – taking forward only part of existing concepts – requires some other existing concepts to be put aside (to be thrown away). A consequence of the new paradigm functioning over a reorganization of known facts is that all this is supported by already conducted experiments, which must be protected and cultivated; indeed, the majority of theoretical conclusions must also be protected and cultivated. Only one part of theoretical ‘conclusions’ (just some theories and some strange theoretical concepts) need to be set aside, as a result of the reorganization and the more functional collocation of Physics. The nowadays order of Physics has its roots at the beginning of the last century, but its stabilization comes somewhere around 1924, and has ‘suffered’ for about a hundred years so far. Now Physics has to be liberated from some ideas which were seen as a salvation a hundred years ago. For example, in 1927 it was difficult to say that since an interference and diffraction pattern could be obtained with electrons [6], the nature of matter is only particular (composed of particles), while the motion of these particles could be written in a wave equation. Whereas today, when it is known that the interference pattern is obtained also by large bodies [7], then reality must be acknowledged and given its place in science – that the nature of material is particular, while waves are one of the ways that these particles move.

Many physicists have at their fingertips the phrase that experiments ‘support both wave-like nature and particle-like nature, so the nature of matter is dual’, or that experiments ‘support the special theory of relativity’. But both experiments that support the particle-like nature of matter, and experiments that support the ‘wave-like of matter’ support the unique nature of matter – that of particles; but in the former case we manage to distinguish particles as individuals technologically and with particle mathematics and in the latter case we do not. But the fact that we cannot distinguish individual particles does not mean that they change the nature of their existence, because we can successfully distinguish them as a system of particles and just as successfully we can write equations for their movement – wave equations. As for the ‘experimental proofs’ of the Special Theory of Relativity (STR), I consider that many physicists use this with an ease which is not appropriate for scientists. We know that the experimental proof of a theory requires experimental results to match theoretical results. Even at the beginning of the ‘experimental support’ for the STR it was known that experimental results were approximately those of the STR. They are closest to this theory, the supporters of the STR would say. But when were experimental results last compared with a theory which opposed the STR? It is said that the existence of the Transverse Doppler Effect (TDE) for light makes the difference. But was the measurement of the TDE ever tested in sound waves? The STR doesn’t say so, so nowadays Physics does not deal with this
issue. However, even if it were proved experimentally that there is no TDE in sound waves (I am very confident that the experiment will testify that TDE also appears for sound), there are also many other areas in which experiments need to be carried out and scientifically interpreted, without the bias which is frequently used today, especially when it is a question of the STR. In this article we will not deal with ‘experimental proof’ in detail, because we will do this in an expanded version of this work, but we will mention here some of the experimental challenges.

2. The nature of matter

Matter is the material substance that constitutes everything in universe. At the most fundamental level, matter is constituted of elementary particles, and the behavior of these constituents forms the basis of all objective phenomena. Many philosophers and scientists (Leucippus, Democritus, Lucretius, P. Gassendi, R. Descartes, C. Huygens, R. Boyle, I. Newton, A. Lavoisier, J. Proust, J. Dalton, A. Avogadro, R. Clausius, R. Braun, J. Maxwell, L. Boltzmann, M. Planck, and many others throughout the twentieth and twenty-first centuries) by means of many methods (philosophical, theoretical and experimental) have proved that matter is constituted of particles. Despite this, modern Physics states in relation to the nature of matter that matter has dual nature (!). Or more concretely matter is particle-like and wave-like! When and why is there a need to say that matter is wave-like? The ‘strange’ idea that matter has a wave-like nature was sketched at the beginning of the twentieth century, because of a failure to identify ether. Maintaining equations of electromagnetism, without explaining what particles are, or what is the medium which moves in the case of the propagation of light, leads to the idea of the ‘wave-like nature of matter’. For these waves, even the textbooks write that they are ‘the most curious waves’ [8]. I consider that the idea that ‘matter also has a wave-like nature’ is an idea presenting a barrier to the development of Physics and has been unjustified since its birth, and I consider that the time has now come for it to leave the stage of Physics and to go to its museum.

2.1. Both theories of light – those of Descartes-Huygens and Gassendi-Newton - were ‘corpuscular’

Of course, the idea of dual nature came about because of light. According to modern Physics there are four main theories about light: particle theory, wave theory, electromagnetic theory and quantum theory. Indeed, the first two are mentioned more as history while the electromagnetic theory of light and the quantum theory of light are still taught and employed. In the last one hundred years the scientific consensus has been greater about the latter, which has united almost all elements of the other theories. For this reason, the quantum theory of light is called the wave-particle theory of light. However, there is a paradox throughout this history. The creators of the ‘wave theory of light (R. Descartes and C. Huygens) were corpuscularianists as Gassendi and Newton were [9-11]. Corpuscularianism is a physical theory that supposes all matter to be composed of minute particles and became important in the seventeenth century. The two theories of light in the seventeenth century were corpuscular, because neither Descartes and Huygens (and later Young, Fresnel, Maxwell and Lorentz) had built a wave theory of light which presupposed the wave-like nature of matter. Their theory said that light waves were the motions of particles, whose impulse and energy was carried from particle to particle. According to them, these particles were part of a substance which had to be identified and which was called ether. Thus, the Descartes-Huygens theory differs from the Gassendi-Newton theory only in the manner of the motion of the particles which has its effect in the phenomenon of light. The Descartes-Huygens theory claims that the ether particles are disturbed and then the oscillation and waving of ether produces light, like the oscillation and waving of air in the propagation of sound. A wave equation was written for this kind of motion. Meanwhile, the theory of Newton claims that the particles which make up light shower from its source and propagate into the surrounding area. This theory does not describe the motion of these particles in a wave equation. That is the difference. The fact that Newton’s theory of light has no wave equation does not mean that one could not be written for Newton’s corpuscles. This could be done, and Huygens indeed did it. This tells us that only when ether was ‘eliminated’ did the ‘wave theory of light’ become the ‘pure wave theory’. Finally, judging from the fact that ether was considered to be a material medium which propagate light, then the electromagnetic theory of light down to Hendrik Lorentz can
also be considered to have been a particle theory of light, described by a wave – the wave of light, like the waving of ether.

2.2. Confusion in 1905
The year 1905 is considered as an Annus Mirabilis in Physics. In fact, this year muddled Physics more than it solved any problem. There are two paradoxes. The first paradox is that the person who discovered light quanta [12], which could have contributed to a final understanding of the nature of light and matter, in another work of the same year equipped light with super-powers [13]. The first theory required that the quanta of light had impulse (an opinion which was strengthened later [14, 15]) while the other theory required that the mass of a photon at rest was zero. The second paradox is that the person considered in 1905 to be the gravedigger of ether, in 1915 invented another ether. In fact, in ‘throwing away ether’ Einstein did not offer a solution for the manner in which light propagated in his work [13], while in 1915 he invented another ether which he called spacetime. In fact, Einstein’s spacetime represented a substance which ‘curved and expanded’ and whose make-up and nature of this ‘substance’ is still not set out today for discussion. According to Einstein there are two ethers in nature: the ether of light and the ether of gravity [16, 17]. He says clearly: ‘More careful reflection teaches us however, that the special theory of relativity does not compel us to deny ether; ... We may assume the existence of an ether; Recapitulating, we may say that according to the general theory of relativity, space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light.’ [16]. So, it is not that Einstein excluded the ether of light, but he invented one more ether - the ether of gravity. On the other hand, for as long as Einstein ‘threw away the ether’, the electromagnetic theory of light is a ‘pure wave theory’ of light. According to this theory that what oscillates is electric vector and on a normal plane with this a magnetic vector oscillates. A vector oscillates and waving? How is that possible? A vector is an abstract concept, so this tells us how a category of being oscillates and waving, in the same way as a particle or a body. But, doesn’t make sense to say that vector oscillates and waving.

2.3. What is a wave?
What is the starting point for an explanation of waves? In all textbooks we find that the starting point for an explanation of waves is the definition of an oscillator; that is an object – elementary particle or body – which moves back and forth repeatedly. When many oscillators are near one another then the impulse and energy moves, from one to another and this is perceived in the rippling of all these oscillators. So, that is wave, a disturbance traveling through a medium. The medium is the set of lot oscillators. However, the same particles may not vibrate but only make a translational movement. Do we have a wave in this case? Can there be a wave without oscillation? For example, we take a sack of balls and we throw them one by one against a wall. We give the balls the same specified velocity and we throw them in a specified period of time. This motion of the balls has frequency, wave length, period and energy. And we could describe these balls as a wave with all the properties a wave would have. Indeed, if the person throwing the balls moves towards the wall, or the wall moves towards them, the Doppler Effect (DE) can be fully applied to these balls. The balls move because the person throws them, so they don’t need a medium in order to spread out through it. Thus, we arrive at the conclusion that the waves for the means of propagation can be of two types: waves which diffuse through a medium, and waves which have no need for a medium. But in modern Physics this division between waves already exists. Yes, but modern Physics does not consider the type of waves which do not need a medium for propagation to be like the ‘wave of balls’ in our example. Modern Physics considers waves without media to be non-material entities. This kind of wave is the greatest support for the concept of ‘the dual nature of matter.’

In conclusion, particles can make other kinds of motions, but this does not change their nature as particles. Thus, a wave is not a form of existence of material particles (bodies), but just one kind of motion for them. In conclusion, I consider that Physics should redefine waves, placing at the beginning
of the definition the following formulation: a wave is one kind of motion of particles (bodies). After this, the definition can continue with the properties of waves.

2.4. Lost improvement opportunity

*What did de Broglie and Davisson-Germer experiment discover?*

Until 1924 it was only light that was described as having dual nature. In 1924 de Broglie connected impulse (the typical physical size of a particle) with wave length (typical size of wave movement) and formulated the ‘de Broglie hypothesis’, claiming that all matter, not just light, has a wave-like nature [18]. In fact, de Broglie did not find the ‘secret wave nature of particles’ but rather found the possibility of using wave apparatus for particles. Likewise, the Davisson-Germer experiment [6] did not confirm ‘the secret wave nature of particles’, but rather their capacity for wave motion. Thus, this was the moment to say clearly that we are able to describe a wave for a shower of particles, and we have confirmed that this shower of particles also makes an interference pattern. And in consequence therefore, light is a shower of particles which are like all other particles of matter. However, the physicists of 1924-1928 decided to shroud other particles of matter with the mystery with which they had covered light in 1905. Why? To preserve the super-power of light which was a foundation of the STR. At this time was decided what Einstein and Infield later expressed with these words: ‘*But what is light really? Is it a wave or a shower of photons? There seems no likelihood for forming a consistent description of the phenomena of light by a choice of only one of the two languages. It seems as though we must use sometimes the one theory and sometimes the other, while at times we may use either. We are faced with a new kind of difficulty. We have two contradictory pictures of reality; separately neither of them fully explains the phenomena of light, but together they do*’ [19].

2.5. Solution: new paradigm!

In relation to the nature of matter, Physics loses nothing from its explanatory power; on the contrary it gains clarity and explanatory power if the nature of matter embraces the following position: Matter is material substance that constitutes everything in the universe. At the most fundamental level, matter is constituted of elementary particles, and the behavior of these constituents forms the basis of all objective phenomena. The nature of matter is unique. Matter is made up of its particles and only of its particles. Its physical properties belong only to the particles, only to matter. Some of the properties of particles are mass, movement, energy, volume. The properties of particles demonstrate close connections between themselves, and these connections are expressed through physical laws, but it makes no sense to say that a property of certain dimensions is equivalent to another property that has other dimensions; and it makes even less sense to say that such a property can be transformed into another. Specifically, it makes no sense to say that energy is equivalent to mass, or that energy and mass are transformed into one another. Energy is a property of matter. It is impossible to have energy without matter. All particles, and even all bodies (including celestial bodies) can oscillate and waving (move like a wave). However, this property of theirs cannot be their nature. As has been said, particle show another fundamental feature – motion. Motions are of some types. Oscillation and waves are only two of the types of motion of particles (bodies). The way that particles move cannot change the particular character they have. Great confusion is created when a being (a particle) is confused with its manifestation (a wave). A particle is a being, while a wave is a kind of movement of this being. The particle is the manifestor, while the wave is the manifestation. The particle is the thing which exists and which can also exist in other forms of motion, i.e. without a wave. But a wave cannot exist without a particle, because without a particle there is nothing to oscillate, to waving. Thus, one of the fundamental mistakes of the Physics of 1900 is confusing a being with its behavior. This confusion is the same as confusing a dancer with a dance. A person does not become a dance because they start dancing; we cannot say the person is the dance, but we could be precise and say that a person is someone who can walk, can spin and also can dance. Thus, dancing is a manifestation of a person and not a form of their existence.

Light is also a wave of particles; it’s a wave motion of particles, and a motion of particles for whom Physics has successfully described a wave equation. Light is a manifestation of particles. All the effects
and laws of light can be explained with this logic. The explanation of interference, diffraction, polarization, and other laws of light which are more successfully explained with wave mathematics apparatus does not change the particle nature of light. The apparatus of wave mathematics represents a very successful solution which enables Physics to manipulate many particles at the same time. But this apparatus cannot confirm the existence of a second nature of matter and cannot change the nature of particles. Mathematical apparatus only describes the behavior of matter and does not – and cannot - change its nature. Now we know that the interference pattern is not created only by particles of light and by electrons, but also by larger bodies (C_{60} molecules [7], organic macromolecules [20]), so a wave equation can also be written for large bodies; it is enough that they make a wave motion. Even tennis balls give an interference pattern (A preliminary experiment was made by the author. It remains for this to be repeated and the results published). But as it is proven, for these particles – depending on the properties that are considered – we can also write equations with Galilean-Newtonian mechanics. Experiments have confirmed that we can operate with a single photon and with a single electron in the way we operate with a macromolecule, or with a large body. So why do we need to maintain the term of the dual nature of matter? It is not a question of the dual nature of matter, but of the dual nature of the presentation of the particles which make up matter. Thus, the modern duality ascribed to the nature of matter should be abandoned and, in its place, we should place a genuine duality: the duality of the methods of study of the particles of matter. These methods have their own mathematical apparatus [21]. These methods are methods based on individual particle equations (in accordance with the equations of Galilean-Newtonian mechanics), which are applied when we are dealing with a small number of particles; and methods based on equations of wave mechanics, which are applied when we are dealing with a large number of particles. The mathematical apparatus of the two methods are entirely compatible and are based on the laws of mechanics. The existence of methodological duality does not presuppose the existence of the duality of the nature of matter. Even less does it produce that duality. The choice of the method to be used to work with particles does not depend on their dimensions, but on the number of them in a system. The wave apparatus for any given particle does not depend on the particle’s dimensions, but on the number of particles in a system. Thus, the wave apparatus for any given particle is not used because the particles are small, but because they are numerous – which corresponds with the probabilistic method of study.

2.6. Spacetime is nothing more than a failed attempt to re-discover the DE
Ontologically speaking, the universe consists of matter and space. All properties are reserved for matter. Although space is a fundamental category of the universe it has no physical property. The only properties that can be ascribed to space are dimensions of extent, but even this property stems from matter. Only if we have the particles (bodies) of matter, are we able to know the dimensions of space. We must respect the hierarchy of concepts. Matter and space are ontological categories, while time is of a lower order. Time is a physical quantity. Thus, time is a measurable property of the universe and nothing more. The question may be asked: of what is time a measurable property; of what ontological category? It emerges that it is a property of matter. Specifically, time is one of the fundamental physical quantities which expresses the rate of the development of matter. The property called time cannot meet with space, because space has no physical property. Nowadays, Physics operates with the very strange and unjustified term ‘spacetime’. According to the STR and GTR spacetime is a metric of space-time and at the same time is both a being (nobody knows what or of what kind), and a kind of ‘ether of gravity’ [16, 17] which allegedly curves and expands. Claiming that spacetime is a metric of the universe, which depends on velocity of one reference frame relative to another, is a consequence of misunderstanding the DE. Spacetime is a pale copy of the DE. Using the DE we explain why and how the observers receive information about events in relative motion. Claiming that spacetime is curved by massive bodies is a pale re-discovery of Faraday’s lines of force.

The category which is in permanent connection with space is matter. For example, a space-matter or matter-space composite would be very logical, even if it could not always be used when some material, a piece of matter, has to be used. A matter-space composite is logical and compatible with the real world,
because matter and space cannot exist without one another. Nevertheless, given that matter is the carrier of all physical properties, the term *matter* is used, and deserves to be used as the only term, conveying that there is an indivisible companion at the fundamental level – space – and a great number of indivisible fundamental properties such as movement, gravity, inertia, time, impulse, energy etc.

3. **Light is special to our lives, but quite common to the laws of motion**

Physics does not have a problem with the speed of light when its source, or the observer who observes it, is at rest. This conclusion is important because when there is motion of the source/observer, the DE can be seen. Which means that we have to do with DE. The DE is nothing more than a relationship between frequencies and velocities. And this effect offers an easier and qualitatively better explanation of the speed of light than any depending on the transformation of relative motion (Galilean transformation and Lorentz transformation). As we have studied the speed of light from the perspective of the DE we can return to relative motion and apply the findings about the velocity of light to this motion, because the DE effect is typical relative motion. Even more importantly, in my opinion, the DE and Galilean relativity are the same thing, as well as relativistic DE and the STR being the same thing.

3.1. **New paradigm of the Doppler effect leads us to a new paradigm for Physics**

Let us take a source of sound waves $S$, resting at the origin $O$ of the $x$ axes (Fig. 1a). To an observer (C) who is at rest anywhere in the frame of reference with origin $O$, the velocity of the wavefront will be $c$ and the frequency of the wavefronts which the observer records will be the emitting frequency of the source $f_s$, independent of the direction (angle $\omega$). Let us now move the source with velocity $v$, emitting the same frequency (Fig. 1b). Then, the same observer at rest, independent of his position (angle $\theta$), again records velocity $c$ for wavefronts; but the frequency of these fronts to this observer is no longer $f_s$. The frequency $f_o$ that the observer records for a given position is dependent on the magnitude and direction of the source velocity ($v$). But for a given source velocity (if $v = \text{const.}$), then $f_o$ is dependent on angle $\theta$. What does this dependence mean? On what precisely is frequency $f_o$ dependent? One thing is certain, the velocity of the wave remains always $c$, regardless of the position of the source or observer.

![Figure 1. Velocity of wavefronts; resting source (a); moving source (b).](image)

4. **Relative velocity between wave and source**

For any position of a resting observer (A, B or C in Fig. 1b), the observer will record the same wavefront velocity (velocity $c$). But the various positions of the observer change the frequency $f_o$ that he records, even when the magnitude and direction of vector $v$ are constant. Since an alteration of the observer’s position alters the angle $\theta$ (Fig. 1b), then the dependence of the frequency on the observer’s position can be explained by the alteration of this angle. But are there other quantities that vary depending on the angle $\theta$, when the magnitude of velocity $c$, magnitude of velocity $v$ and direction of velocity $v$ are constant? We can see in Fig. 1b that by moving the observer along the wave front, the vector $u_{cv}$ changes...
(in magnitude and direction). This vector represents the relative velocity between the wavefront (with velocity \(v\)) and its source (with velocity \(u\)), and the angle \(\vartheta\) is formed by the direction of the velocity of the source \(v\) and the direction from which the observer receives the signal, i.e. the direction of the vector \(u_{cv}\). Therefore, the dependence of frequency \(f_0\) can be written:

\[
f_0 = F_{f_0}(f_0, u_{cv}).
\]  

(1)

And since:

\[
u_{cv} = F_u(c, v, \vartheta)
\]  

(2)

then the functional dependence of frequency \(f_0\) can be written:

\[
f_0 = F_{f_0}(f_0, c, v, \vartheta).
\]  

(3)

The question now is how to find the explicit form of equations (2) and (3). Looking for the explicit form of function (2), by the law of cosines for the magnitude of relative velocity \(u_{cv}\) we can find [22]:

\[
u_{cv} = \sqrt{c^2 - v^2 \sin^2 \vartheta + v \cos \vartheta}.
\]  

(4)

Now, looking for the explicit form of function (3), we will recall triangle OSC from Fig. 1b which we have magnified in Fig. 2a, and can assert that ‘the velocity of the wave remains always \(c\), regardless of the position of the source or observer’. So, the observer at \(C\) will measure velocity \(c\) for the wavefront in both cases, both in the case where the source rests at origin \(O\), and in the case where the source moves. Thus, instead of relative velocity \(u_{cv}\) (Fig. 2a) we can write of velocity \(c\) (Fig. 2b), but in this case the velocity \(c\) must be multiplied by another time interval \(t_s\) so that we can write:

\[
u_{cv} t_s = c t_o
\]  

(5)

And it is not hard to understand that the time period \(t_o\) is exactly the period of time within which the signal travels from the moving source to the observer. Suppose that the source emits with the period \(T_s\) and within a time \(t_s\) emits \(n\) wavefronts \((t_s = nT_s)\), with frequency \(f_s\). If the source is resting, the time interval of emitting of \(n\) wavefronts is the same as the time interval of receiving these wavefronts \(t_o\), \((t_s = t_o)\), but these two times intervals are not simultaneous. If we want to have the DE, then, as a condition, we must at least have the motion of the source (or the observer) through the spreading
wavefronts, as we have in Fig. 1b and Fig. 2, where the observer receives \( n \) signals within time \( t_o \) by periods \( T_o \) and we can write: \( t_o = nT_o \). In this case, the emitting time interval of the \( n \) wavefronts and the time interval of them being received, are not only not simultaneous, but they are also different \( (t_e \neq t_o) \). Accordingly, for equation (5) we can write:

\[
u_{cv} T_s = cT_o.\]  (6)

Now, knowing the relationship between period and frequency we obtain:

\[
\frac{f_o}{f_s} = \frac{c}{u_{cv}}
\]  (7)

which represents the more simple and general form of the Doppler effect formula. And finally, with the help of equation (4) we obtain a very useful DE formula:

\[
f_o = f_s \frac{1}{\sqrt{1 - \frac{v^2}{c^2} \sin^2 \vartheta} + \frac{v}{c} \cos \vartheta}.
\]  (8)

Equation (8) represents a general Doppler effect (GDE) formula for an arbitrary angle for the moving source. The GDE (8) is obtained without any approximation and without any arbitrary intrusion. Below we give a summary of the three special solutions of equation (8): for \( \vartheta = 0^\circ, \vartheta = 90^\circ \) and \( \vartheta = 180^\circ \):

\[
f_o = \begin{cases} f_s \frac{1}{\sqrt{1 - \frac{v^2}{c^2} \sin^2 \vartheta} + \frac{v}{c} \cos \vartheta}, & \text{for any } \vartheta \\ f_s \frac{c + v}{c}, & \text{for } \vartheta = 0^\circ \\ \frac{f_s}{\sqrt{1 - \frac{v^2}{c^2}}}, & \text{for } \vartheta = 90^\circ \\ f_s \frac{c - v}{c}, & \text{for } \vartheta = 180^\circ. \end{cases}
\]  (9)

As we can see, the TDE for mechanical waves was easily explained, as was the longitudinal DE. So why is the explanation of the TDE for sound and water waves absent from textbooks? Because in the realm of ‘classical mechanics’ this equation is in use:

\[
f_o = f_s \frac{c}{c + v \cos \vartheta}
\]  (10)

which claims to express the DE for an observer who receives a signal at an angle \( \vartheta \) from a moving source. Interpreting equation (10) the textbooks come to the conclusion that the classical theory predicts no TDE \([8,23]\), or in classical theory for \( \vartheta = 90^\circ \) the DE vanishes. But as we have pointed out, the facts say otherwise: even for \( \vartheta = 90^\circ \) the DE for sound waves does not vanish, we must just measure it. The ‘classical’ DE formula (10) is derived with the arbitrary intrusion of factor \( \cos \vartheta \), and gives us only approximate results.

In conclusion, we have an essentially new approach to the DE, which can be summarized in one simple sentence as follows: the most important quantity in the DE is the relative velocity between the wavefront and the source/ observer. This sentence marks a new paradigm in the DE, which is
characterized by the following: firstly, it illuminates an understanding of the principle of the relativity of velocity; secondly, it illuminates the fact that the ‘postulate on light’ is true, because the velocity of light and the relative velocity of light are two different values and that this ‘postulate’ does not require in any of its formulations that relative velocity should not be greater than the velocity of light [24]; thirdly, the DE is the same for all waves – the transverse DE is a special case of the DE and can also be seen in mechanical waves [22,25]. It can be clearly seen that only this new paradigm of the DE is sufficient to bring about a paradigm shift in Physics.

Finally, it is interesting to note that Lorentz, Poincare, Minkowski, Einstein and all other contributors to what is today known as the STR missed a historical chance for a correct understanding of the work titled ‘Uber Doppler’sches prinzip’ by Woldemar Voigt [26]. A correct understanding of this work would guide Physics today [27].

5. A glossary of some weird terms in Physics
Nowadays Physics has two key philosophical problems. The first problem is of an incorrect manipulation of terms: Physics confuses physical facts, hypotheses, theories, laws and postulates on the one hand, and likewise confuses concepts of matter, energy and mass on the other hand. The second problem (a historical and genetic problem for human beings) is related to the action of the first law of mechanics on physicists themselves in their work – something which is reflected in conservatism and in the support of authoritative authors rather than physical facts, or startling new explanations. As a consequence of these two problems, Physics is filled with ‘weird terms’. I consider that all these ‘weird terms’ of Physics should be indexed with evidence of the theory in which they appear and to be considered as unproven assets which cannot be taken as evidence of proof for the theories which gave birth to them. And for these reasons, if they are included in textbooks they should be considered ‘black spots’ of the respective theories. This is because as products of a theory they cannot be explained in reality and, most of all, they cannot be proved experimentally.

I will go on to mention just a few of these ‘weird terms’ which are circulating in Physics today, accompanying each with a few words. The dual nature of matter – as above. Time dilation – stems from a misunderstanding of the DE. Specifically, there is a misinterpretation of observing time ($t_o$) in the DE. The correct explanation can be seen in equation (5). Length contraction – stems from a misunderstanding of the DE. In particular, this is a misinterpretation of observed wavelength ($\lambda_o$) in the DE. Length contraction has not been confirmed experimentally. It is so unstable as a term that modern Physics really doesn’t know the meaning of this contraction (sometimes it is said that it is the path that is contracted and at other times that it is the body). Next, there are then some physicists who say that the contraction is only apparent [28] while others say that it is true [29]. The truth is much more straightforward: we are dealing with the addition and subtraction of the paths in relative motion. Meanwhile, if we talk about the relative motion of a cluster of particles (the DE), this addition/ subtraction is expressed with the extension/ contraction of the wave length. However, the contraction of the path and of the wave length is relative and this means that for an observer at another point there is no contraction, but instead extension [30]. Another fundamental problem of STR about of length contraction is the fact that this theory always requires only the contraction and only in one direction. Spacetime – stems from misunderstanding of the DE and the nature of matter. This produces an even weirder term: the waving space-time. Massless particles – stems from the Lorentz transformation. Creation and annihilation of particles – an error which comes from a misunderstanding of the nature of matter.

The vocabulary used goes beyond what we have listed here as only some weird terms, while in quantum mechanics there are other examples. Their removal would further strengthen quantum mechanics and would contribute further to the understanding of reality. I consider that these terms have had their day, like phlogiston, calories, cold as a substance etc., and should now be eliminated from science.
6. Conclusion

Until now, Physics has lived through many paradigm shifts, in a range of fields. But it has not lived through anything as great for more than one hundred years. We consider that now is the time for a paradigm shift in some realm of Physics which – because its consequences would spread across almost all other fields in the study of Physics – can be called a new paradigm of Physics. The core of the new paradigm of Physics should be the nature of matter. According to this new paradigm, Physics should give up on wave-particle dualism, should redefine waves, and should cancel the mystery about light and its privilege in Physics. This would have consequences which would make Physics more understandable, and – more importantly – would make it capable of solving current problems and for opening up new perspectives in exploring nature and the universe.

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