A step toward the
Theory of Everything

The Spacetime Model

Version 3.02
4 March 2009

Part 2

Constitution of Matter

Jacky JEROME

Ingénieur Européen EUR-ING
Ingénieur DPE (Diplômé Par l'Etat)
Ingénieur IPF
Ingénieur ITP-ECI
Email: toe-author@orange.fr

ISBN 97829531234-0-2
Editions Arts et Culture 42
4, square Kennedy
42120 LE COTEAU (France)

Cover: On the left of the photo of Einstein: Maxwell, Feynman, Max Planck, Schrödinger
On the right: Pauli, Niels Bohr, Marie Curie, De Brogglie, Dirac, Heisenberg

Patent Rights

This theory, the “Spacetime Model”, was registered at INPI, the French Patent Institute, under the following references:

238268, 238633, 244221, 05 13355-2 895 559, 248427, 258796, 261255, 268327, 297706, 297751, 297811, 297928, 298079, 298080, 329638, 332647, 335152, 335153, 339797.

This list is not exhaustive and some recent registrations at INPI are not mentioned. The “Spacetime Model” was also registered in other legal forms for Copyright.

First deposit date at INPI: **May 5th, 2005**
Major deposit date at INPI: **December 27th, 2005**

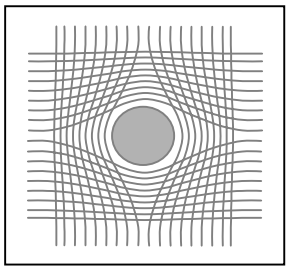
In 2006, the two versions of this document, English and French, were addressed to more than 7000 physicists worldwide by e-mail. Several paper copies were sent in October 2006 to the most important Academics of Science and Committees of Foundations for Research.

The “Spacetime Model” was also published on November 30, 2006, on 31 different web sites.

Before reading…

To fully understand this part, the reader must be familiar with the deductions and results developed in Part 1. These results are summarized below:

The curvature of spacetime



Let's fill up a container with water. We drop a billiard ball into the container. The volume of the ball produces a displacement of water.

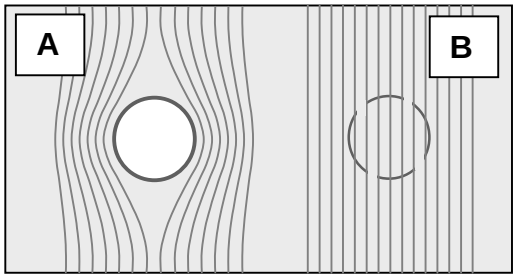
The same phenomenon applies to spacetime. Contrary to generally accepted ideas, it is not mass which deforms spacetime, but volume, more exactly “closed volume”.

Mass = Volume?

In our world, mass and volume seem to be two different quantities because in atoms, the mass is not proportional to the volume. So, we have a large range of atoms with different masses and volumes. However, at the particle level, mass = volume (with some reservations explained in Part 1).

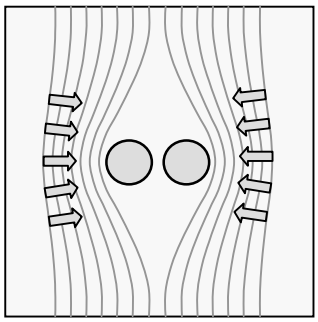
In reality, we have two main classes of volumes:

- **Closed volumes (A):** These volumes make a displacement of spacetime. Thus, a pressure force appears on the surface of the volume. This pressure produces a “mass effect”, an effect having all mass characteristics. Nucleons and electrons are examples of closed volumes.
- **Open volumes (B):** These volumes exist but do not produce any displacement of spacetime. If there is no curvature, there is no mass effect either. Orbitals of electrons in atoms are examples of open volumes.



Each atom has a particular proportion of open and closed volume. This is why mass and volume give us the illusion of being two different quantities.

What is Gravity?



Two volumes inserted into spacetime curve it. Since spacetime is elastic, its curvature produces pressures on these two volumes. This tends to bring them closer to each other. So, contrary to what we think:

Gravity is not an attractive force between masses but a pressure force exerted by spacetime on closed volumes.

Since a pressure force is the inverse of an attractive force, there is no difference between the current theory and this new explanation of mass and gravity:

Attractive force (Newton) + Concave curvature of spacetime (Einstein)
= Pressure force + Convex curvature of spacetime

Validation by experimentation

Part 1 describes a simple experimentation, which proves that the curvature of spacetime produces a pressure force, not an attractive force. Moreover, this simple experiment highlights a black hole behavior when R = Rs.

Validation by mathematics

In Part 1, the Schwarzschild Metric and Newton Law aren't calculated using the Einstein Field Equations but using this new explanation of Mass and Gravity, from the Hooke Law. Moreover, the proposed theory is in perfect accordance with the Von Laue Diagram.

Please note that the Higgs Theory is far to propose to the Physicists Community a simple explanation, an low-cost experimentation and a full mathematical validation (Schwarzschild-Newton-Einstein-Hooke) as those explained in Part 1.

1 Wave-Particle Duality

Matter presents the particularity of having a wave and particle behavior. This phenomenon is known as "wave-particle duality", or "complementarity". However, this enigma, which has been challenged by so many physicists, has still not been solved.

This chapter solves the mystery of wave-particle duality.

1.1 Current definition of duality

It is generally accepted that wave-particle duality is two different visions of a single object (fig. 1-1). Usually, physicists take a cylinder to explain duality. We observe either a rectangle or a circle depending on where we stand.

This metaphor is very interesting but it doesn't explain anything. It does not explain what really occurs at the particle level.

As a physicist, it is necessary to leave this philosophical aspect to the philosophers and to try to solve this enigma in a scientific way, with a logical and rational explanation.

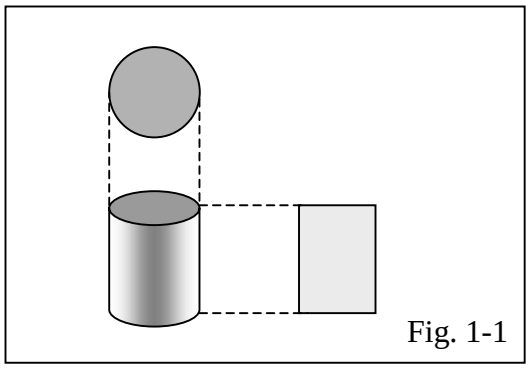


Fig. 1-1

1.2 Explanation of the duality

A toy boat is in the middle of a swimming pool. If you want to capsize it, you have two possibilities: to launch stones (particle concept) or to make waves (waves concept).

Let's replace the stones with a high-pressure washer. The water that is emitted from it can be considered a particle and has a corpuscular behavior. In fact, we can capsize the small boat by pointing the hose towards it.

Now let's put the nozzle in the water in the swimming pool. The water emitted from the hose, which was like a particle in the air, will also be like a particle in the water. This operation does not change the corpuscular nature of the water that is emitted from the nozzle.

We can observe that the water is transformed gradually into waves.

If, moreover, we activate the pressure washer for a short time, comparable to the action time of a particle, we can see that the small jet of water emitted from the nozzle becomes a single wave.

As we can see in this example, the water has either a corpuscular or a wave behavior.

Nature offers us identical situations: the water of Niagara Falls has a particle behavior during its fall and, once it has reached the river down below, the particles become "eddies", or waves.

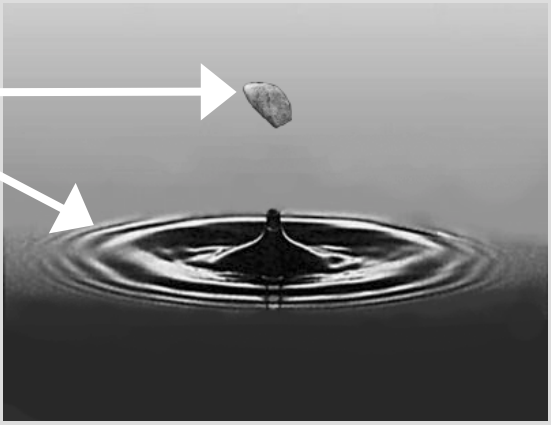
The opposite situation also exists: let's consider the example of an almost empty swimming pool. If we make only one wave in the residual water, some amount will spill out of the drain valve. Thus, the wave is transformed into a short filament of water, or "particle". The water coming out of the drain valve is obviously not a wave. Yet, it is the same water that, a few seconds ago, was a wave.

Another example that anyone can conduct is a stone falling into a container filled with water (example 1, fig. 1-2).

In example 2, a drop of water replaces the stone. The same object (water) has either a particle behavior (drop) or a wave behavior. We are exactly in a wave-particle duality situation. This photograph proves that the wave-particle duality also exists on Earth.

Example 1
A stone
and a water wave
*are of **different matter**.*

In that case, the wave-particle duality can't be explained. It is an enigma.



Example 2
A drop of water (corpuscle)
and a water wave
*are of **identical matter**.*
Water has either a corpuscle behavior or a wave behavior.

In this particular situation, wave-particle duality is explained with logic and consistency.

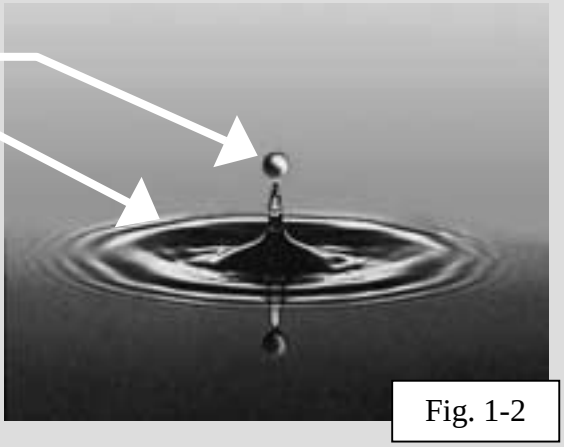


Fig. 1-2

1.3 First principle of duality

To summarize, when the particle and the wave are of different matter, like a stone and water, the mystery of wave-particle duality can't be explained. It is a true enigma. On the contrary, if the particle and the wave are of identical matter, like water/water in our examples, the wave can be transformed into particles and the converse.

However, in our first example, water coming out of the nozzle can't be transformed into waves if the experiment is done in the air. This transformation is possible only if the medium is also water. The same condition can be applied in the example of a drop of water. The wave exists only if the medium is also water.

In other words, the medium must also be in the same composition as the particle and the wave. This is a necessary condition.

To summarize, as figure 1-3 shows:

> **Wave – particle duality appears only in the very particular situation where the wave, the particle and the medium are of identical matter**.

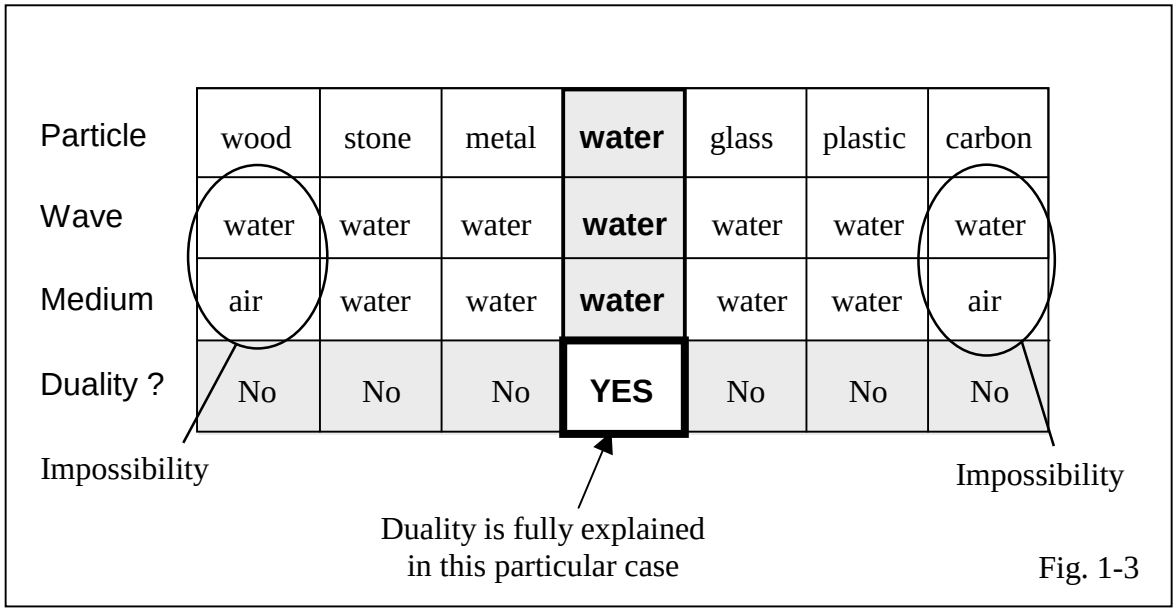


Fig. 1-3

Thus, we can have a duality in the following cases: water/water/water, air/air/air, or spacetime/spacetime/spacetime, the latter being useful later. If one of these three objects is different from the others, the duality can't be explained logically and becomes a true mystery.

Note

Medium and waves are obviously of identical matter. However, we will separate them for teaching purposes. Sometimes, we will use the wave concept, for example when we are talking about 511 KeV gammas, and sometimes we will use the medium concept.

1

Wave-particle duality can exist if, **and only if**,

- the particle,
- the wave,
- the medium,

have the same constitution.

1.4 Important deduction

In other words, if a duality is observed in quantum mechanics, it means that the medium, particles and waves have the same internal constitution. For example, if the medium is spacetime, particles and waves are made of spacetime too. This is a necessary condition. This deduction will be utilized in the following chapters to explain the constitution of the particles.

1.5 Second principle of duality

As we saw in the preceding example, the water of the pressure washer is transformed gradually, in intermediate phases, from a particle state into a wave state. Obviously, all these states of transition between particle and wave cannot coexist. It is either one or the other but not several states together.

Experimentations on particles confirm this fact. Indeed, particle and wave states never appear simultaneously.

We can thus state a second principle of duality, resulting from experimentation, based on the "OR EXCLUSIVE" conjunction:

2

When the conditions of the first principle of duality are met, the element concerned can exclusively take one, **and only one**, of the three following states:

1 - Particle state, when it is motionless
2 - Wave state, when it is moving
3 - Halfway state between wave and particle, during the transition (the particle is moving at a very low speed).

1.6 Third principle of duality

As we saw in the preceding example of the pressure washer, the wave state appears only if the particle is moving. Otherwise, **if the particle is motionless, it remains in a corpuscular state**.

Therefore, the third principle of duality is:

3 **When the particle is moving, it becomes a wave**

This principle is very important since it solves many enigmas of modern physics.

For example, in accordance with experimentations, magnetism only appears when the charged particle is moving. The reason, covered in Part 4 "Electromagnetism", is quite simple:

> *When the particle is motionless, it is a corpuscle in a spherical symmetry*[1]*. When it is moving, the particle becomes a wave, and the spherical symmetry disappears to be replaced by a complex wave with magnetic (and spin) components. In other words, the simple electric field becomes a electromagnetic field.*

So,

Electromagnetism is nothing but a consequence of wave-particle duality.

1.7 Polymorphism

All elements that meet the criteria of duality are polymorphic. Their form can be transformed from a particle form into a waveform and conversely. We have arrived at the concept of polymorphism that will be used further in Parts 3 and 5. Even if it is obvious, like the three preceding principles, it is interesting to formalize this concept as follows:

Elements that meet the duality criteria are necessarily polymorphic

Note: This proposal is not commutative. Any polymorphic element does not present a duality, particularly if it doesn't produce waves (modelling clay for example)

[1] Only the "r" radius is relevant in the explanation of 'electric field'. The angles φ et θ are not relevant.

1.8 History

Why, since 1905, has this enigma never been solved?

In fact, the real question arising is: “Is there not the possibility that we are in the particular case where waves, particle and medium are of the same constitution?”.

The answer is YES.

There is perhaps a probability of 1 per 1000, but this possibility exists.

Unfortunately, since 1905, physicists have great difficulty solving this enigma because **they have generalized a particular case**. Indeed, trying to understand the wave-particle duality with, for example, a stone and water, leads to a true enigma.

As we see, the only way to explain logically the wave-particle duality is to consider that, in quantum mechanics, we are in the particular case where waves, particles and medium are of the same constitution.

1.9 Conclusions

Duality has always been regarded as a burden for the physicists because no one has been able to explain it rationally. This enigma is summarized as follows:

> *“We note a wave-particle duality, which is very strange. However, this is a normal situation since quantum mechanics is, by definition, illogical and irrational”.*

This document does not share this "theory of irrationality" of some physicists concerning quantum mechanics. It transforms this disadvantage into an advantage. Instead of regarding duality as a burden, it regards it as fortuitous, the great opportunity to solve the mystery of matter. Indeed, this enigma, which is no longer a mystery, is summarized as follows:

> *“Since we note a wave-particle duality in quantum mechanics, we can deduce from this that **waves, particles and medium** have the same constitution. This is a necessary condition. Thus, if we find the constitution of the medium, we will know the constitution of waves and particles and the converse".*

-o-o-o-o-o-

Note
It is obvious that wave-particle duality only applies to waves and particles. Is the photon a particle? It is far from being proven. As Einstein (in 1920’s), many physicists think that photons aren’t “traditional particles” but, rather, mathematical objects, like vectors, used to describe waves. It means that wave-particle duality doesn’t apply to photons. This is why the Young Slits Enigma is not solved with the above explanation. In reality, this mystery has a different explanation, which is covered in Part 4 “Electromagnetism”.

2 EM radiations

EM radiations are mathematically described with a high degree of accuracy, but no one is able to explain the constitution of photons and EM waves.

To solve the mystery of EM waves, we will proceed by an indirect method. Initially, we will try to understand why "c", the velocity of light, is invariant. There is a good probability that the solution to this enigma will lead us to the constitution of EM waves.

Since the first principle of wave-particle duality shows that waves and particles have, necessarily, the same constitution, the knowledge of the waves leads us directly to the knowledge of the particles. So, the resolution of the c invariance enigma, although interesting, is not an end per se but rather a method of investigation by which to solve the mystery of the constitution of particles.

Note: The photon concept is covered in Part 4 "Electromagnetism".

2.1 History

The nature of EM radiations has always been the "pet peeve" of physicists. To this day, this problem has not been solved.

- Newton, during his time, thought that light was made of particles.
- In the nineteenth century, physicists favoured the wave concept. EM waves were propagated in aether, an unknown propagation medium.
- In 1905, continuing the works of Max Planck (Nobel Prize - 1918), Albert Einstein (Nobel Prize - 1921) built a particle theory of EM radiations. The concept of aether became obsolete since photons do not need any aether to be propagated. However, some problems, like Young's experimentations for example, were still not solved with the photon concept.
- Later, in 1922, Einstein returned to aether. He was confronted with the problem of duality since the photon is incompatible with the wave, and therefore with aether.
- In 1959, 39 years later, Louis de Broglie (Nobel Prize - 1929) proposed the idea that aether was made of neutrinos.
- Around 1980, physicists verified once more the constant speed of light with quasars, using embedded systems and telescopes in satellites.

These recent experiments show that the propagation of EM waves and the enigma of the constant speed of light are still not solved. The aether concept would help but no one is able to give an exact definition of it.

Finally, since 1905, the enigma of the constitution of light has been so persistent it prompted Louis De Broglie to say: *"Science will make a great step ahead the day that it can explain a simple ray of light"*.

2.2 Nature of EM radiations

One of the peculiarities of the EM wave is that it can be propagated in a vacuum. But in a vacuum… there is nothing… and the EM wave cannot exist in the absence of a propagation medium.

The introduction of the photon partially solves this problem. Indeed, like any particle, the photon can move in a vacuum. However, if an EM radiation behaves like a particle in 90% of the cases, it also behaves like a wave in the remaining 10% of cases, as in Young's slits experimentation. The enigma thus remains unsolved for these cases.

When a hard drive periodically makes one, two, three or more errors, it must be formatted. Of course, this leads to a waste of time, but there is no other solution. In quantum mechanics, errors or inconsistencies don't occur in one's, two's or three's, …but in ten's. In such a case, the only thing to do is to "format" the quantum mechanics. The best approach is to start from scratch, ignoring the few laws of quantum mechanics that are inconsistent, but keeping experimentations in mind.

Therefore, to understand the nature of EM radiations, we must return to the early 1900's, when Einstein explained the photoelectric effect and discovered special and general relativity.

As stated, the particle aspect of EM radiations, namely photons, will be discussed in Part 4 "Electromagnetism".

2.3 Separation of media

The problem of velocity additions suggests that we are in the presence of two distinct media:

1- "Apparent medium"

This is the visible medium that carries out the experimentations, and from where the EM wave is emitted.

For example, in Fizeau Experimentation, this medium is water, and in Michelson's, it is the Earth's atmosphere moved by the Earth itself.

2- "Real medium"

EM waves are propagated in a "real medium". For example, this *"Real Medium"* could be De Broglie "Neutrinos Sea".

The *"apparent medium"* and the *"real medium"* are overlaid (fig. 2-1).

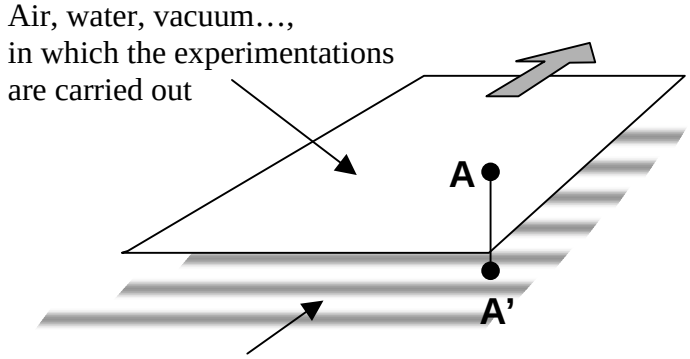


Fig. 2-1

In this figure, points A and A', as well as the apparent and real media, are separated for teaching purposes but, obviously, they share the same place. Any apparent medium has, necessarily, a subjacent real medium that is associated with it.

2.4 Properties of the "Real medium"

The *"real medium"*, if it exists, must have at least the following two properties:

1- To be present everywhere

Since EM waves are propagated everywhere, the *"real medium"* must also be present everywhere, in air, in water … and even in a vacuum. Spacetime is an excellent candidate to be this *"real medium"* since it is present everywhere, even in a vacuum[1].

2- To have propagation properties

We know that any wave needs a propagation medium to move. Since spacetime is elastic and can be deformed (Einstein), it could be an excellent propagation medium.

Therefore, spacetime could be used without any problem as a support for EM waves.

This being said, gravity and EM waves do not curve spacetime in the same manner. Please read the three following documents, Part 1, Parts 3 and Part 4 concerning these subjects.

[1] Spacetime is not this unknown aether for which we are looking. Spacetime is spacetime. There is no other correct definition and spacetime can't be identified with aether. In order to avoid any confusion, we will use the term "real medium" instead of "aether".

2.5 Constant speed of light

Let's imagine the emission of a beam, L, from a laser diode (fig. 2-2). The diode, A, is fixed on an *"apparent medium"* moving with the velocity "V".

In fact, the laser beam L is not emitted from the *apparent medium* as this figure shows, but from the point 'A' located in this *"real medium"* which is spacetime of the universe.

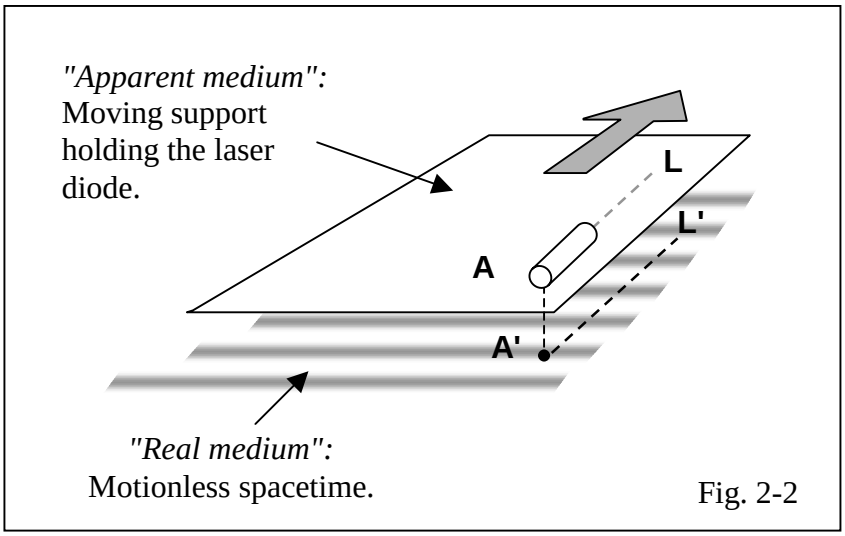


Fig. 2-2

Since light is propagated in the *real medium*, its speed depends only on the nature of this medium, and nothing else. In reality, the permittivity of free space ε_0 is not a "vacuum permittivity" but rather a "spacetime permittivity", a physical constant that defines the spacetime propagation characteristics, as the "spacetime permeability" μ_0.

Fizeau, Michelson and other physicists thought that light is propagated in this *apparent medium* which is moving, water, air, vacuum etc…, whereas, in fact, it is propagated in this *real medium* which is the "motionless" spacetime of the universe.

Note 1
We should not have any confusion between the word "motionless" used in the context of the universe, which is correct, and the same word used in Special Relativity, which is not relevant in that study.

Note 2
The spacetime of the universe, sometimes called "global spacetime structure", is the one that was created about 13.9 billion years ago, and not the local spacetime of special relativity. So, in this document, the word "spacetime" will always refer to "global spacetime structure of the universe", as in Friedman-Robertson-Walker Definition.

Note 3
There should not be any confusion between the ***apparent medium,*** *from where the EM wave is emitted, and its propagation medium, the* ***real medium****, which is spacetime of the universe.*

2.6 Case of two reference spaces

Figures 2-3 and 2-4 show that the presence of a *"real medium"* does not affect the principles of Special Relativity.

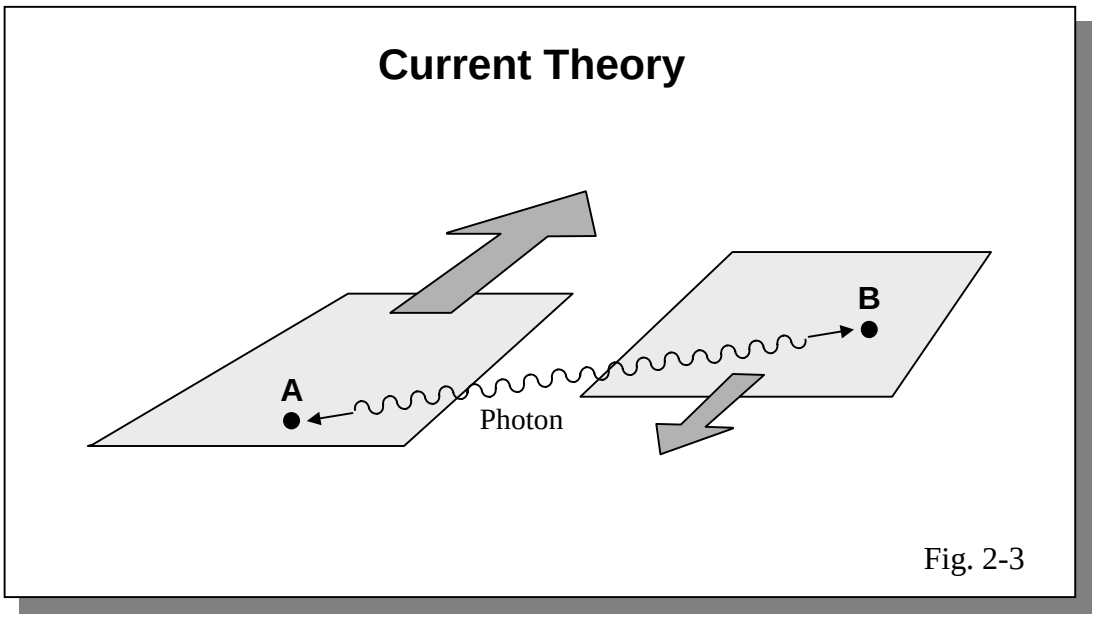


Fig. 2-3

A photon is emitted from A to B, or the converse, to synchronize the two reference spaces, which are both moving. The points A and B belong to the apparent media. In this case, no one can explain why the speed of light is constant. Logically, the velocities should be added. Since this is not the case, this diagram must be revised (…but not the experimentations!!!), despite the fact it has been used since 1905.

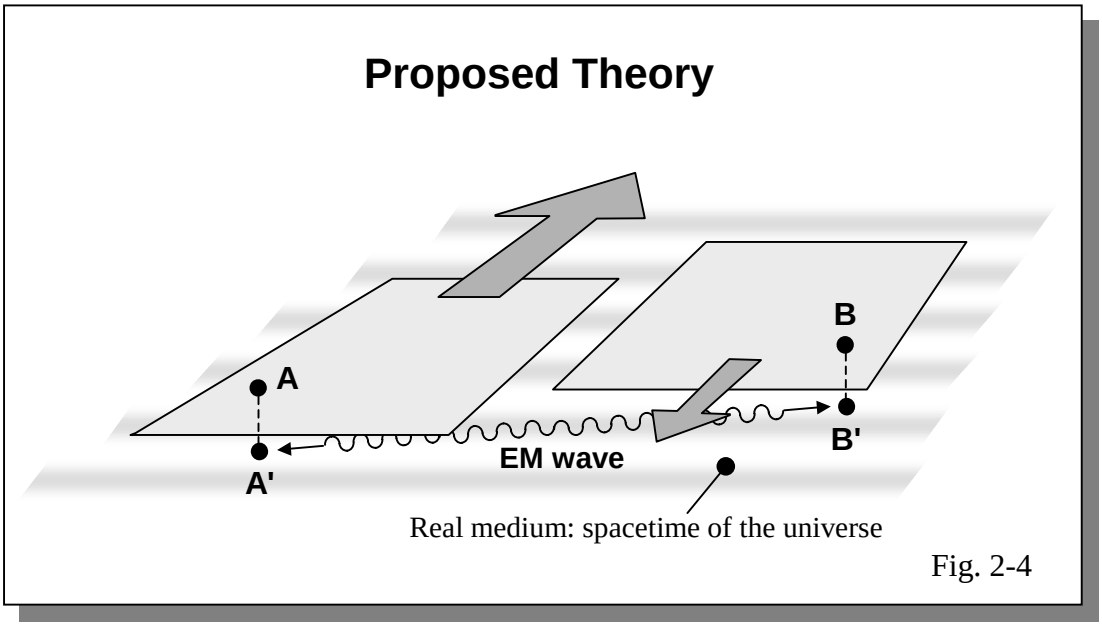


Fig. 2-4

Light is not propagated in the apparent medium, which supports the sources of light A and B, but in the real medium, which is **global spacetime of the universe**. EM radiations do not consist of photons but of EM waves (please see Part 4 "Electromagnetism" concerning this assertion). As a result, the constant speed of light is easily explainable. The velocity of light is a function of the real medium characteristics, i.e. spacetime permittivity ε_0, and spacetime permeability μ_0. Thus, the speed of light is always 300 000 km/s, whatever the velocity of the reference space, or the apparent medium, from where the light is emitted.

2.7 Conclusions

- EM waves are emitted from an *apparent medium* but are propagated by the *real medium,* which is global spacetime of the universe.
- In this *real medium*, the speed of light is 300 000 km/s. Its invariant velocity is only a function of the permittivity ε_0 and the permeability of spacetime μ_0
- EM waves are a succession of spacetime vibrations.

Therefore, although it amounts to the same thing, it would be more accurate to write:

"The speed of light is 300 000 km/s in spacetime"

rather than:

"The speed of light is 300 000 km/s in a vacuum"

Note:
Under certain conditions, EM waves may move at a speed different than 300 000 km/s. For example, using Bose Einstein Condensate made up with sodium atoms at -273.15°, Lene Vestergaard Hau, from Harvard University, USA, slowed down EM waves to 17 m/s. In the same way, EPR also is an exception to the theory. See Part 1, "Mass and Gravity", and Part 4, "Electromagnetism", to understand these few exceptions.

3 Movements in Spacetime

This chapter affords the reader a more concrete vision of the role of spacetime in EM waves. The deduction developed in chapter 2, i.e. EM waves = spacetime movements, will lead us directly to the knowledge of the constitution of the elementary particles.

3.1 EM waves

The spacetime vibrations of an EM wave are shown in figure 3-1. This is a simplified figure, which is not necessarily the real representation of an EM wave. These vibrations are **variations of spacetime density**.

The universe is filled with EM waves of all kinds. Thus, spacetime is not motionless but is vibrating continuously. In this chapter, we only consider the vibrations of EM waves, not those due to gravitational waves.

3.2 Movements in spacetime

Variations of density are “movements” in spacetime, like "whirlpools" or "eddies" in water. The propagation of EM waves is similar to that obtained by a stone that makes rings when thrown into the water. The only difference is the medium that is spacetime instead of water.

In figure 3-1, wave 1 is the main wave, and waves 2, 3, 4… are secondary waves (if they exist). In this figure, the wave is propagated from left to right.

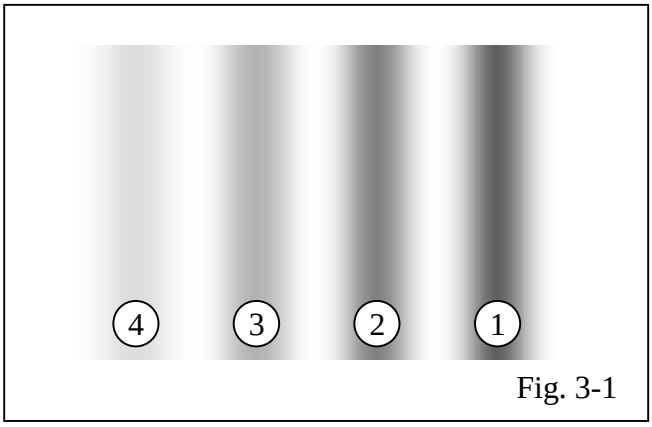


Fig. 3-1

3.3 Mathematical formalization

From a quantum mechanics point of view, we have a "wave packet" (fig. 3-2). In reality, the form of EM waves depends on the phenomenon that created it.

For our further demonstrations, we will take the simple form of a damp sinusoid (fig. 3-3 and 3-4), even if these schematics are not fully exact.

Figure 3-3 represents the periods, from 1 to 4, of the wave in figure 3-1. Figure 3-4 is the same wave but with only one period.

Important: The reader must keep in mind that these graphs are only for teaching purposes.

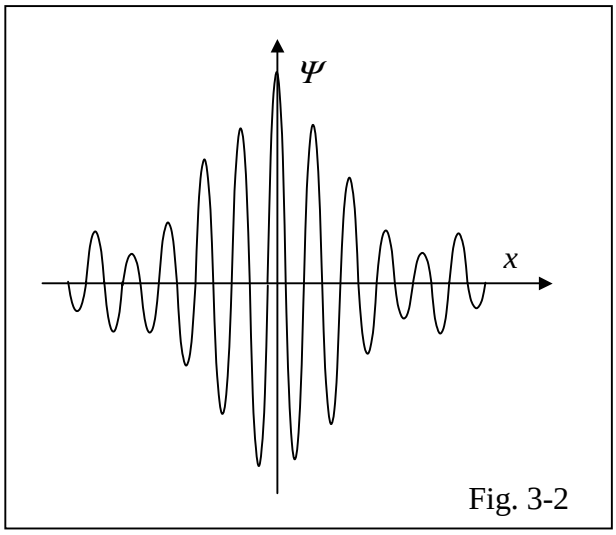


Fig. 3-2

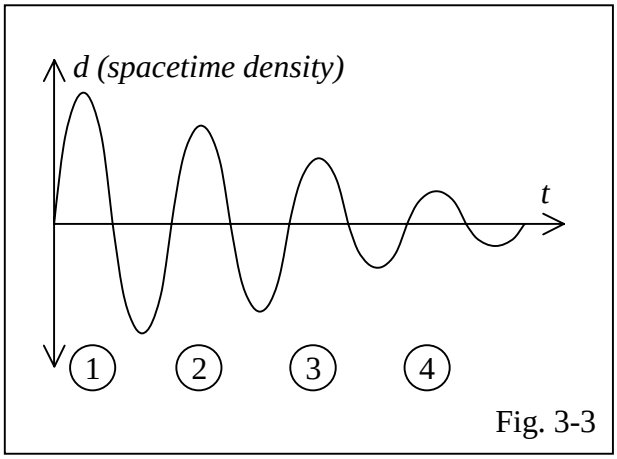


Fig. 3-3

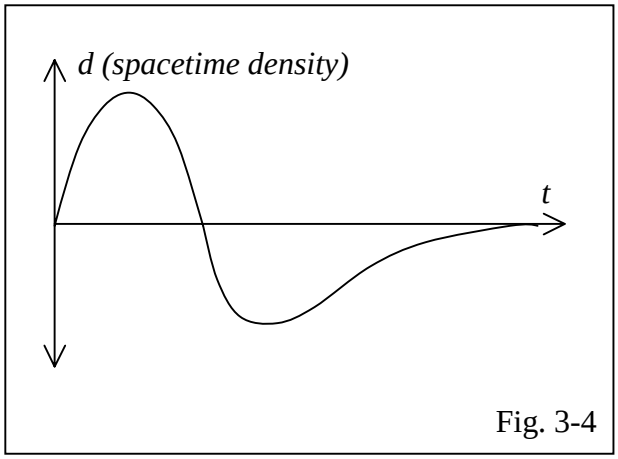


Fig. 3-4

3.4 Polarity of spacetime

The following graphics (fig. 3-5 and 3-6 on the next page) are identical to the preceding ones (fig. 3-3 and 3-4). Sign "+" was inserted in areas of high relative density of spacetime and sign "-" in areas of low relative density.

The "reference" is the density of spacetime before the arrival of the wave. The positive and negative variations of the wave densities, i.e. spacetime densities, are relative to this reference. This is why the word "relative" was used.

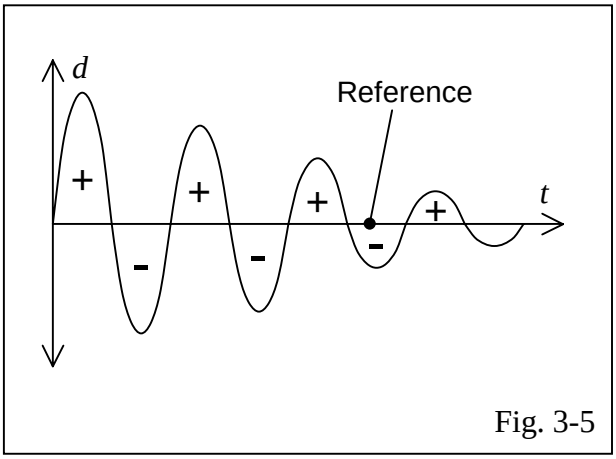


Fig. 3-5

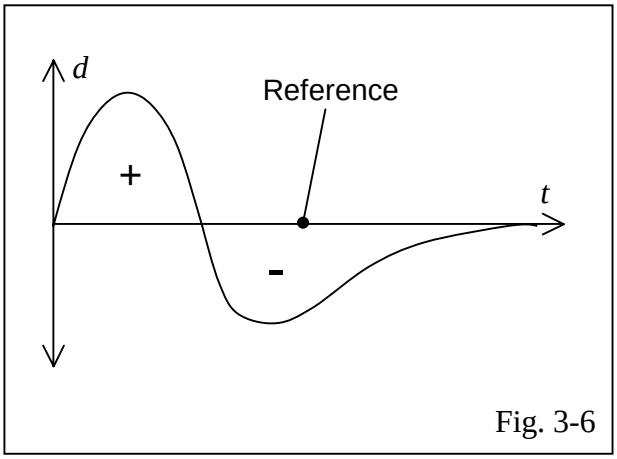


Fig. 3-6

3.5 Example

Let's imagine that ambient air is divided into small cubes. In this example, the EM wave is replaced by a soundwave.

Each cube has a density of air. When a soundwave arrives, the pressure of the air inside each cube changes in a combination of positive and negative pressures, or high and low pressures. After the passage of the soundwave, the pressure of cubes falls back to its initial value.

It is this initial value of density of air that is called "reference" on figures 3-5 and 3-6.

Important note

In this example, a sound wave makes a periodic displacement of air into each cube, which can be identified to EM or Matter waves.

The presence of an object, like a house, also makes a displacement of air. The phenomenon is different and can be identified to gravity.

In reality, these two displacements of air are two different phenomena. They can be assimilated to electromagnetism (the soundwave) and the curvature of spacetime in general relativity (the house).

The difference between these two phenomena is fully explained in two other documents, Part 1 “Mass and gravity”, and Part 4 “Electromagnetism”.

This page left blank intentionally

4 Forces in Spacetime

Physicists think that nature has three fundamental forces: gravity, electroweak force (unified in 1972 by Weinberg and Salam, Nobel Prize – 1979) and strong nuclear force.

This chapter covers one of these three forces. Differences of high and low densities of spacetime necessarily produce a force. We have the same phenomenon in air: the difference of pressure produces wind.

We do not know the character of the force described below, or its properties. At the present moment, we will simply be satisfied to understand it. We will try to identify this force later, in the following two chapters.

4.1 Elasticity of spacetime

A material is said to be elastic if it is deformed under stress, e.g. external force, and then returns to its original shape when the stress is removed. This is the case of spacetime.

The Einstein Field Equations, EFE or "Einstein Equations", demonstrate that matter curves spacetime and, since 1916, many experiments have proven that spacetime is elastic.

4.2 Principle of "Least curvature"

The principle of Maupertuis[1] in 1744 indicates that nature always tends towards the least action. Transposed to spacetime, this principle becomes:

Spacetime tends naturally towards the least curvature

This principle goes hand in hand with the Einstein's concept of elasticity. Indeed, like any elastic material, spacetime naturally tends to minimize its curvature.

[1] Koenig, De Fermat, Liebniz, Euler, Lagrange, Jacobi and Helmholtz have written similar principles.

4.3 Principle of "Least relative density of spacetime"

Let's imagine a space far away from masses or waves (fig. 4-1, on the left). Following a disturbance, the spacetime is curved (fig. 4-1, on the right).

As we see in this figure, the word “curve” is synonymous with “density”. Any part of spacetime that is curved necessarily produces variations of density. These two words express the same phenomenon.

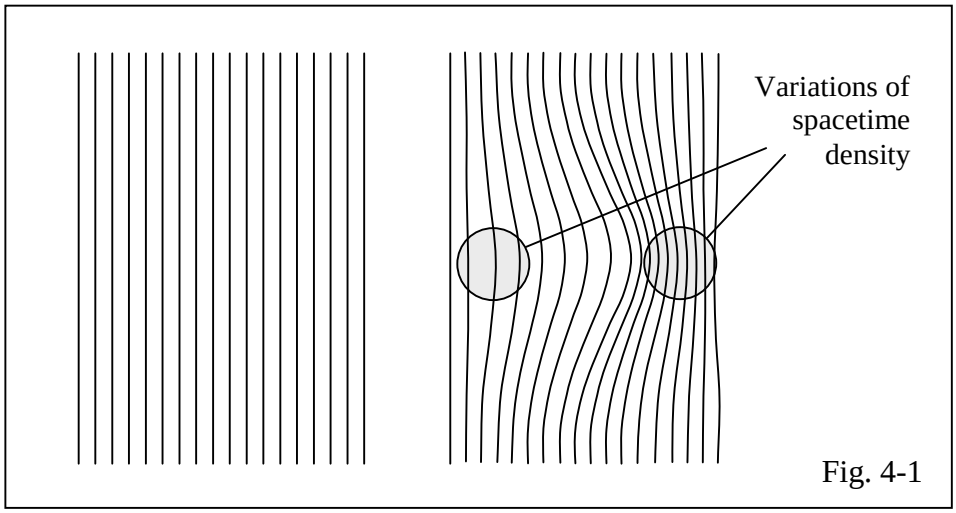


Fig. 4-1

Thus, the principle of least curvature can be stated in a different way, which will be useful for us, later in this document:

Spacetime tends naturally towards its least relative density (*)

(*) Paragraph 3.4 covers the definition of "relative density".

4.4 Density of spacetime

For teaching purposes, the two figures in the preceding chapter, fig. 3-1 and 3-5, are grouped in figure 4-2 which represents an EM wave, on the left, and its simplified mathematical representation, on the right.

We do not know if a low density produces a negative polarity or the reverse. Further in this document, we will presume that a high density of spacetime corresponds to a positive polarity, and a low density to a negative polarity.

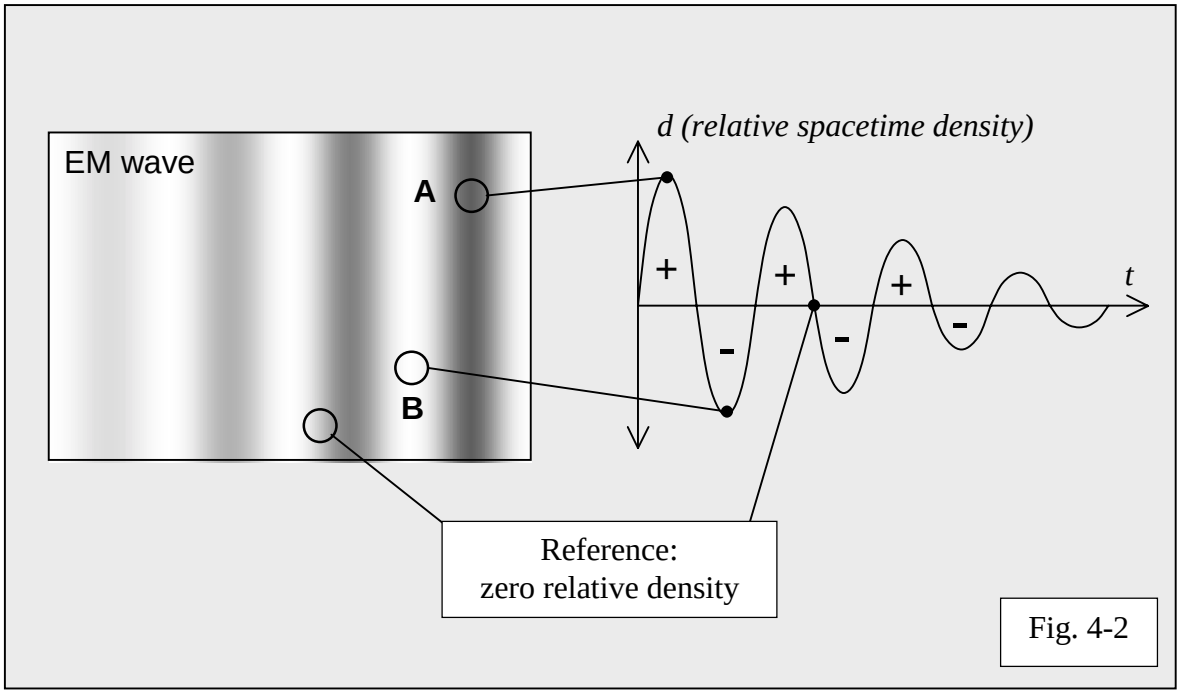


Fig. 4-2

4.5 Annihilation process

Let's imagine that we take the two “pieces” A and B of the EM wave (spacetime vibrations) in figure 4-2. These two small parts are represented in figure 4-3.

What happens if we put these two areas, A and B, in contact?

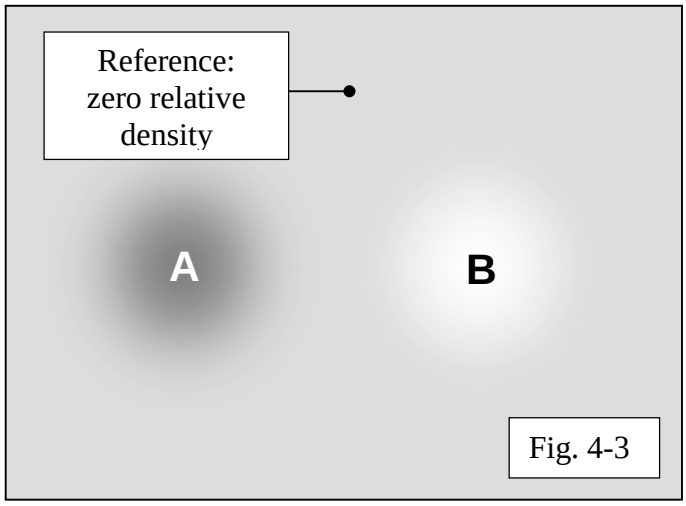


Fig. 4-3

Intuitively, we might think that these two areas will cancel out each other. The area of high density of spacetime in A will annihilate the area of low density of spacetime in B.

We can also demonstrate this phenomenon with the "spacetime curvature" concept (fig. 4-4). Since spacetime is elastic, the two areas A and B will not remain motionless. In any case, spacetime tends towards a null relative curvature. The Maupertuis Principle adapted to spacetime states: The only way to get the least curvature of spacetime is when areas A and B annihilate each other.

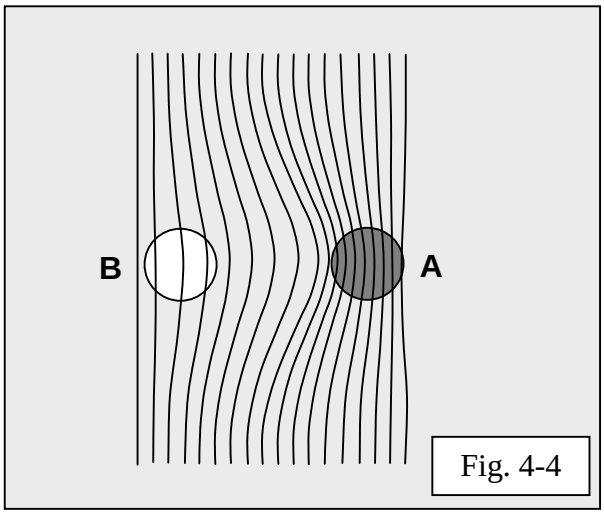


Fig. 4-4

To better understand the phenomenon, let's consider the example of an acoustic wave. As we know, it is a succession of pressures and depressions in air.

Let's isolate two small cubes of air, one in a pressure half period (A), and the other in a depression half period (B). Now, let's put them in contact. Intuitively, we might think that these two areas, A and B, will mutually cancel out each other. The result will be two neutral areas with zero relative density, like our "reference" in fig. 4-2 and 4-3 or 3.5 and 3.6.

The same phenomenon occurs in spacetime when we put together two areas, one with a high density of spacetime, and the other with a low density.

4.6 Attractive force

Each area of pressure A and depression B of spacetime is delimited by a kind of virtual line called the “horizon of influence” which is marked L (fig. 4-5).

If the two areas are far away from each other, nothing occurs. One area doesn't have any influence on the other.

If their horizon of influence comes into contact, the high density of spacetime in A tends to cancel the low density of spacetime in B. As we have seen before, the two areas, A and B, will cancel out each other.

When the annihilation begins, the two areas continually approach each other, and finally disappear completely if they have exactly the same volume.

This “attraction” of the two areas towards each other until complete annihilation is like an attractive force.

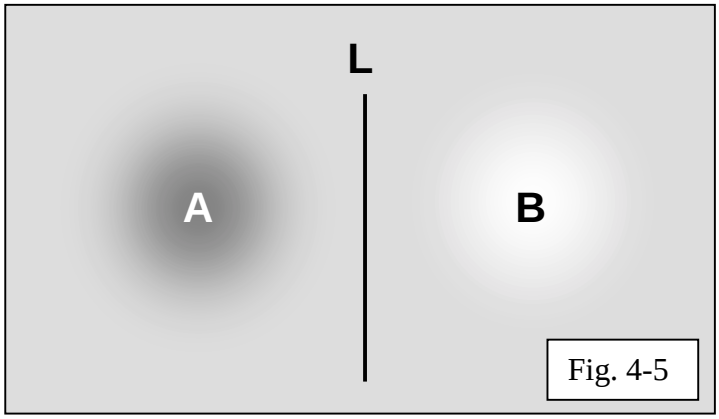


Fig. 4-5

The principle of least relative density of spacetime, or its twin principle of spacetime curvature, confirms this attraction. Since the attraction process is identical to the annihilation process, it is not necessary to go over the preceding explanation again.

Two areas with opposite polarity, at short distance,
tend to a mutual annihilation, thus producing an attractive force.

4.7 Repulsive force

In the same manner, two areas with the same polarity of density of spacetime will tend to push each other away (fig. 4-6).

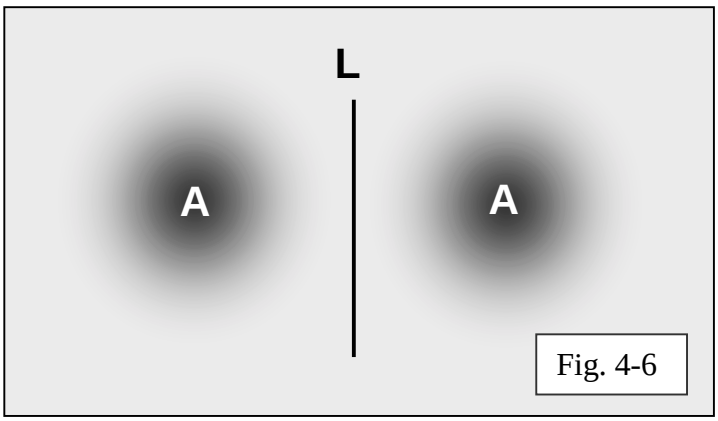


Fig. 4-6

When the two areas approach each other, their horizons of influence (L line in fig. 4-6) come into contact.

Just before the contact, the relative density of spacetime on this line L was zero. If the two areas continue to approach each other, this relative density will increase or decrease depending on the polarity but, obviously, **will no longer remain null**. A repulsive force appears between the two areas A and B since the line L must remain null.

The principle of least relative density of spacetime or its twin principle of curvature of spacetime confirms this repulsive force.

Thus:

Two areas with the same polarity, at short distance, tend to push each other back thereby producing a repulsive force.

4.8 Fusion

Under certain conditions, two areas of identical polarity can merge (fig. 4-7).

For example, if the energy of one area is higher than the "barrier" of another, this barrier can be crossed over and fusion becomes possible. We know this phenomenon on Earth in nuclear fusion with light nuclei. Thus, under some conditions of proximity, repulsion can become a fusion.

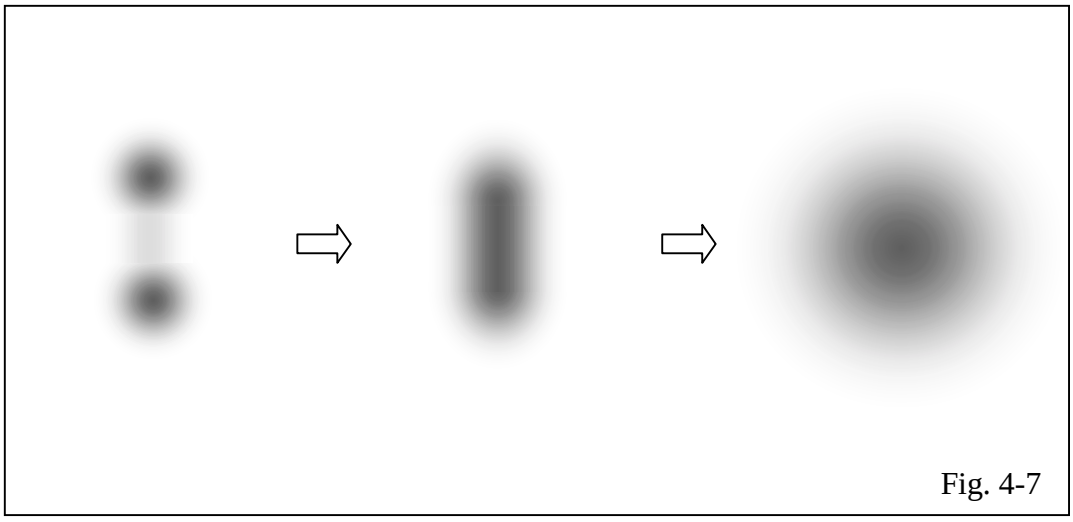


Fig. 4-7

5 Electron-Positron Annihilation

In this chapter, we propose a scenario using the attractive and annihilation forces seen in the preceding chapter, including the explanation of wave-particle duality seen in chapter 1. More precisely, we will try to imagine what occurs when two areas of opposite density of spacetime are put together.

For the moment, we do not know the character of this interaction. In the following chapter, we will try to describe the phenomenon and compare it to something known.

5.1 Scenario

Let's imagine two areas of spacetime, A and B, of the same dimension (fig. 5-1 on the right). These areas are two small pieces taken from an EM wave (fig. 5.1 on the left) and are made of high and low density of spacetime respectively. Area A comes from a positive half-period and B from a negative one (fig. 5.1 down).

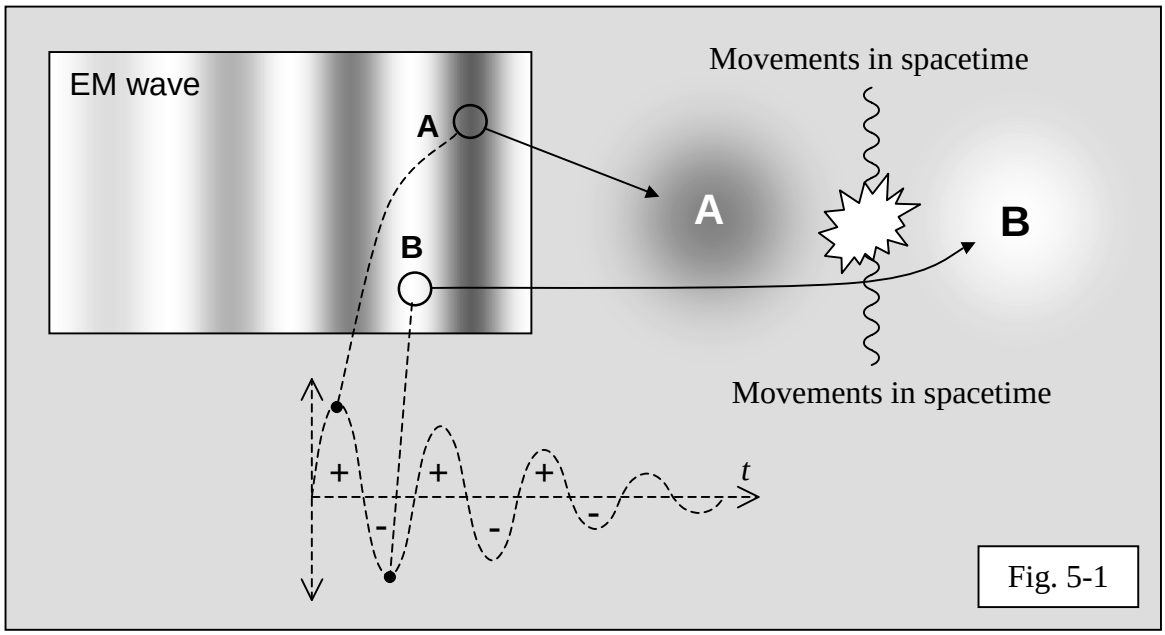


Fig. 5-1

In the previous chapter we saw that when two areas of opposite polarity meet, they annihilate each other.

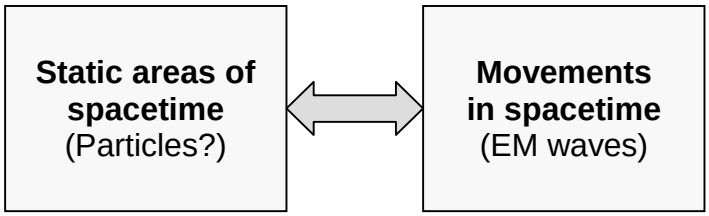
As we can imagine, this annihilation produces movements in surrounding spacetime. We have the same process when an anticyclone comes into contact with a depression; annihilation always produces wind and disturbances in surrounding space.

We must note that all the elements of figure 5-1 are made up of spacetime:

- The areas A and B are "parts" of the EM wave, therefore areas of spacetime
- Surrounding space is also made up of spacetime
- Since everything is spacetime, movements produced by annihilation are also made up of spacetime. As we saw, these movements are like an eddy or whirlpool in water. They are EM waves.

The loop is thus closed:

1. The two "pieces" of waves, areas A and B, are annihilated,
2. … which produces movements in spacetime,
3. … movements which are EM waves.



5.2 Different volumes

Let's complicate the problem slightly. Let's suppose that one of the areas has a volume of 0.1% superior to the other (not represented in the figure). What would occur?

It is simple: the excess 0.1% will not be annihilated.

For example, let's take an area of a volume equivalent to 511 KeV[1], and the other 509 KeV. After annihilation, it will remain an area of 2 KeV. This area will be ejected in a direction that preserves the momentum, in relation to the two other disturbances.

[1] It would seem strange to relate mass or energy to volume. Explanation of this assertion is given in Part 1 "Mass and Gravity".

5.3 Interpretation

This scenario, purely intuitive, coincides curiously with that of an e+e- annihilation.

- The two areas of high and low density of spacetime could be the positron and the electron.
- The movements of spacetime due to annihilation could be the two gammas of 511 KeV created during an e+e- annihilation.
- The volumes A and B disappear. In physics, the positron and electron disappear too.
- The volume of the movements in spacetime corresponds to the volumes destroyed.
- The remainder, if volumes are slightly different, could be the neutrino. Indeed, we don't have the proof that the positron has exactly the same mass as that of the electron[1], but we have proof that the neutrino exists. Further discussion of the neutrino is covered in Part 3 “Quarks and Antimatter”.
- If the neutrino comes from an electron or positron, it must also have a spin = 1/2. This is exactly what the experimentation proves.

Such a coincidence in the experimentation is disconcerting but not sufficient to validate a theory. We will make further deductions in the following chapter. As you will see, our conclusions confirm that the present scenario describes, word for word, an e+e- annihilation.

> *Note: If this scheme is correct, the neutrino should have a very light charge, so light that it could be very hard to detect. This eventuality is covered in chapter 8.2 "The Neutrino", in Part 3 "Quarks and Antimatter".*

[1] The accuracy of measurement is: $|m_{e^+} - m_{e^-}| / m < 8.10^{-9}$, with a CL of 90%.

This page left blank intentionally

6 Nature of Particles

We know of about 300 elementary particles. Among those, physicists have favored the electron. It seems that the electron, and its antiparticle the positron, are the basic particles of the universe. For this reason we have also chosen the electron and the positron with which to continue our research into the constitution of particles.

This chapter synthesizes the preceding deductions.

6.1 Constitution of particles

The following deductions, made in five different ways, always lead to the same conclusions: particles are areas of spacetime.

1) 1st principle of duality

This principle, which fully explains the enigma of wave-particle duality, states that particles, waves and medium must have the same constitution. Since the medium is spacetime, **particles and waves are also made of spacetime**.

2) Electron-positron pairs production

We know that a high-energy gamma, which passes near a nucleus or any charged particle, can decay into an electron-positron pair.

This phenomenon is very simple to explain. The positive Coulomb Field of the nucleus attracts the negative areas of the EM wave and pushes back the positive areas, namely the areas of low and high density of spacetime. Thus, **the wave decays in two parts** (fig. 6-1 and 6-2). These two "pieces of wave" are e+e- pair(s).

Obviously, it is impossible to create particles or any other object from nothing[1]. The electron and positron originate somewhere, and this "somewhere" can only be the original EM wave, i.e. spacetime vibrations.

[1] Spacetime is not considered as "nothing".

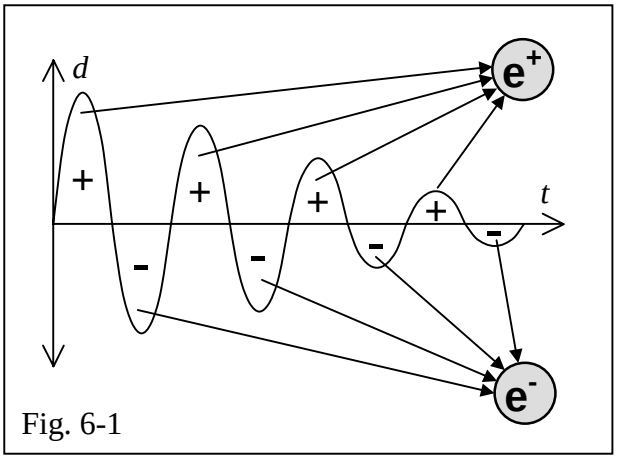


Fig. 6-1

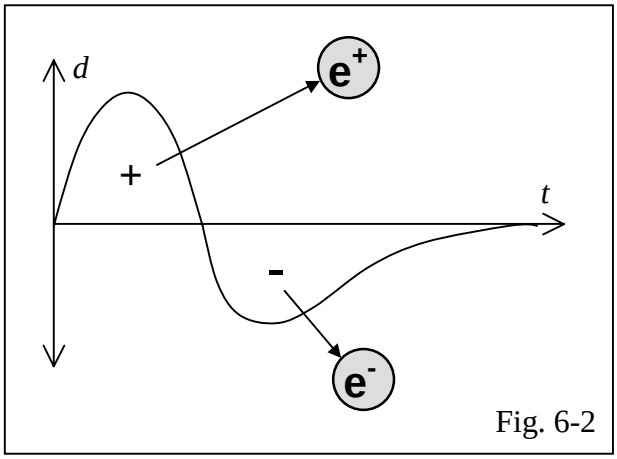


Fig. 6-2

Since the original EM wave is made up of spacetime, the electron and the positron are necessarily made up of spacetime too. We can deduce that:

The electron and the positron are made up of spacetime

3) Electron-positron annihilation

We have studied, in the previous chapter, the annihilation of an electron and a positron. Since the result, two gammas of 511 KeV, are a movement in spacetime, **the origin, or the electron and the positron, is made up of spacetime too**. This experimentation is a simple conversion from spacetime (particles) to spacetime (gammas), in accordance with the wave-particle duality explanation of chapter 1.

4) De Broglie Waves

In 1924, Louis De Broglie had the idea that any particles could have an associated wave similar to the EM wave. For De Broglie, all the waves have a comparable constitution. The experimentations of Davisson (Nobel Prize - 1937) and Germer in 1927 confirmed De Broglie's theory. So:

- Particles and matter waves are of the same constitution (first principle of duality).
- "Matter waves[1]" and EM waves and are of comparable constitution (De Broglie).

By association, we deduce that particles have the same constitution as EM waves, i.e. **they are made of spacetime**.

[1] The subject of EM and matter waves is covered in the two following documents: Part 3 “Quarks and antimatter”, and Part 4 “Electromagnetism”.

5) Coulomb's Force

Let's return to the scenario discussed in the preceding chapter and try to identify this force. What is this unknown force that brings closer the two areas A and B until their complete annihilation? We have four possibilities:

- **Gravity?** The scenario of chapter 5 couldn't work with two areas of identical polarity. Since gravity disregards polarity, this unknown force is not gravity.
- **The strong nuclear force?** In chapter 5, we never mentioned nuclei or quarks. Thus, this unknown force cannot be the strong nuclear force.
- **The weak nuclear force?** In the same way, it is not a question of interactions with bosons Z°, W+ or W-. This unknown force is not a weak nuclear force or, more precisely, the weak nuclear component of the electroweak force.
- **The EM force?** By elimination, it must be the EM force.

We deduce that the unknown force discussed in the preceding chapter is the Coulomb component of EM force. This conclusion seems logical since the two areas, A and B, are "pieces of EM waves", which are related to EM force.

Since the Coulomb Force acts only on charged particles, we deduce that the two areas A and B are charged particles. However, these two areas are “pieces” of an EM wave, i.e. spacetime. We naturally conclude that **the particles are made up of spacetime.**

6.2 Conclusions

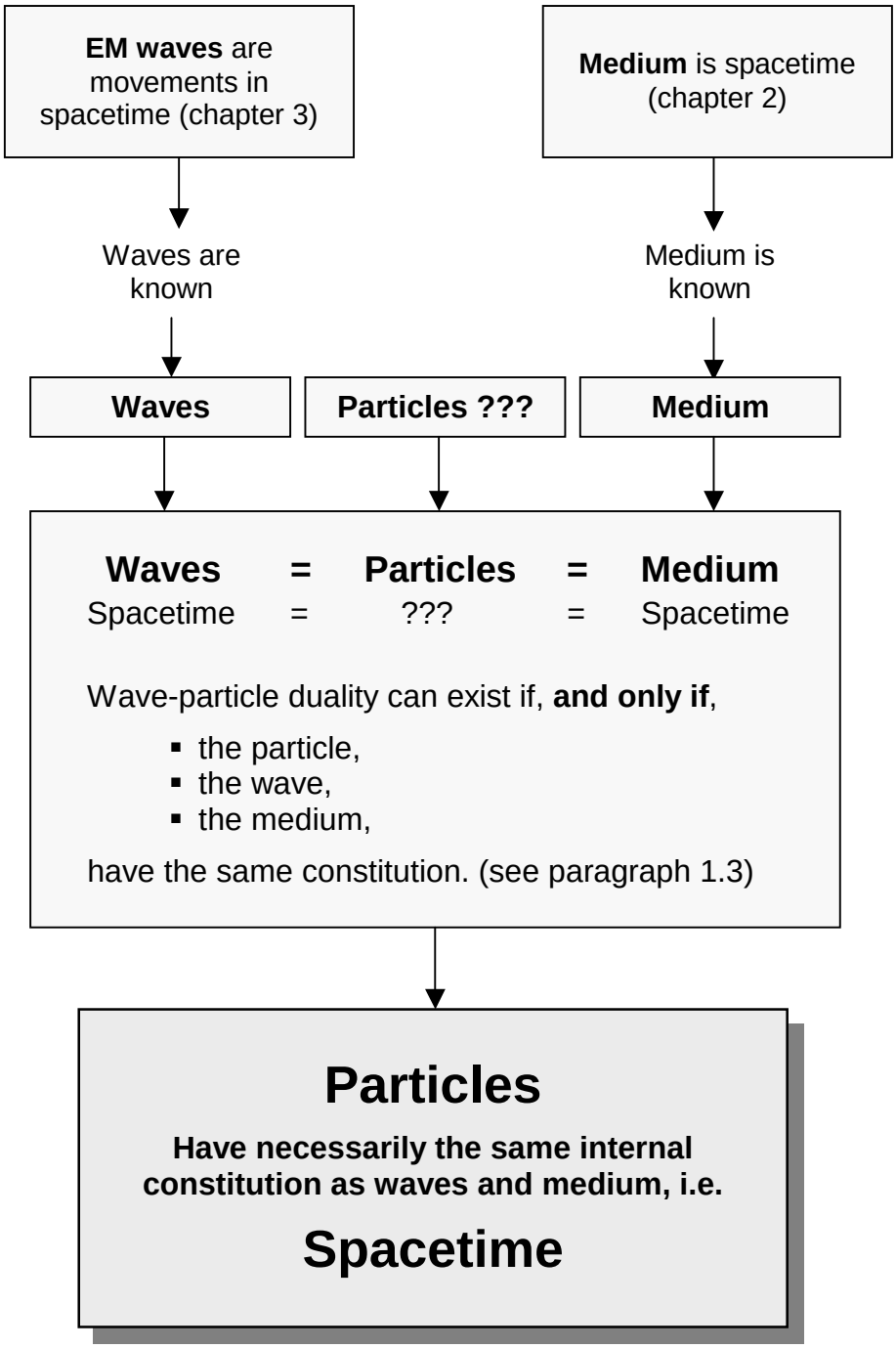
The conclusion is that Nature is founded on only one basis, which is summarized below.

EM waves and elementary particles are made of

Polymorphic areas of high and low densities of spacetime

Particles = Static areas of spacetime
EM waves = Dynamic areas of spacetime (vibrations)

Note: the concept of polymorphism has been added to the following definition for reasons that will be discussed in Part 3 “Quarks and Antimatter”.



6.3 Einstein's Point of view

Let's note this remark by Einstein, which tends to confirm our deductions: *"Matter cannot exist without spacetime"*.

Thus, the proposed theory is far from being unrealistic since, in the 1920's, this great physicist thought that Nature was directly connected to spacetime.

6.4 The fifth dimension?

This conclusion also corroborates our simple model of the universe based upon spacetime and using only four dimensions. Indeed, we are faced with the following alternative:

- Either the charge is independent of the four known dimensions and thus cannot be expressed by the form $q = f_{(t,x,y,z)}$. It is then necessary to envisage a fifth dimension, independent of the others four. This new dimension is the charge, q. In this way, the universe variables would be t,x,y,z,q.
- Or, the charge is a function of four known dimensions and can be expressed by the form $q = f_{(t,x,y,z)}$. In this case, we can remain in these four well-known dimensions. All particles are then expressed with the four spacetime variables: t,x,y,z.

Except for the few years of his life when Einstein was interested in the Kaluza Theories, he believed the universe had only 4 dimensions. The previous demonstration shows that he was right. It is not necessary to add a fifth dimension to explain the charge.

The observation that the charge is nothing but differences in density of spacetime is in full agreement with Einstein's ideas.

This page left blank intentionally

7 Clarification

As the discussion stands now, the reader may take the following stance:

> *"This does not mean anything… When I take a hammer, I see that this hammer is made of matter, and not of the so-called polymorphic areas of high and low densities of spacetime…".*

This chapter is probably the most difficult to understand of the theory since it tries to explain to the reader that all the matter of the universe is made up of spacetime areas and that we are living in a virtual world. This is far from being obvious.

7.1 What we know

For the past 50 years, what we have known is particularly disconcerting:

1 - Inside the atom
It has been known for a long time that if the atom was one meter in diameter, the nucleus would have 100 microns and the electron less than one micron. Thus, if we eliminate all the vacuum of the atom (99.999%), the size of the human body would be reduced to a pinhead…

2 - Waves
In accordance with De Broglie, matter and waves are identical. Thus, the human body, at least the 0.001% that remains after all the vacuum is removed, would be nothing but waves…

3 - Energy
As we know, $E = mc^2$. So, this pinhead would be identical… to pure energy… We will further reconsider this equation in Part 4 "Electromagnetism".

To summarize, as we know, matter is made of:

- A vacuum: 99.999% (experimentations)
- Waves or matter-energy: 0.001% (De Broglie, Einstein, experimentations)

Under these circumstances, is it logical to continue considering matter as a physical concept?

Of course not. It is obvious that we can't continue to call "matter" something that is 99.999% vacuum and 0.001% waves or energy…

It would be more reasonable to consider that what we call “matter” is nothing but a virtual concept since a vacuum and waves don't exist in concrete terms. So, if a vacuum and waves are both virtual concepts, we are living in a virtual world.

Please, note that this is not a new idea. These conclusions were well known in the last century, in particular when Davisson and Germer demonstrated in 1927 that matter and waves are identical.

It seems that we have great difficulty accepting the idea that we are living in a virtual world made of two virtual elements:

1. A vacuum (99.999%)
2. and waves or energy (0.001%)

Note: *This enigma (99,999% of an object is a vacuum) is fully explained in Part 3 “Quarks and Antimatter”.*

7.2 The Spacetime Model contribution

The current theory doesn't change our point of view about objects, which are always made up of a vacuum (99.999%) and waves (0.001%). Nothing has changed and matter, or its counterpart waves, remains a virtual concept.

The Spacetime Model is a little more precise regarding the nature of waves (fig. 7-1).

So, the major difficulty doesn't arise from the Spacetime Model but from what we have known for 50 years: **99,999% of matter is made of a vacuum.**

We already know that gravity has its origin in spacetime. The Spacetime Model demonstrates that spacetime is also "curved" by EM and De Broglie Waves. The Spacetime Model simply extends the Einstein Concept to all components of the universe, stating that

All is spacetime

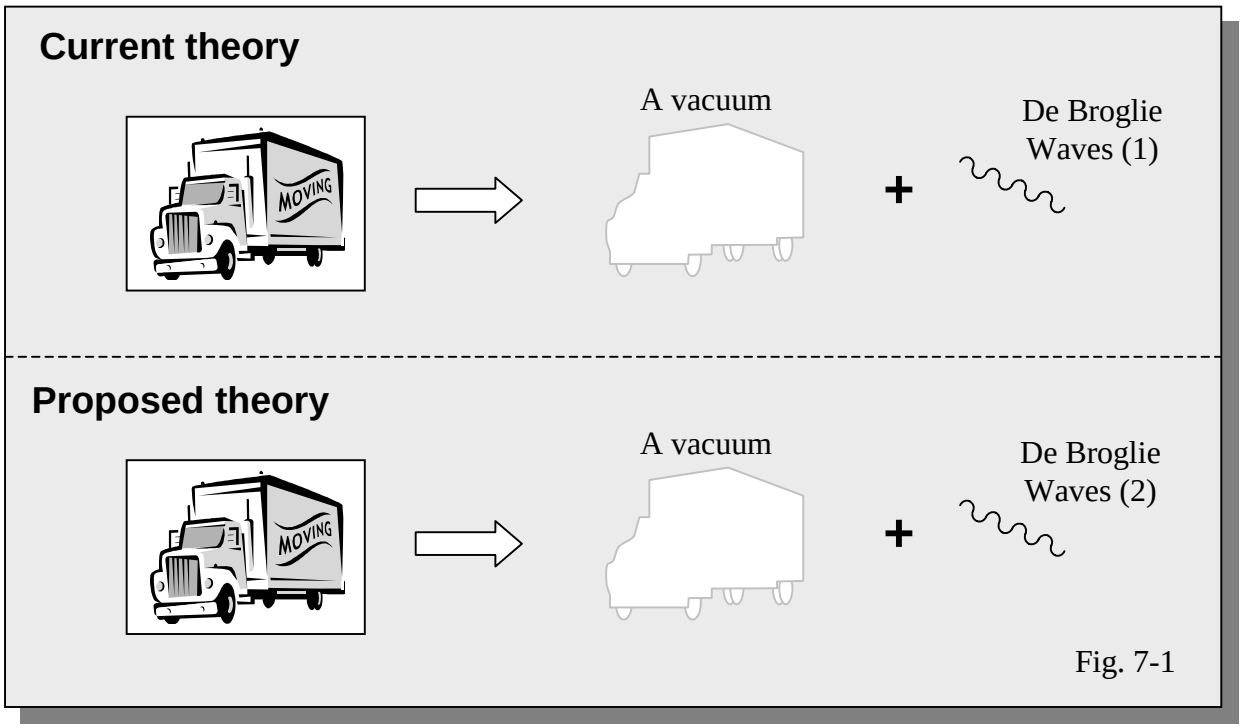


Fig. 7-1

(1) At the present time, no one knows exactly the constitution of De Broglie Waves
(2) The constitution of matter and many enigmas of quantum mechanics are fully explained if we consider that De Broglie and EM Waves are spacetime variations. This is the only contribution of this new theory.

7.3 Explanation

In reality, we must not think in terms of "matter" but in terms of "forces". Indeed, forces alone generate all forms of communication experienced in human life:

- Intelligence: chemical interactions in neurotransmitters and glial cells (Coulomb Force),
- Sound, music, speech… (vibrations of air),
- Heat (infra-red EM waves),
- Pain (electrical currents in the sensory nerves),
- Joy (hormones which are specific molecules issued from the Coulomb Force),
- Human power (electrical currents in the motor nerves),

…and what we call "matter" is:

- What we see: light, or EM waves,
- The weight of objects: gravitational force,
- The touch: Coulomb Forces between molecules.

Of course, all these forces are invisible, as those of two magnets, but they exist and must be taken into consideration in any explanation of what we call "matter".

7.4 Importance of forces in spacetime

Let's try to understand the importance of these forces in life. If we remove all these forces from the human body, what would remain?

- If all the EM force disappeared, we would not have any more light. We would be blind.
- Acoustic waves are propagated in the air by forces. If these forces did not exist, we could not hear noises, music, or speech.
- We know that nerves propagate electric potentials. If our hands were disconnected from our brain, we would not have any feelings (sensory nerves), or movements (motor nerves).
- But the chemical interactions between neurotransmitters and glial cells of our brain are Coulomb Forces. Thus, our brain would no longer function.
- Molecules are associations of atoms thanks to the Coulomb Force. Thus, the human body, life, and all the objects that surround us would not exist since there would be no association of atoms in molecules.
- Moreover the atoms themselves could not exist since it is still the Coulomb Force that maintains the electrons on their orbital. If we remove the Coulomb Force from the nucleus, what would become of the Schrödinger Equation?
- At last, nucleons are quarks associations thanks to the nuclear force.

Thus, if all of these forces did not exist, the universe would only be made of free electrons and positrons[1]. In other words, the universe would be made of areas of low and high densities of spacetime.

Finally, these polymorphic areas of spacetime that we call “matter”, that is to say atoms, which are made of a vacuum and waves or energy, have only a passive role to play in Nature. On earth, we encounter the same situation. For example, on a CD, it is not the material, or PVC, which is relevant, but the data or music registered on it, i.e. a virtual concept.

To summarize, we can say that **Nature = Forces**. Forces are a virtual concept produced by spacetime which, by various combinations, make up atoms, molecules, and finally the universe and life.

"As a magician makes us believe that an object is on our right whereas it is on our left, nature makes us believe that ***all is matter*** *whereas* ***all is forces produced by spacetime****."*

[1] We will confirm later, in Part 3 “Quarks and Antimatter”, that quarks are made up of positrons.

Complements

Predictions

According to paragraph 5.3, the neutrino could have a very slight charge.

Partitioning the theory

The five parts of the Spacetime Model can be downloaded at the following URL address:

Part 1 ..... Mass and gravity..... www.spacetime-model.com\mass.pdf
Part 2 ..... Constitution of Matter ..... www.spacetime-model.com\matter.pdf
Part 3 ..... Quarks and Antimatter ..... www.spacetime-model.com\quarks.pdf
Part 4 ..... Electromagnetism ..... www.spacetime-model.com\electromagnetism.pdf
Part 5 ..... Forces, the Universe ..... www.spacetime-model.com\forces.pdf

Part 1 - Mass and Gravity

Mass

In our world, mass and volume seem to be two different quantities because in atoms, the mass is not proportional to the volume. So, we have a large range of atoms with different mass and volume. However, at the particle level, mass = volume. In reality, we have five classes of volumes. The two main classes are:

1. **Closed volumes**. These volumes produce a displacement of spacetime. As we know, the spacetime curvature produces gravity, but it also produces a "mass effect". Electrons are examples of closed volumes. Indeed, electrons have a mass.
2. **Open volumes**. These volumes exist but do not produce any displacement of spacetime. If there is no curvature, there is no "mass effect" either. Orbitals in atoms are examples of open volumes. Indeed, orbitals are massless.

…/…

…/…

Each atom has a particular proportion of open and closed volume. This is why mass and volume seem to be two different quantities but this is an illusion. At the particle level, more exactly at the electron and positron level, mass equals volume. Composite particles, like mesons, are combinations of other classes of volumes.

Gravity

Contrary to a preconceived idea, spacetime is not curved by mass but by closed volume. This phenomenon is the same as when a ball is immersed into water: It is the volume of the ball, and not its mass, which produces the displacement of water.

A particle also produces a displacement of spacetime. Since spacetime is elastic (Einstein), the curvature of spacetime produces a pressure on volumes. This tends to bring them closer to each other. It means that gravity is not an attractive force between masses, but a pressure force on closed volumes.

Part 3 – Quarks and Antimatter

Quarks

This part demonstrates that we need two positrons to make three u quarks. A u quark with an electron becomes a d quark (please note that the rule of addition of fermions is covered in Part 4). This deduction, from the wave-particle duality and spacetime, has been extended to all particles. Finally, u quarks, d quarks, antiquarks, muons, antimuons, taus, mesons, baryons etc... can be made with only two basic particles: electrons and positrons.

Antimatter

From this discovery, we can deduce that antimatter is not located at the bottom of the universe but right before our eyes, embedded in u and d quarks.

A simple calculation demonstrates that any atom is made up of an equal number of electrons and positrons, exactly 2A, with A = atomic number. For example, the C12 is made of 24 electrons and 24 positrons, the latter being embedded in quarks.

The calculation is fully explained in this Part and is **100% accurate for all 2930 known isotopes**.

Part 4 - Electromagnetism

The mystery of the wave-particle duality solved in Part 2 leads to a full knowledge of electromagnetism. This phenomenon is quite simple to understand.

In short, when a charged particle is motionless, its electric field has a spherical symmetry. When it moves, it becomes a wave and its spherical symmetry disappears. Its 1D space is transformed into a 2D/3D space. A magnetic component (2D/3D) is added to the electric field (1D) of the particle.

This phenomenon is exactly what experimentation proves ($\Delta q/\Delta t$).

Part 5 - Forces, the Universe

Nuclear force

Electrons or positrons, which surround other particles as a spacetime wave, produce a recall force toward the center of the particle, like a rubber band. This force is nothing but the "strong nuclear force".

Unification of forces

This part unifies the three basic forces (gravity, electroweak and strong nuclear force) in two generic forces: the Coulomb Force and the Hooke Force.

The Universe

A suggestion regarding the creation of the universe is proposed. In reality, the Big-Bang Theory does not explain the “electron mystery" and this enigma is discussed. This Part offers two suggestions, much more credible than the “Big-Bang”, regarding the creation of the universe.

Contact

You can contact the author[1] by email at:

toe-author@orange.fr

or writing to:

M. Jacky JEROME
Editions Arts et Culture 42
4 square Kennedy
42120 LE COTEAU
(France)

[1] Note: The author is a physics hobbyist and does not work in an institutional establishment. The writing of the Spacetime Model has been done entirely on his own money and time, with no help from the scientific community. If you find some error in this document, please let him know.

Table of content