The Θ-Brane Theory: A canvas for the Universe

Formal essay in theoretical physics

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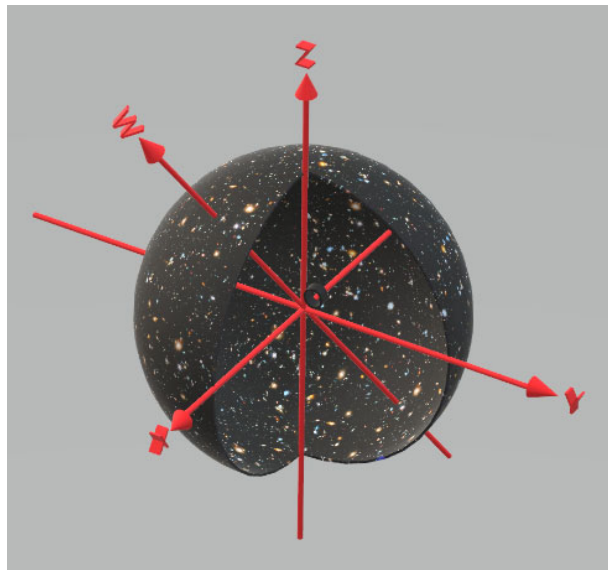
ABSTRACT

There is no need to carry out major surveys in the field to discover that modern physics is faced with dead ends both in the field of quantum physics and astrophysics, to name but a few. Some more rebellious physicists do not hesitate to speak of a crisis. No need to dwell on this subject for a long time, experts in the field will know what we are talking about here. So how to get out of it and evolve towards a promising new physics.

Some advocate rushing ahead, digging even deeper into existing theories, yet at the source of these impasses. The present theory proposes, on the contrary, to take an important step back and to question the controversial question of the historical and perhaps too rapid rejection of the notion of Aether, which has become a taboo subject with post-relativistic physics. This theory therefore puts this controversial notion back on the drawing board, but with a new approach where this Aether is quite different from the pre-relativist one; a solid Aether presenting no drag problems and which at the same time provides support for all matter and serves as a canvas for the Universe as a whole.

Furthermore, for all physicists and mathematicians who might be interested, this has the potential to pave the way for several promising new areas of research in particle physics, astrophysics, materials physics, wave mechanics, 3D and 4D geometry, complex systems of rotation in 3D and 4D, etc.



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1. Introduction

This document aims to present a new theory affecting both the world of particles and that of the Universe as a whole and which could in a way be described as a theory of everything. It will first and foremost state principles developed from thought experiments and supported, if necessary, by mathematical formulations, illustrations of principle and graphical representations.

The theory is based on 4 fundamental and relatively simple postulates enacted in the section 2.

This document must be seen as a formal essay in theoretical physics. For this reason, it is possible that certain stated principles will or may appear incomplete, controversial, or even unfounded. The idea here is not to have a perfect score on everything that is stated, but rather to put forward the most plausible ideas possible which can be supplemented, corrected or improved as needed.

Moreover, some of these principles have already been expressed in other theories. The idea here is to put it all together with the aim of making it a cohesive whole that would best answer various unresolved questions about the present subject.

This theory touches on a multitude of aspects of the world of the extremely small (particle physics) and the extremely large (astrophysics). For this reason, this document is relatively bulky in order to cover, in more or less details, most of these aspects.

Also note that some proposed validation experiments are cited in this document and are underlined on a shaded background like this.

2. The four basic postulates of the theory

So that the reader can get a quick idea of the text that will follow, this section presents, in a very summarized way, the 4 basic postulates of the theory. These postulates will be gradually founded and explained in the section 6 of this article.

❖ **Postulate 1: Everything is waves**

Everything that is measurable, observable, and likely to have energy or mass in the Universe is made up of waves or accumulation of waves. The basis of this postulate is explained in section 6.1.

❖ **Postulate 2: These waves exist in linear or orbital modes**

This theory categorizes these waves into 2 parts:

1. Linear waves or “L~” waves: Waves propagating in a straight line at *c* speed, such as electromagnetic waves (photons), gluons and the L~ component of neutrinos.
2. Orbital waves or “O~” waves: Waves propagating in an orbital way to form elementary particles (electron, quark, and their antiparticle), the O~ component of neutrino and possibly other exotic particles.

Note that in this theory, neutrinos are considered as a combination of L~ and O~ waves (see section 11 for more details).

The basis of this postulate is explained in section 6.2.

❖ **Postulate 3: These are mechanical waves propagating without any friction in a solid medium**

These L~ and O~ waves are mechanical waves propagating or fluctuating without any friction in a solid medium.

The basis of this postulate is explained in section 6.2.

❖ **Postulate 4: This solid medium, named Θ here, forms a 3-Brane supporting the entire Universe**

The basis of this postulate is explained in section 6.3.

These 4 postulates complement each other. They take on their full force when considered as a whole. In this way, they can explain many things, which would not be possible if they were taken individually. The following text will tell more.

3. Some variables and abbreviations

Here is a list of some abbreviations which will often appear in the text and which should therefore be defined at the start.

- Θ: Theta 3-Brane: a three-dimensional solid membrane that takes the shape of the curvature of the Universe (positive, null or negative curvature).
- Θ_0: The center point of Θ in the 4th dimension, if Θ has a positive curvature. Also, the place of the Big Bang.
- GR: General Relativity Theory.
- L~: Linear propagation waves (photons, gluons).
- O~: Orbital propagation waves (particles).
- P↑: Propagation axis of an L~ wave.
- R_Θ: Radius of the Universe or distance between Θ_0 and Θ (m).
- R↑: Radial axis starting at Θ_0 and passing through Θ at any reference point (see Fig. 6).
- r~: Radial wave oscillation mode i.e. perpendicular to Θ plus and minus the axis R↑ (towards the 4th dimension).
- S↕: Standing fluctuations generated by O~ waves (So↕ fluctuations) and L~ waves (Sl↕ fluctuations). This theory argues that these fluctuations are what modern physics calls quantum fluctuations.
- SR: Special Relativity Theory.
- t~: Tangential wave oscillation mode i.e. tangentially to Θ (in its 3 dimensions).

Note: L~ waves, O~ waves, So↕ and Sl↕ fluctuations can combine with r~ and t~ oscillation modes to form various possible waveforms (e.g.: photon: Lr~ wave, electron: Or~ wave).

4. The Θ-Brane and the Relativity theories

The bad foundations of Aether rejection; In 1905, the physicist Albert Einstein issued the theory of Special Relativity (SR) in which he defined that the laws of physics remain the same regardless of the reference frame in which the experiments are carried out or its speed relative to another reference frame. Implicitly, this meant that it was no longer required to have an absolute frame of reference, as Aether was envisioned at that time. Einstein also mentioned that the notion of Aether was not useful for demonstrating the law.

For many physicists, this became the ultimate argument allowing them to definitively set aside the principle of Aether, especially since at the time this principle was already controversial. Subsequently, Einstein achieved a new and great success with his theory of General Relativity (GR), which further confirmed physicists in their rejection of the notion of Aether. For them, the vacuum was totally empty, and an Aether was not required for the transport of electromagnetic waves.

However, it must be pointed out here that the SR theory has never demonstrated the non-existence of Aether. Thus, the principles of SR can apply whether or not there is an Aether.

On this subject, in 1986, in an interview by Paul Davies in "The Ghost in the Atom" [1], the eminent physicist John Bell suggested that the Lorentz contraction [2] is perfectly coherent, not inconsistent with relativity, and could produce an Aether theory perfectly consistent with the Michelson–Morley experiment [3]. Bell suggests the Aether was wrongly rejected on purely philosophical grounds: "*what is un-observable does not exist*". Einstein found the non-Aether theory simpler and more elegant, but Bell suggests that doesn't rule it out. Besides the arguments based on his interpretation of quantum mechanics, Bell also suggests resurrecting the Aether because it is a useful pedagogical device. That is, many problems are solved more easily by imagining the existence of an Aether.

Bell's assertion is very understandable because, in the Michelson and Morley experiment or its derivatives, one can argue that, one way or the other, none of these experiments will succeed in validating or invalidating the existence of any form of Aether, because the acquisition of the information required for the development of this experience involves the round trip of the light wave. This then nullifies any difference in measurement in one axis or the other, since what is gained by the speed of light in one direction is lost on its return, thus nullifying any difference.

But, despite that, physicists have ruled it out on the basis of Occam's Razor or even a principle of simplicity; physics has no reason to retain more complicated notions when a simpler notion manages to explain the phenomena. This appreciation could be valid at the time of the emission of the SR theory, but this theory does not explain all the phenomena in the Universe. Thus, other theories and subsequent discoveries forced to question the relevance of an Aether. Here are some examples, below.

Relevance of an Aether, first example, the GR; in 1915, the year in which Einstein emitted this theory in which he defined the concept of the space-time continuum that can be bent under the effect of gravity. This same "Continuum" implied a certain necessary cohesion of the Universe to precisely explain this continuity. Thus in 1920, in a speech at the University of Leiden, Einstein admitted that there could be a kind of Aether but that no substance or state of motion could be attributed to it [3]. At the end of his speech, he said:

> "*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*".

Relevance of an Aether, second example, quantum vacuum fluctuations; in 1948, based on quantum mechanics, developed by Werner Heisenberg, physicists Richard Feynman and Julian Seymour Schwinger laid the foundations of what was later called quantum vacuum fluctuations. The vacuum suddenly didn't seem as empty as it should have been. Subsequently, in 1951, in an article entitled "Is there an Aether?" published in the journal Nature, the eminent physicist Paul Dirac wrote [5]:

> "*Physical knowledge has advanced much since 1905, notably by the arrival of quantum mechanics, and the situation (about the scientific possibility of aether) has again changed. If one examines the question in the light of present day knowledge, one finds that the aether is no longer ruled out by relativity, and good reasons can now be advanced for postulating an aether... We have now the*

> *velocity at all points of space-time, playing a fundamental part in electrodynamics. It is natural to regard it as the velocity of some real physical thing. Thus with the new theory of electrodynamics (vacuum filled with virtual particles) we are rather forced to have an aether*".

In 2005, physicist Robert B. Laughlin added [6]:

> "*The word 'ether' has extremely negative connotations in theoretical physics because of its past association with opposition to relativity. This is unfortunate because, stripped of these connotations, it rather nicely captures the way most physicists actually think about the vacuum. . . . Relativity actually says nothing about the existence or nonexistence of matter pervading the universe, only that any such matter must have relativistic symmetry. [..] It turns out that such matter exists. About the time relativity was becoming accepted, studies of radioactivity began showing that the empty vacuum of space had spectroscopic structure similar to that of ordinary quantum solids and fluids. Subsequent studies with large particle accelerators have now led us to understand that space is more like a piece of window glass than ideal Newtonian emptiness. It is filled with 'stuff' that is normally transparent but can be made visible by hitting it sufficiently hard to knock out a part. The modern concept of the vacuum of space, confirmed every day by experiment, is a relativistic ether. But we do not call it this because it is taboo*".

Relevance of an Aether, third example, vacuum energy or dark energy; As early as 1915, in his GR theory, Einstein, who then believed in a static Universe, introduced into his equations a principle equivalent to vacuum energy which he then called "Cosmological constant". This constant was then to compensate for the gravitational effects and thus maintain the Universe in a static state. In 1929, astronomer Edwin Hubble demonstrated, through his observations of the redshift of distant galaxies [7], that the Universe was rather expanding. The cosmological constant was therefore larger than Einstein initially thought. He would then have called his inability to predict the idea of a dynamic Universe, as opposed to a static Universe, his biggest mistake.

In 1998, two independent projects, the High-Z Supernova Search Team [8] and the Supernova Cosmology Project [9], referring to stable and well-marked light sources such as type Ia supernovae, demonstrated that the Universe was not only expanding, but that this expansion was accelerating. The cosmological constant, and therefore the vacuum energy, was even stronger than expected. So, here again, a curious phenomenon for something called "vacuum".

Also in 1998, physicists Robert R. Caldwell, Rahul Dave and Paul Steinhardt introduced the term "Quintessence", a scalar field, to qualify this vacuum energy [10]. It is ironic here to say the least that the term "quintessence" (from the Latin "quinta essential", literally "fifth essence") was originally the Latin expression for the fifth element, which Aristotle assumed and called Aether...

Towards a rehabilitation of the Aether? Following this analysis of certain post-relativistic discoveries, let us return to the period just after the SR when the notion of Aether was discarded and ask ourselves the following question: Would this notion have been discarded so quickly if physicists had then known the subsequent discoveries of vacuum quantum fluctuations or vacuum energy? We can reasonably think not, and that the Aether would then have been renewed with a new vision and orientation, at least by a significant part of physicists.

So why, following these considerations, is Aether not seriously reconsidered today and why part of the research efforts are not devoted to it? Is it for physicists a fear of having to reconsider a position anchored for many years, of being excluded from the train of research currently in motion, of being ostracized by their colleagues? Perhaps all this at the same time, but we should know that physics is not at the service of physicists but rather the opposite. So, if this notion of Aether is plausible, it should be considered!

In what follows, a new concept of Aether will be introduced that can respond to the various knowledge acquired since 1905. Thus, like any good Aether, it will ensure the support of electromagnetic waves, but also the support and movement without drags of particles and the material objects they form. And ultimately, this new Aether will give a well-defined structure and cohesion to the Universe in a larger 4D space. This Aether will thus be above and primordial to everything, even to the Universe itself. So don't stop reading here if you want to know how this is possible.

5. The impasses of modern physics

According to the present theory, modern physics, by denying the existence of any form of Aether, has placed itself in an impasse. This has not prevented it from making tremendous progress in many areas, but on certain points of view it remains blocked.

In an attempt to get out of it, without having to back down and take another path, physicists have put forward the string theory which remains, however, at present very controversial. This controversy comes mainly from the high number of its free variables, its dimensions (up to 26) and the extremely high number of its possible solutions ($\sim 10^{500}$ according to the physicist Peter Woit, [11]) making this theory practically impossible to predict anything.

To get out of this impasse, the present theory argues that modern physics must go back on the principle of non-existence of any form of Aether until the period of emission of relativistic theories (1905 to 1915) and resume from there by integrating the form of solid Aether described in the present theory.

To illustrate one of the effects of this impasse, let us take the example of the matter-antimatter asymmetry. Why does modern physics fail to explain this fundamental notion of the creation of the Universe? By integrating the notion of solid Aether in a well-defined framework, the present theory easily manages to explain this asymmetry (see section 13).

These new notions then lead, or have the potential to lead, to a host of other simpler explanations of phenomena not explained or difficult to explain by modern physics.

Compared to string theory, this theory uses only one dimension of space more than our current 3D world. Moreover, by considering electrical and magnetic phenomena as mechanical phenomena, this theory only needs 3 fundamental units:

- time (scalar unit)
- length (vector unit in 4D space)
- energy (scalar unit)

Note: the force could also be considered instead of the energy, but this one requires a direction (vector), therefore less elementary than the energy which is a scalar.

Modern physics mentions various energy fields which act without any support in absolute vacuum. This theory argues that these fields cannot exist in absolute vacuum, because by its very nature, vacuum is nothing and therefore cannot support these fields. The support medium Θ presented here provides this support. Here is a list of these main fields:

- Electric field (section 14.1)
- Magnetic field (section 14.2)
- Gravitational field (section 15)
- Higgs field (section 10.3)
- The Quintessence (section 17)
- Quantum vacuum fluctuations (section 11)

Finally, it is through the multiple and relatively simple explanations provided that this theory takes on its full meaning and more coherently reframes the understanding of the Universe, somewhat in the way that he did, in its time, Copernicus with his model of the heliocentric solar system, even if this system was not entirely perfect in the sense that it put the sun at the center of the Universe [12].

Thus, the present theory brings explanations or offers an interesting potential of explanations to several phenomena such as:

- Well-defined limits and coherence for a finite Universe (section 6.3)
- Velocity near *c* and mass of the neutrino (section 11)
- Neutrino and antineutrino chirality (section 10.3)
- Particle mass acquisition (section 6.1 and 10)
- Formation of elementary particles (section 6.1 and 10)
- Reason for the color charge of quarks (section 10.7)
- Matter-antimatter asymmetry (section 13)
- Gravitational force (section 15)
- Galactic halo concentration problem (section 15)
- Reason for Big Bang and cosmic inflation that followed it (section 0)
- Reason for the accelerated expansion of the Universe (section 0)
- Possible explanations for dark matter (section 10.10 and 17)
- Instant quantum information transfer (section 20.1)

The possibility for this theory to be able to bring so many explanations or possibilities of explanations cannot be simply the result of chance. There is really something there that needs to be seriously analyzed in order to better understand the laws and phenomena that govern our Universe.

The Θ-Brane has only one thing in common with Luminiferous Aether: a mechanical propagation medium for L~ waves. It is different from Luminiferous Aether on several points:

Luminiferous Aether	Θ
Fluid or solid	Isotropic solid
Drag problem	No drag problem
Content in the Universe	Universe support
Subsequent to the Universe	Prior to the Universe
1 possible mode of wave propagation	Possibility for 2 modes and 2 sub-modes of waves
Only supports L~ waves	Supports L~ and O~ waves

6. The foundations of the 4 postulates of the theory

6.1 Extension of the Breit-Wheeler Process; The basis of the 1st and 2nd Postulate

In 1934, physicists Gregory Breit and John A. Wheeler theoretically described a process by which an electron-positron pair is created from the collision of two photons [13] (see Fig. 1). Due to the very high energy levels required for photons (gamma rays), this process has long been difficult to demonstrate. However, in an article published in August 2021, a group of researchers from the "STAR collaboration" project explains that they have experimentally demonstrated the process [14].

In this document, we are going to focus more precisely on the detail of the process by which 2 photons manage to form an electron-positron pair, i.e. at the place circled in red in the Fig. 1. The Breit-Wheeler process does not indicate anything specific to this effect; the positron-electron pair is simply formed spontaneously without further details.

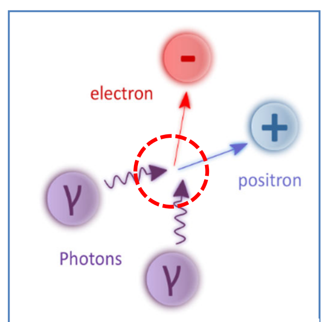


Fig. 1: Scheme of formation of an electron-positron pair according to the Breit-Wheeler

This theory argues that this formation process takes place rather by a smooth transition, in wave form, from photons to electron-positron. This process is illustrated in the Fig. 2 and explained in more detail in the following.

To be able to get an idea of what is happening there, we will position ourselves at the energy center of the 2 photons moving towards each other. In this situation, the 2 photons will move towards us with each an energy equivalent to half of their energy sum. We put forward here the realistic hypothesis that it is very unlikely that these 2 photons are directed exactly at each other. We can certainly imagine a shift in trajectory that will make them pass very close to each other. Thus, during their passage close to each other, we put forward the hypothesis that these 2 photons will interfere together, which will cause them to deviate and enter into rotation around each other. This is illustrated in Fig. 2.

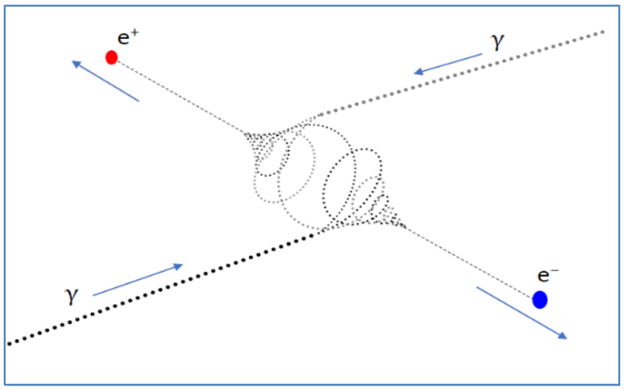


Fig. 2: Diagram of electron-positron pair formation where photon ripples are transmitted to electron-positron.

If the 2 photons are not energetic enough to form an electron-positron pair, this deflection movement will not be large enough to continue and cause the 2 photons to collapse on each other. There will then simply be a deviation of the 2 photons which will then resume their course with the same energy. If the 2 photons are sufficiently energetic, the deviation will continue, which will cause the photons to rotate around each other.

At this time, a process still to be defined will cause the two photons to start separating into two half-photons each. It is difficult to explain the exact nature of this process leading to this separation into two parts of the photons. However, this theory advances the following hypothesis:

1. The photons would each have a linear polarization. This polarization would be the result of the vector sum, equally, of a right circular polarization and a left circular polarization (see Fig. 3).
2. At the beginning of the rotation of the photons around each other, these circular polarizations would be affected differently by the gyroscopic force which would force, according to the representation in Fig. 4, the right circular polarization to deviate to the right and the left circular polarization to deviate to the left.
3. Following this process, the half-photons of the same polarization of each initial photon would gradually rotate around each other, one group to the right and another to the left according to the initial rotation axis of the photons.
4. Each group of these half-photons would end up associating together in the same rotational movement: according to the Fig. 4, the right rotation would go to the right and the left rotation would go to the left.
5. The two groups would then gradually collapse on themselves to move towards the formation of 2 small particles as illustrated in the Fig. 2.

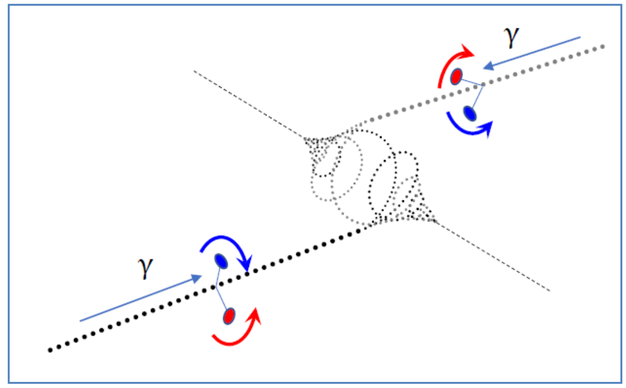


Fig. 3: Diagram illustrating the polarization of photons before the formation of the electron-positron pair.

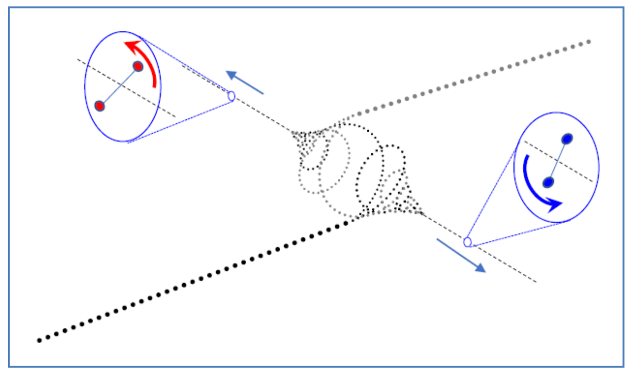


Fig. 4: Diagram illustrating the rotation of the waves in the electron-positron after the formation of the pair

This theory suggests that this process can also apply to 2 gluons rather than 2 photons. This process will then lead to the emission of 2 neutrinos. This is discussed further in section 10.3.

However, the process described previously do not explain how it manages to induce the collapse previously mentioned and how the electric charge to the particles being formed. This will be covered in the section 10.4.

Obviously, this whole process remains hypothetical, as are many other theories or hypotheses such as the one put forward in 1934 by Breit and Wheeler. However, such hypotheses must be made in order to enrich the discussions and possibly lead to a better understanding of the phenomena. This also makes it possible to start imagining experiments that may allow them to be verified, in whole or in part.

In the process as described above, the wave motion of each photon is separated into 2 parts which will then recombine in some way to form the electron-positron. Thus, it is quite reasonable to suggest that this linear wave motion of the photons will translate into orbital wave motion in the electron-positron formed. In this way, this article argues that electrons and positrons are actually formed of electromagnetic waves or parts of waves propagating tightly around these particles.

One can then reasonably ask whether this principle of orbital waves forming the elementary particles that are the electrons and the positrons could also apply, by extension, to the other elementary particles that are the quarks. This article argues that this is the case and consequently, all matter consists of electromagnetic waves propagating in an orbital way in the elementary particles constituting it. This is discussed further in section 10.

This then leads us to the first postulate of the Θ-Brane theory:

❖ **Postulate 1:** **Everything is waves**

Note that this extension of the Breit-Wheeler process will be taken a little further to the section 10 where the photons will be replaced by gluons and where this will lead to the formation of a pair of charged leptons and the associated neutrino-antineutrino. We will then see the reason for the right chirality of antineutrinos and the left chirality of neutrinos.

According to the previous hypotheses, it can also be said that these waves propagate linearly (L~ waves) or orbitally around the center of the particles (O~ waves). This is discussed further in sections 7, 9 and 10.

This then leads us to the 2nd postulate of this theory:

❖ **Postulate 2:** **These waves exist in linear or orbital modes**

6.2 The solid Aether evoked by Young and Fresnel; The basis of the 3rd Postulate

We are now coming back some 200 years, around 1820. At that time, the notion of Aether was widely conveyed and studied by several physicists. Among them, Thomas Young and Augustin Fresnel argued that, to properly respond to the characteristics of light waves, it was preferable to consider that these were transverse waves traveling in the Aether [15]. This then implied that the Aether must be solid, because in classical mechanics only solids can allow the propagation of this type of wave.

However, the drag's problem of massive objects in Aether remained just as difficult to solve whether it was gaseous or solid. With the postulate explained in section 6.1 to the effect that everything is only waves, including matter, this problem is entirely removed if we consider that this solid Aether is without any friction for the passage of waves.

This then leads us to the 3rd postulate of this theory:

❖ **Postulate 3:** **These are mechanical waves propagating without any friction in a solid medium**

6.3 A framework for Friedmann's universes; The basis of the 4th Postulate

In 1922 and 1924, the physicist Alexander Friedmann published a series of equations based on the Minkowski metric and which made it possible to answer the 3 possible models of curvature of the Universe according to the GR theory. These 3 models refer respectively to a negative, zero or positive curvature of the Universe [16][17].

The present theory is compatible with these 3 curvature models. However, the hypothesis of a Universe with positive curvature is favored here for two main reasons. First, it makes it possible to provide an explanation for the matter-antimatter asymmetry, which is not possible with the other models with zero or negative curvature (see section 13). Second, with such a curved Universe, it is possible to conceive of a greater force of expansion in the initial phase of the inflationary period following the Big Bang (see section 0).

However, the current dominant position of cosmologists is that the Universe is flat, therefore with zero curvature. However, there are a few articles published in 2019 that question this flatness of the Universe [18][19][20]. Subsequent papers, however, reaffirmed that the Universe is flat [21][22].

It should be noted that the assertion of the value of the curvature of the Universe is based on the part that we can observe, called the horizon of observation. It cannot therefore be excluded that beyond this horizon, the Universe has a non-zero curvature. Thus, the common point of these apparent contradictions mentioned above would be that the Universe would indeed have positive curvature, therefore closed, but would be extremely large so that the observable part would indeed appear flat to us. However, the debate remains open on this subject.

For now, consider the case of a Universe with positive curvature. Such a Universe by closing in on itself takes the form of a 3-sphere or even a sphere of dimension 4. Thus, the surface of such a sphere has in fact 3 dimensions, hence the presence of the number 3 before the term sphere. In mathematics, these spheres of dimension higher than 2-sphere (the sphere of the 3D world) are called hypersphere. For purposes of simplification of the text in what follows, the prefix "hyper" will be considered as the addition of one dimension compared to the properties of the 2-sphere, that is to say the 3-dimensional sphere of our 3D world. Thus, this 3-sphere becomes a hypersphere and its surface becomes a hypersurface with 3 dimensions.

Our brain cannot represent a hypersphere as it really is. We have to go through simplified representations generally one dimension less like, for example, a ring could represent a sphere. Fig. 5 is an example of such a simplified representation. The mauve surface is effectively 3 dimensional and all of its points are equidistant from the center of the hypersurface indicated by a "0" in this figure. Thus, this hypersurface has zero thickness in the direction of the R↑ axis (see Fig. 6).

It is important to remember this, because this simplified representation, with one less dimension, will be repeated several times in this document.

In the Universe with positive curvature evoked by Friedmann, the mauve hypersurface of Fig. 5 represents the place where the Universe resides. In GR theory, this hypersurface refers to space-time, also called the space-time continuum. The present theory posits that this hypersurface is the same solid medium mentioned in section 6.2.

The presence of the Θ membrane then makes it possible to ensure the cohesion of this Universe in this larger 4D space. Indeed, according to this representation, the thickness of the Universe in the direction of this 4th dimension is zero. This is why Θ becomes necessary to ensure its cohesion. At the same time, this medium, as seen in section 6.2, serves as a support for waves and matter while confining them within its 3 dimensions.

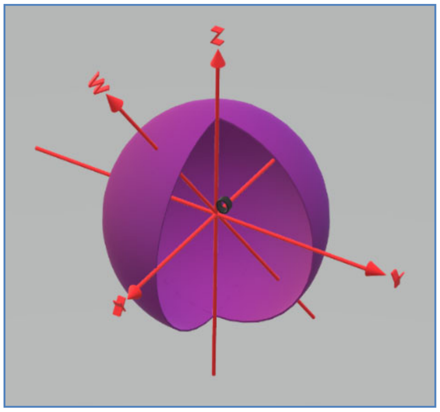


Fig. 5: Illustration with one dimension less than a hypersphere. The mauve surface has in fact 3 dimensions. The 4 axes represented by X, Y, Z and W are all perpendicular to each other and all cross at 90° the mauve surface.

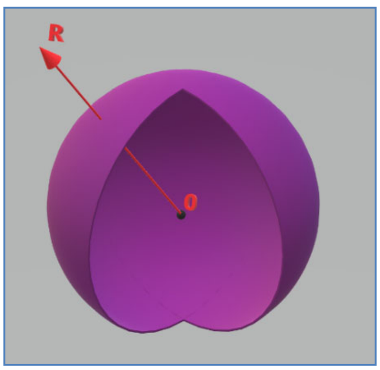


Fig. 6: Illustration of the R axis in the hypersphere Θ

In this document, this medium or 3-brane is designated by the Greek letter Theta (Θ) for the following reasons:

- Theta begins with "T" as "Tri-Spherical Brane", or as "Tout" in "Théorie du Tout" ("Theory of Everything" in French),
- The Theta symbol has a round shape symbolizing the hyperspherical shape of this medium,
- Theta sounds a bit like "Aether" to symbolize the solid Aether proposed in this theory.

This then leads us to the 4th postulate of this theory:

❖ **Postulate 4: This solid medium, named Θ here, forms a 3-Brane supporting the entire Universe.**

7. Wave propagation modes with Θ

Mechanical waves in or on the volume or the hypersurface of Θ can exist. These waves propagate according to 2 modes:

Linear waves or L~ waves: Waves propagating in a straight line such as electromagnetic waves (photons), gluons and the L~ component of neutrinos (see section 9 and for more details).

Orbital waves or O~ waves: Waves propagating in an orbital way to form elementary particles (electron, quark, and their antiparticle), the O~ component of neutrinos and possibly other exotic particles (see section 10 for more details). This theory argues that these waves play an important role in the formation of particle spin.

Note that in this theory, neutrinos are considered as a combination of L~ and O~ waves (see section 11 for more details).

Moreover, this theory suggests that the L~ and O~ waves extend laterally according to a decreasing pattern like $1/d$ for L~ waves and $1/d^2$ for O~ waves, while moving away from the center of emission of these waves. These lateral O~ and L~ waves by meeting in opposite or quasi-opposite directions will locally create stationary or quasi-stationary ripples, called here S↕ fluctuations.

In addition to these modes of propagation, these types of waves and fluctuations can oscillate in 2 possible ways:

- **Along the R↑ axis:** the oscillation takes place towards the 4th dimension, plus and minus the hypersurface Θ. This type of oscillation is the source of electric charges and electromagnetic waves. In what follows, these waves will be designated by the letter "r" as a subscript.
- **In the hypersurface Θ:** the oscillation occurs along any axis limited to the 3D volume of the hypersurface Θ. The oscillation is therefore transverse or even perpendicular to the R↑ axis. This type of oscillation is at the origin of neutral waves such as neutrinos. In what follows, these waves will be designated by the letter "t", for transverse, as a subscript.

8. Physical characteristics of Θ

8.1 Summary

This section will present a summary of the main characteristics that Θ must have in order to be able to play its role of supporting waves and the Universe:

- **An isotropic 3-dimensional solid** with the same curvature as that of the Universe.
- **A mechanical stiffness in two forms:**
  - Shear stiffness (G_Θ, unit: N/m²): This stiffness is the equivalent of the shear modulus in mechanics of materials. It acts mainly on a small scale in the process of wave propagation and particle formation.
  - Elastic stiffness (K_Θ, unit: N/m²): This stiffness is the equivalent of bulk modulus in mechanics of materials. It acts mainly on a large scale in the process of cosmic inflation and accelerated expansion of the Universe.
- **An inertia** (I_Θ, unit: kg): This inertia is the equivalent of mass in inertial processes. However, unlike mass which has a rest energy equivalent to $m\,c^2$, this inertia has no rest energy. Its only energy is that associated with its displacement according to the formula $m\,v^2/2$. This inertia plays a role in the wave propagation process and in the attribution of mass to the particles.
- **A total absence of friction:** In its processes of exchange of potential and kinetic energy in the propagation of waves or in the expansion of the Universe, Θ presents no friction.

This makes it possible, among other things, to maintain the internal energy of particles and wave packets such as the photon.

- **A capacity for instantaneous transmission of quantum information:** The characteristic described here remains, for the moment, highly hypothetical and aims to respond to the very specific particularities of quantum mechanics, particularly with regard to the apparently instantaneous transmission of quantum information between 2 entangled particles.

  Thus, the present theory advances that the hyper-membrane Θ would be able to support, via its internal structure, and this instantaneously, the transmission of information or quantum state of the wave function of a particle or two entangled particles. This point is discussed in more detail in section 20.1.

8.2 Mechanism of wave propagation in Θ

This section will deal with the way in which these characteristics of Θ intervene in the process of wave propagation and in that of the expansion of the Universe.

Before attempting to understand the mechanism involved in wave propagation in Θ, it is first necessary to understand this mechanism in known solid materials. In these materials, these waves are called "sound waves" or simply "sound".

In any solid medium, the speed of propagation of waves depends on their mode of oscillation [23]. When the oscillations are perpendicular to the axis of propagation, which are called shear waves or secondary waves (Shear waves or S waves in seismology), the speed c_S of the waves is given by:

$$c_S = \sqrt{\frac{G}{\rho}} \tag{1}$$

where: G is the shear modulus of the solid medium (N/m² or Pa)
ρ is the bulk density of the solid medium (kg/m³)

When the oscillations are in the direction of the axis of propagation, which are called pressure waves (Pressure waves or P waves in seismology), the speed c_P of the waves is given by:

$$c_P = \sqrt{\frac{K + \frac{4}{3}G}{\rho}} \tag{2}$$

where: K is the bulk modulus of the medium (N/m² or Pa)

Since the modulus K is always positive, the speed c_P is always greater than the speed c_S. Typically, c_S is about 60% of c_P.

In Θ, the equivalent of these sound waves are electromagnetic waves (Lr~ waves or photons), gluons (a mix of Lr~ and Lt~ waves) and the Lt~ component of neutrinos. These waves or particles are then mechanical waves of oscillation of Θ. So, in Θ, the speed of sound is the speed of light c (299 792 458 m/s). When we know that the fastest sound speed in known materials is in diamond with 12 000 m/s (pressure wave), we understand how much the Θ membrane is different from known materials.

Moreover, only one speed of sound exists in Θ, that of light. There is therefore no 2nd possible speed of wave propagation as explained above for known usual solid materials. So, how to explain this difference in behavior on this subject between Θ and the usual solid materials? This is analyzed in the following.

For Θ to be able to play its role of supporting L~ and O~ waves and also the Universe as a whole, the present theory stipulates that this hyper-membrane must have two moduli of stiffness, as in usual solid materials:

- A shear modulus (G_Θ, unit: N/m²): this modulus acts on a small scale in terms of wave propagation and particle formation.
- A bulk modulus (K_Θ, unit: N/m²): this modulus acts on a large scale in the process of cosmic inflation and the accelerated expansion of the Universe.

Despite these similarities, how explain that Θ has only one sound propagation speed, the speed of light? Here are some hypotheses about that.

First, the modulus K_Θ would be significantly lower than the modulus G_Θ, i.e. by more than ten orders of magnitude such that it would have a negligible influence on the speed of wave propagation. Despite this, the previous formulas for c_S and c_P show that if K_Θ tends to 0, there remains a ratio of $2/\sqrt{3}$ between these 2 speeds ($c_P = \frac{2}{\sqrt{3}} c_S \cong 1{,}155\ c_S$).

This situation could lead us to think that this is a proof of the non-existence of Θ. However, this difference in behavior is not sufficient to establish such a proof if we consider that, concerning wave propagation, Θ does not behave quite like conventional materials. This is explained in the following.

To explain this difference, we must first understand the process that leads to wave propagation in common solid materials. In this process, at equivalent mass density, the speed of propagation is influenced upwards by the intensity of the restoring force of the structure of the material during the passage of the wave. This force depends on the modulus of stiffness involved in the material.

Fig.7 illustrates this process. It represents the internal structures of a material through which sound waves pass. These figures do not necessarily represent all the possible structures of materials, but they are nevertheless sufficient to explain the principles involved in the process of wave propagation.

In these figures, the red color indicates compression forces and the blue color, stretching forces. The fuchsia dotted arrows indicate the restoring forces at stake in the material. The black dotted arrows indicate the direction of wave propagation. The opposite direction of propagation is also possible.

We see here that it is the stretching/compressive strengths of the internal structures of the material that are involved in this process.

In the case of shear waves, the figure shows 4 lines of force in stretching/compression whereas for pressure waves, the figure shows 8. For shear waves, it is considered that the deformation is small and therefore that the elongation of the side green lines remain negligible.

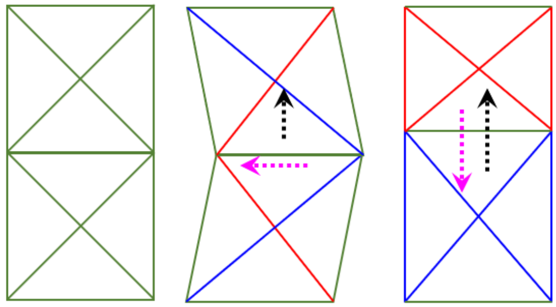


Fig.7: Compressive and stretching forces in a common material when sound waves pass.

The restoring force for pressure waves is therefore greater, which explains in a simple way why pressure waves move faster than shear waves.

What about now in Θ? First, it must be understood that in Θ, the context of wave propagation is, on certain points, different from what happens in usual materials. In Θ, there can be oscillations which occur towards the 4th dimension, i.e. plus and minus the R↑ axis. This is the case of the photon oscillation mode. In the usual materials, the oscillations are limited to the 3 dimensions of Θ.

In order for this oscillation towards the 4th dimension to take place, Θ must have a characteristic that allows the restoring force in this mode of oscillation. The present theory argues that for this, the shear modulus of Θ is in fact a modulus of stiffness to the angular deformation of its internal structures. This module would thus act during a deformation of Θ towards the 4th dimension.

Fig. 8 illustrates the principle. The distance d indicates the deformation towards the 4th dimension. The restoring force is then proportional to the tangent of the deformation angle and therefore to the distance d shown in the figure.

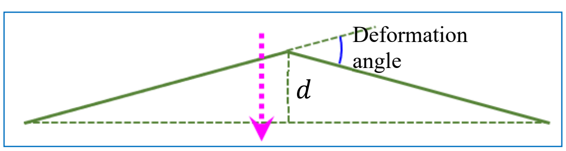


Fig. 8: Restoring forces as a function of deformation angle.

In this document, this angular stiffness modulus is denoted $G_{A\Theta}$ (unit: N/m²).

This angular stiffness modulus is also required in the particle formation process (see section 6.1 and 10). It also makes it possible to ensure that Θ has the stiffness required not to be crumpled by its internal expansion forces during the phases of cosmic inflation and accelerated expansion of the Universe (see section 0). This crumpling can be imaged, with one less dimension, by the crumpling of a cloth subjected to incoming pressure.

Another different point to consider concerning Θ compared to usual materials is the fact that in Θ, the wave propagation is done by packets. This is not the case with the usual materials in which the waves will rather propagate according to a pattern which gradually spreads out.

This propagation by packet in Θ will ensure that it is essentially the shear modulus which intervenes there in the process of wave propagation. Such propagation by packets involves local curvatures of Θ along 3 deformation axes perpendicular to each other. These curvatures necessarily imply the angular stiffness modulus.

Fig. 9 illustrate the points stated above. There are 3 possible deformation modes of Θ:

- 2 deformation modes perpendicular to R↑, named here tangential modes t1~ and t2~
- 1 deformation mode parallel to R↑, named here radial mode r~

Note: these modes are described in more details in section 9 and 10.

In the diagrams of Fig. 9, the red color indicates compression forces in the angles and the blue color, stretching forces. The fuchsia dotted arrows indicate the restoring forces at stake in Θ. The black dotted arrows indicate the direction of wave propagation. The opposite direction of propagation is also possible.

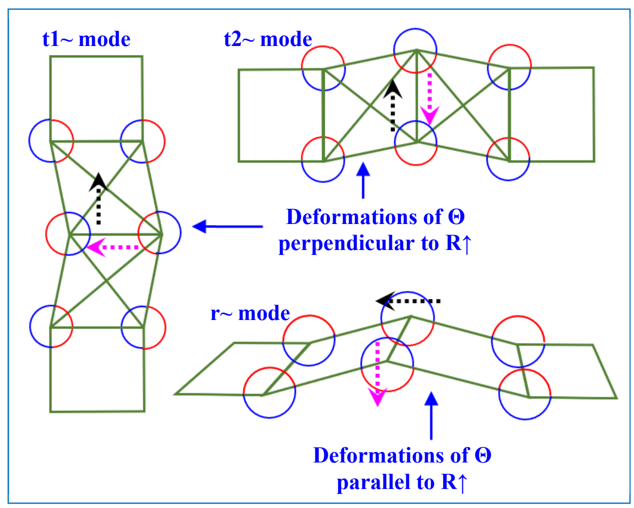


Fig. 9: Restoring forces as a function of the angle of deformation according to 3 possible modes of propagation

We can see in these figures, that for the 3 propagation modes illustrated, there are 6 angular compression forces (red color) and 6 angular stretching forces (blue color). Thus, the restoring forces are the same in these 3 modes and therefore the speed of propagation of the waves is the same there.

We can also note in these figures that the green lines are slightly stretched or compressed. Thus, due to their bulk modulus K_{Θ}, these lines would cause an additional restoring force which would increase with the angle of the deformation.

However, as mentioned before, the K_{Θ} modulus would be more than ten orders of magnitude less than the $G_{A\Theta}$ modulus, such that this additional force would be negligible. So, considering the negligibility of the effect of K_{Θ}, the formula for the speed of sound in Θ, or yet the speed of light, for r~ and t~ modes, is given by:

$$c_\Theta = c = \sqrt{\frac{G_{A\Theta}}{\rho_\Theta}} \tag{3}$$

Without wanting to go into too many details about the possible effect of the modulus K_Θ, we can all the same argue here that this could make the "vacuum" very slightly dispersive. The reason is that the effect of the K_Θ modulus is not proportional to the effect of the $G_{A\Theta}$ modulus when the frequency or amplitude of oscillation changes. Thus, the effect of the modulus K_Θ is relatively less when the frequency or amplitude of oscillation is less. This would then have the effect of causing c to vary very slightly upwards with frequency.

However, these differences explained here would be below the accuracy of current measurements of the speed of light. High-accuracy experiments measuring c at very low and very high frequencies might be able to bring out this difference.

Moreover, the effect of the modulus K_Θ being less in the r~ propagation mode compared to the t~ mode, it can be argued that the t~ waves would propagate very slightly faster than the r~ waves with the increase in frequency.

In support of this last aspect, this theory points to the arrival of the neutrinos emitted by the supernova 1987A event a few hours before the arrival of the photons. Although this shift has been explained in a few subsequent studies [24][25], the present theory suggests that it cannot be excluded that part of this advance is attributable to this possibility of a slightly higher speed of neutrinos on photons as previously described.

Another thing to consider in this possible effect of the modulus K_Θ is the fact that this modulus is not constant, but varies according to the elongation of Θ. It is thus strongly negative at low elongation and then gradually increases with the elongation of Θ until it becomes positive at greater elongation. This is discussed in more details in section 0. This variable characteristic of the modulus K_Θ will thus further complicate the evaluation of its effect, however small, on the speed of wave propagation in Θ.

Finally, it should be mentioned that the moduli K_Θ and $G_{A\Theta}$ will increase with the density of Θ, but less rapidly than this density. This will then have the effect of slowing down c with the increase in the density of Θ. This is discussed in more detail in section 18.

8.3 Inertia of Θ

We are now going to examine another particular characteristic of Θ, namely its inertia. Mass and inertia are both expressed in terms of kilogram (kg). However, inertia has no energy at rest as mass would have according to the formula $E = mc^2$. The only energy of inertia is that defined by the kinetic energy formula $E = iv^2/2$ where i is the inertia of a section of Θ and v is its speed of movement.

It is normal that Θ has no mass because it itself determines the speed of light which in turn defines the energy of mass. Θ thus being prior to mass energy, it cannot therefore possess one. However, Θ must have inertia because this property is essential to ensure wave propagation. It is via this inertia, and the particle formation process explained in section 6.1 and 10, that the energy then concentrated in the particles can assign them a mass according to the formula $E = mc^2$.

The kinetic energy of a section of Θ is given by:

$$Ec_{s\Theta} = \frac{1}{2}\rho_\Theta\, V_{s\Theta}\, {v_{s\Theta}}^2 \tag{4}$$

where: $Ec_{s\Theta}$ is the kinetic energy of the section of Θ (N-m or J)
ρ_Θ is the inertial density of Θ (kg/m³)
$V_{s\Theta}$ is the volume of the displaced section (m³)
$v_{s\Theta}$ is the speed of movement of the section (m/s)

In addition to kinetic energy, Θ can accumulate potential energy due to its angular deformation. The potential energy of a section of Θ is given by (with all reserve):

$$Ep_{s\Theta} = \frac{1}{2}G_{A\Theta}\, V_{s\Theta}\, \sigma_{s\Theta}\, D_{s\Theta} \tag{5}$$

where: $Ep_{s\Theta}$ is the potential energy of the section of Θ (N-m or J)
$\sigma_{s\Theta}$ is the second derivative of the profile of the section of Θ (1/m)
$D_{s\Theta}$ is the displacement of the section relative to its zero-energy position (m)

The preceding formula is made with all reserve because it introduces a notion of second derivative on Θ or a notion of curvature. As this curvature can vary according to the angle of observation, it would probably be necessary to introduce here a formula with tensors. The author of these lines willingly leaves this to experts in this type of calculation, who will kindly pay attention to it.

The phenomenon of wave propagation occurs when, in the wave, there is an exchange of energy between the kinetic energy and the potential energy of the sections of Θ affected by the ripple. The maximal values of energies $Ec_{s\Theta}$ and $Ep_{s\Theta}$ are then the same. The speed of this exchange is twice the frequency of the wave (wave function raised squared).

8.4 Inertia and absence of friction of Θ

To allow wave propagation without any damping, Θ has no friction. Thus, in the wave, the oscillation between kinetic energy and potential energy is done without any loss of energy.

9. The L~ waves

9.1 Summary

According to the present theory, the linear waves or L~ waves circulate in Θ at the speed c according to 2 modes of oscillation:

- Radial mode (r~ oscillation mode): the oscillation takes place perpendicular to Θ (plus and minus the R↑ axis) and therefore necessarily also perpendicular to the P↑ propagation axis.
- Tangential mode (t~ oscillation mode): the oscillation takes place:
  - tangentially either in the 3D volume of Θ or, in other words, perpendicular to the R↑ axis.
  - perpendicular or parallel to the axis of propagation P↑.

For these 2 modes of oscillation, it is the angular stiffness modulus, which is at stake, as explained in section 8.2.

According to this theory:

- The photons (electromagnetic wave) oscillate according to the r~ mode (Lr~ waves).
- Neutrinos oscillate according to the t~ mode (Lt~ and Ot~ waves). Their orthogonality with r~ waves would explain their very weak interaction with known matter.
- Gluons probably oscillate according to a combination of the r~ and t~ modes.

Since the r~ and t~ modes oscillate perpendicular to each other, they cannot mutually interact. This is explained by the fact that their energy level is proportional to the square of their oscillation amplitude. Thus, when the waves of these modes of oscillation cross, the resulting amplitude always gives an energy corresponding to the sum of the squares of each of the waves. There is therefore no modification of the energy level, and their propagation is therefore not affected.

This would explain why certain types of waves do not or very little interact with matter. This is particularly the case for neutrinos which can only interact with the very short-lived W and Z bosons of the weak interaction [26]. In this specific case, there is every reason to believe that these bosons have waves of the same type as those of neutrinos to affect them in their course.

Any particles oscillating in a mode different from that of usual matter, and therefore unable to interfere with it, could thus be candidates for dark matter (see section 10.10 and 17).

9.2 The Photon

According to the present theory, elementary particles are formed by linear waves (L~ waves) rotating around each other. In this sense, these elementary particles that are electrons, positrons, quarks and antiquarks are formed by the meeting of photons or gluons, i.e. L~ waves, rotating around each other to form O~ waves.

To understand this formation, it is therefore important to know, or at the very least, to have an idea of what the photons can be so that they can manage to form the particles.

The idea behind all this is that if, for example, an electron and a positron meeting, annihilate to form a release of energy in the form of Lr~ waves or, still photons, why wouldn't the reverse also be possible?

Here is the way current physics conceives the photon:

- a packet of electromagnetic waves,
- moving in a vacuum with speed c,
- having a frequency f and therefore a wavelength $\lambda = c/f$,
- possessing an amount of energy defined by the formula $E = h\,f$,
- having an integer spin (magnetic moment).

In this theory, the waves of the photon are mechanical oscillations of the hypersurface Θ on either side of its average position in the direction, positive or negative, of the axis R↑. This leads to local deformations of Θ which are then the source of the electromagnetic fields.

In other words, the deformations, and the speed of these deformations of Θ are at the origin of the electric and magnetic fields. Thus, the electromagnetic fields become fields of mechanical deformation of Θ.

Fig. 11 is a simplified illustration of the oscillations of Θ which would be caused by a photon. The mauve surface represents Θ and has in fact 3 dimensions (the oscillations are of the same amplitude on each side of Θ). The number of ripples here is purely arbitrary. However, this figure cannot illustrate alone the principle of photon polarization. For this, it is necessary to consider an inclination of the photon ripples with respect to the R↑ axis as illustrated on the Fig. 12 and Fig. 13.

Important note: The illustrations of photon presented in the following figures are without any pretension. Thus, the number of oscillations as well as their longitudinal and lateral damping are here purely arbitrary.

This theory however suggests that the lateral amplitude damping would probably be like $1/d$ at a greater distance from the P↑ axis while remaining unitary at $d = 0$ and avoiding infinite integration values at $d = \infty$. It is also possible that the amplitude pattern of the oscillations both on the longitudinal and on the lateral side includes several rises and falls. Thus, a function like $\sin d\,/d$ would satisfy these specifications. Fig. 10 shows an example.

Be that as it may, this debate on the exact shape of the photon remains open and this theory does not aim to provide definitive answers. The following figures are only illustrations of principle allowing to illustrate a little bit the advanced concepts and this, without any other claim.

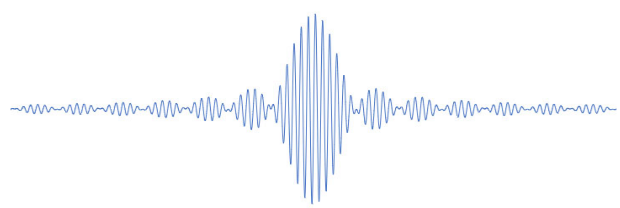


Fig. 10: Illustration of the possible damping of the lateral and/or longitudinal waves of the photon.

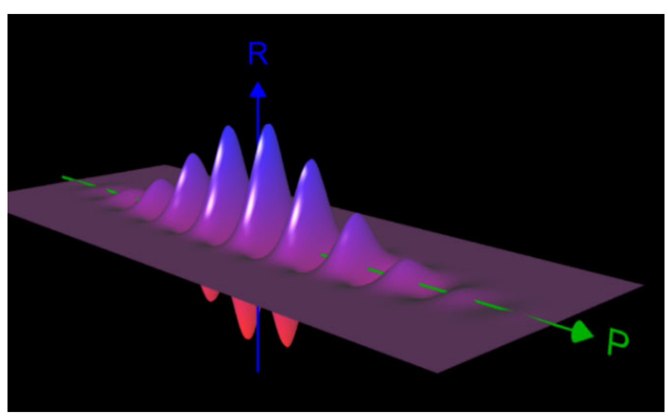


Fig. 11: Simplified illustration of the oscillations of Θ which would be caused by a photon.

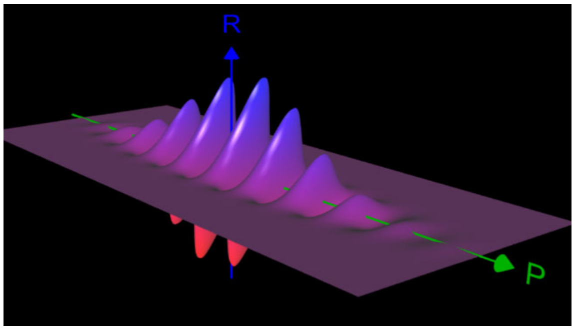


Fig. 12: Same illustration as Fig. 11 but with an inclination of the ripples.

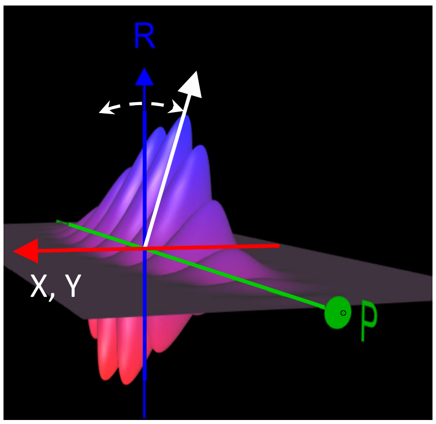


Fig. 13: Inclination of the photon ripple (white arow) to show the principle of photon polarization.

Fig. 14 represents a section of the illustration on the Fig. 13 in the X, Y plane perpendicular to the propagation axis, showing the ripple towards the R↑ axis. The projection of the tilt vector in this X, Y plane then gives the polarization angle of the wave. This angle rotates left or right for left or right polarization. This rotation is illustrated by the curved dotted arrow. In fact, it is the same arrow as the double dotted arrow in Fig. 13. This therefore rotates the tip of the ripple around the R↑ axis. If we assume that the P↑ axis is upwards, at 90° from the R↑ axis, then the polarization rotates counterclockwise in this representation.

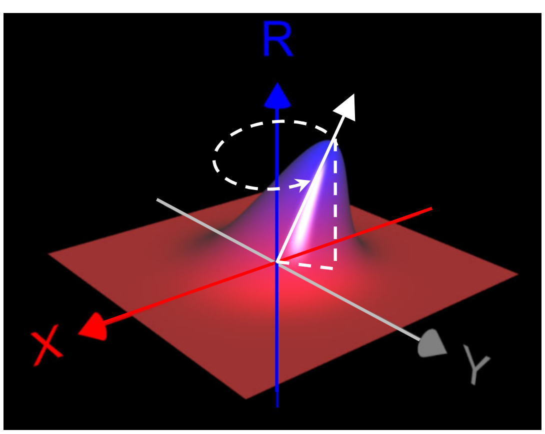


Fig. 14: Other view of the inclination of the photon ripple (white arrow) caused by the photon polarization.

9.3 Photon energy

Fig. 11 is the simplified representation of a photon having a linear polarization. Fig. 15 is a central section of an oscillation of this electromagnetic wave in its axis of propagation.

The energy equation of this wave is:

$$\rho_\Theta \frac{\mathrm{d}^2 R}{\mathrm{d}t^2} - G_{A\Theta} \frac{\mathrm{d}^2 R}{\mathrm{d}x^2} = 0 \tag{6}$$

Since $x = c\,t$:

$$\rho_\Theta \frac{\mathrm{d}^2 R}{\mathrm{d}t^2} - \frac{G_{A\Theta}}{c^2} \frac{\mathrm{d}^2 R}{\mathrm{d}t^2} = 0 \tag{7}$$

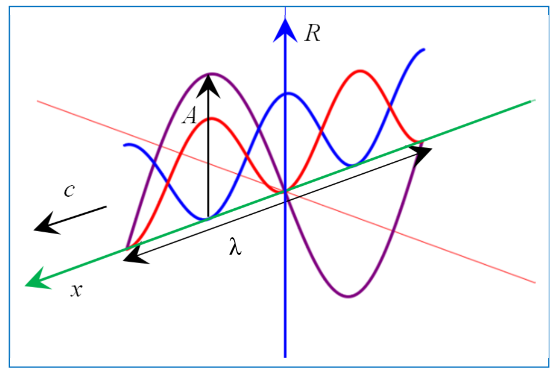


Fig. 15: Central section of an oscillation of the electromagnetic wave in its axis of propagation

We finally obtain that $c = \sqrt{G_{A\Theta}/\rho_\Theta}$, which is in accordance with the law of the speed of propagation as explained in section 8.2.

Moreover, the elimination of the component $\mathrm{d}^2R/\mathrm{d}t^2$ that results from the previous differential equation allows us to argue that Θ, according to these parameters, has no characteristic frequency and can therefore allow waves to propagate without distinction as to frequency, which would be consistent with SR theory.

The blue and red curves in Fig. 15 show the energy oscillations of the wave. The blue curve represents the kinetic energy and the red curve, the potential energy.

The kinetic energy flow or kinetic power of this wave is given by:

$$P_c = \frac{1}{2} S_{lat}\, \rho_\Theta\, c \left(A\, \omega \cos(\omega t)\right)^2 \tag{8}$$

where: S_{lat} is the equivalent area of lateral spreading of the photon at constant amplitude A (m²).
A is the photon oscillation amplitude (m)

The potential energy flow or potential power of this wave is given by (with all reserve):

$$P_p = \frac{1}{2} S_{lat}\, G_{A\Theta}\, c^{-1} \left(A\, \omega \sin(\omega t)\right)^2 \tag{9}$$

It should be noted here that this potential power is caused both by the curvature of Θ not only in the direction of the propagation of the wave, but also of the direction perpendicular to the propagation of the wave according to the pattern of lateral spread. For this reason, this formula is only valid if the lateral spread of the photon remains proportional to its wavelength or if S_{lat} is proportional to λ^2: $S_{lat} = k_{S\lambda}\,\lambda^2$.

The maximum values of these powers are:

$$P_{c\,max} = \frac{1}{2}\,S_{lat}\,\rho_\Theta\,c\,A^2\omega^2 \tag{10}$$

$$P_{p\,max} = \frac{1}{2}\,S_{lat}\,G_{A\Theta}\,c^{-1}\,A^2\omega^2 \tag{11}$$

Considering that $S_{lat} = k_{S\lambda}\,\lambda^2$, that $\omega = 2\pi\,c/\lambda$ and that $c = \sqrt{G_{A\Theta}/\rho_\Theta}$, we get:

$$P_{c\,max} = P_{p\,max} = 2\,\pi^2\,k_{S\lambda}\sqrt{\frac{G_{A\Theta}{}^3}{\rho_\Theta}}\,A^2 \tag{12}$$

This confirms that the amplitudes of these 2 powers are equal. The total energy flow of the photon is therefore:

$$P_\gamma = 2\,\pi^2\,k_{S\lambda}\sqrt{\frac{G_{A\Theta}{}^3}{\rho_\Theta}}\,A^2 \tag{13}$$

The total energy of a photon can then be expressed as follows:

$$E_\gamma = \frac{P_\gamma}{f} = \frac{P_\gamma\,\lambda\,n_\lambda}{c} = 2\,\pi^2\,k_{S\lambda}\,n_\lambda\,G_{A\Theta}\,A^2\lambda \tag{14}$$

where n_λ is the equivalent number of waves of amplitude A of the photon

Considering that $E_\gamma = \hbar\,\omega$, that $\omega = 2\pi\,c/\lambda$ and that $c = \sqrt{G_{A\Theta}/\rho_\Theta}$, we get:

$$\hbar = \frac{E_\gamma}{\omega} = \pi\,k_{S\lambda}\,n_\lambda\,\sqrt{\rho_\Theta\,G_{A\Theta}}\,A^2\lambda^2 \tag{15}$$

This formula implies that to obtain a value of $\hbar$ constant, the product $A\,\lambda$ must also be constant. If we pose as well as $A^2\lambda^2 = k_{A\lambda}$, we get:

$$\hbar = \pi\,k_{A\lambda}\,k_{S\lambda}\,n_\lambda\,\sqrt{\rho_\Theta\,G_{A\Theta}} \tag{16}$$

This means that A will vary inversely proportionally to λ or proportional to the frequency f. For example, for a frequency that doubles, so a length of wave reduced by half, the spreading distance will also decrease by half and amplitude will double. This principle is illustrated in the 3 figures on Fig. 16 for frequencies of 1, 2 and 3 times any reference frequency.

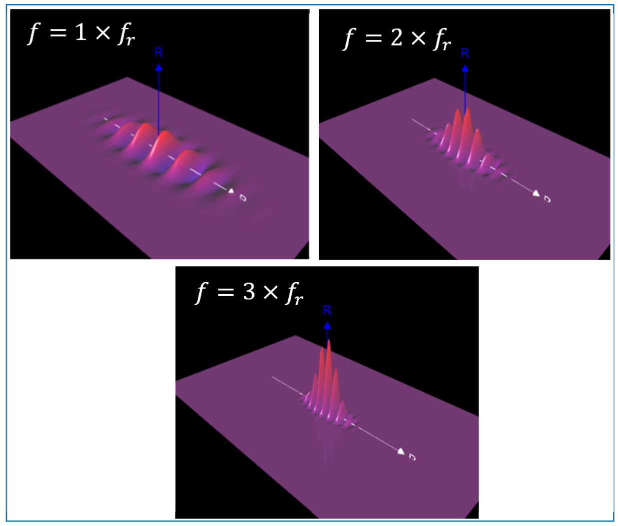


Fig. 16: Illustration of the influence of the wavelength on the amplitude and the lateral spread of the photon

9.4 Lt~ waves

Lt~ waves are oscillations of the Θ membrane limited to its 3D volume. They therefore have no oscillation component along the R↑ axis and consequently no electromagnetic effect.

According to this theory, neutrinos would be the ideal candidates for this type of wave given their electromagnetic neutrality. We will however see in section 10.3 that neutrinos would be formed of 2 oscillation components rotating one around the other. These components would be Lt~ waves moving at speed c as seen in section 8.2. Moreover, this rotation of these waves would slightly reduce the speed of the neutrinos and would give them an Ot~ wave component and therefore a slight mass, in accordance with the predictions of modern physics.

This subject of neutrinos is dealt with more thoroughly in section 11.

10. The O~ waves

10.1 Summary

The orbital or O~ waves are formed when 2 sufficiently energetic L~ waves pass close to each other. These two L~ waves then interfere with each other to start rotating around each other and then eject, on either side of the axis of rotation, a particle and its antiparticle. The ripples are then preserved and strongly compressed and slowed down in the particles and antiparticles formed. However, the energy of the two L~ waves meeting must be equal to the mass and velocity energy of the particles and antiparticles thus formed.

There would be 2 possible modes of formation of O~ waves:

- Meeting of two Lr~ waves which would give Or~ waves or particles (electrons, positrons, quarks, antiquarks etc.).
- A hypothetical mode: meeting of two Lt~ waves which would give Ot~ waves or particles (hypothetical candidates for dark matter).

In section 6.1, we saw the process of forming Or~ waves via an extension of the Breit-Wheeler process. Fig. 2 then showed an example of 2 photons forming an electron-positron pair.

At very high energy levels of the Lr~ waves meeting, the large centrifugal forces involved will cause the particles formed to burst to give particles of greater mass (muon, tau, delta, hyperons) and lower expulsion speed. This will then be at the origin of the formation of quarks and, later, neutrons and protons. Moreover, by thus concentrating the energy of the 2 photons or 2 gluons in a specific place, this process would make it possible to attribute a mass to the particles via the inertia of Θ (see section 6.1 and 10), according to the formula $m = E/c^2$.

The constrained path of the O~ waves around the particles also explains why these particles or the matter that contains them can, under certain circumstances of excitation, suddenly emit a large amount of energy in the form of an explosion. It's sort of a release of energy a bit like a sling. For this reason, this effect is named "Sling Effect" in this theory.

10.2 Fluctuations of Θ around O~ waves

Moreover, this theory suggests that the O~ waves extend laterally according to a decreasing pattern like $1/d^2$ while moving away from the center of the particle. These lateral O~ waves by meeting in opposite or quasi-opposite directions will locally create stationary or quasi-stationary ripples, called here S↕ fluctuations. This point is covered in more detail in section 12.2.

10.3 Pair formation by gluons

In section 6.1, we saw how 2 photons could form an electron-positron pair via an extension of the Breit-Wheeler process. We will now look here at how this process could be extended to 2 gluons instead of 2 photons.

According to modern physics, just after the Big Bang, the Universe probably contained a very large amount of gluons in a sort of QGP (Quarks-Gluons-Plasma) soup. It is therefore quite possible that at this time, the process described in section 6.1 could also have applied to gluons.

One of the production methods that particularly interests us here involves the intermediate production of a H boson (Higgs boson).

The easiest way to produce a H boson is if the two gluons combine to form a loop of virtual quarks. Since the coupling of particles to the H boson is proportional to their mass, this process is more likely for heavy particles. In practice it is enough to consider the contributions of virtual top and bottom quarks (the heaviest quarks) [27][28].

Then, one of the most common decay modes of the H boson is into 2 bosons W^+ and W^- which will then each decompose into leptons + and − with their associated neutrino ([29], section 10 and table A.6, page 254).

Fig. 17 shows the Feynman diagram of this whole process.

We will now examine how to integrate the production of pairs described previously into a process such as that described in section 6.1. This is illustrated in Fig. 18.

In this figure, the 2 gluons, when they meet, will first start to interfere together and thus start a process of rotation around each other, in the same way as described in section 6.1 for photons. This rotation process will automatically cause the formation of virtual quarks as described previously. These quarks are represented by curved green arrows in the Fig. 18.

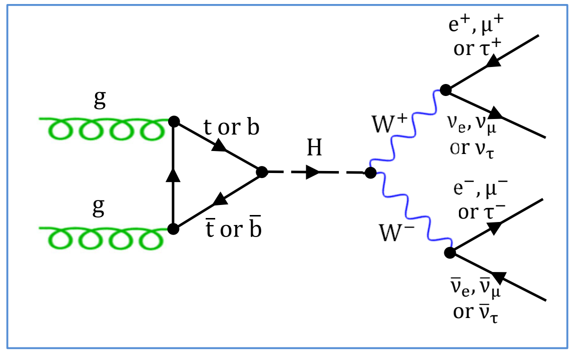


Fig. 17: Feynman diagram of the process of transformation of 2 gluons into 2 charged leptons and their associated neutrino.

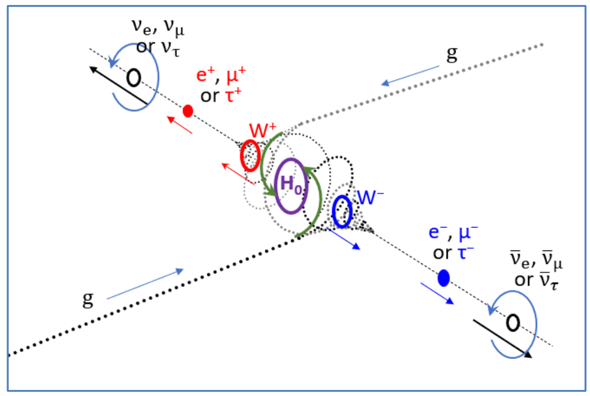


Fig. 18: Diagram of a lepton-antilepton pair and their associated neutrino formation by 2 gluons.

Following this, these virtual quarks will form the H boson which will thus find itself at the center of rotation of the 2 gluons revolving around each other. Subsequently, the H boson will separate into 2 bosons W^+ and W^- which will each take a direction according to the axis of rotation of the 2 gluons around each other. It is considered here that the 2 forming gluons follow the same polarization rules as those described for the photon in section 6.1. In this way, the W^- boson will go to the right and the W^+, to the left.

The W^+ and W^- bosons will each then decay into a lepton with the same charge (electron, muon, tau and their antiparticle) and a neutrino associated with this lepton (antineutrinos for leptons$^-$ and neutrinos for leptons$^+$).

It is via this process and the inertia of Θ that the energy then concentrated in the particles can assign them a mass according to the formula $m = E/c^2$.

Furthermore, the present theory argues that the process here involving the H boson and the W bosons is in fact what is described by the Higgs mechanism, by which the H, W and Z bosons impart mass to particles. The Higgs field through which this boson operates could then only be a manifestation of Θ.

At the final step of this process, neutrino and antineutrino, moving almost at the speed of light, will thus rapidly outpace their associated lepton. In Fig. 18, it can be clearly seen that due to the initial rotational motion of the gluons, the neutrinos will progress with a left rotation and the antineutrinos with a right rotation. This illustrates the reason for the exclusively left chirality of neutrinos and exclusively right chirality of antineutrinos.

Since, in this process, neutrino-antineutrinos are emitted and not with the similar process involving photons, the present theory suggests that gluons are formed from a combination of Lr~ and Lt~ waves. The Lr~ waves would then give the particle-antiparticle and the Lt~ waves would give the neutrino-antineutrino.

According to this theory, this combination of Lr~ and Lt~ waves would be very unstable, quickly breaking down into separate Lr~ and Lt~ waves. This would explain the extremely short range of gluons, thus allowing them to act only within the very restricted interior of hadrons.

10.4 Electron-positron electrical charge acquisition

We saw in section 6.1 how Lr~ waves which are 2 photons manage to form Or~ waves which are electrons and positrons. We will now establish how from this process, the Or~ waves collapse on themselves and at the same time produce the charge of electrons and positrons. This theory advances the following hypothesis to this effect.

Initially, the two groups of polarized waves of the forming photons would have, in addition to their left or right rotation, another characteristic: their ripples movement would be shifted above or below the average hypersurface of Θ, this which would respectively give them a negative or positive electrical charge. Their form would then be like $\sin(\omega\, t) \pm k$. The sum of these 2 shifts would be zero, thus ensuring the electric charge neutrality of the photon.

According to the Fig. 4, the shift is upwards (in the direction of the R↑ axis) for the blue half-photons thus giving the negative charge and, conversely, downwards (against the direction of the R↑ axis) for the red half-photons thus giving the positive charge. This assumption will be used for the explanations on the following pages.

Eventually, as illustrated at Fig. 19, the collapse would complete to form the electron on one side and the positron on the other. One could however think here that these groupings of ripples rotating in the same direction will rather continue to propagate at the speed c so as not to form the electrons and positrons. In the following it will be explained why this does not behave like this.

The 2 groups of ripples formed in the direction of the electron and the positron have a negative and positive charge respectively. Thus, for each of these particles, their ripples are located exclusively on one side of Θ, in the positive or negative direction of the R↑ axis.

This situation combined with the centrifugal force due to the rotation of the ripples around the R↑ axis will gradually cause a deformation of Θ, in the same direction as the ripples as shown in the principle illustration on Fig. 20.

The deformation of Θ is gradual due to its angular stiffness mentioned in section 8.

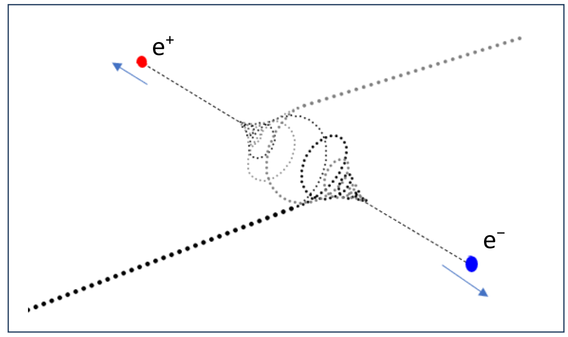


Fig. 19: Final step in the process of forming an electron-positron pair

In Fig. 20, the curved white arrow represents the rotation of the ripples, the blue arrows represent the centrifugal force exerted on the ripples and finally the gray arrow represents the resultant force on Θ.

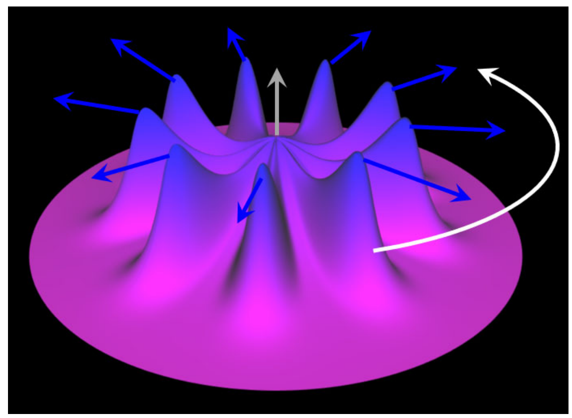


Fig. 20: Illustration of the centrifugal forces due to the Or~ waves in the electron and which cause the formation of its electric charge.

Fig. 21 is a principle illustration of the evolution of the waves towards the electron. The pale blue curves show the spiral evolution of one of the ripples.

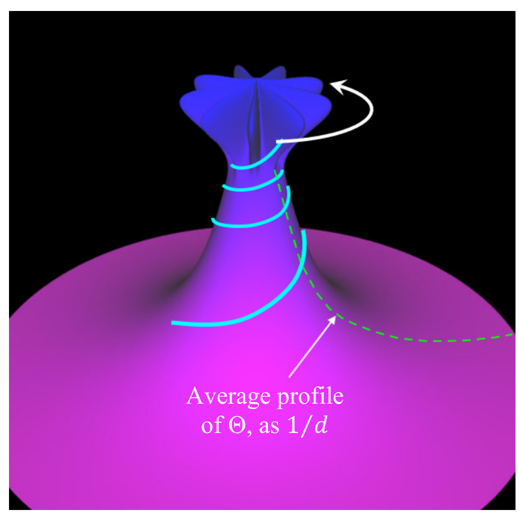


Fig. 21: Evolution of the waves towards the electron.

According to this principle, the groups of ripples or even the formative half-photons remain trapped in this fold of Θ. By progressing in this fold, they end up no longer being able to move forward and thus form the very small particles that are the electron or the positron.

The dashed pale blue line in Fig. 21 represents the profile of Θ like $1/d$ following this process. The derivative of this profile gives its slope and consequently, will vary like $1/d^2$. This slope gives the electric field in V/m. Thus, the amplitude of the deformation is expressed in V.

In this way, the electron or positron creates an electric field, positive or negative, decreasing like $1/d^2$ as it moves away from it.

Following this process, the surplus of energy of the 2 photons compared to the mass of the positron-electron formed will allow them to be ejected at a speed corresponding to this surplus of energy.

By extension, this whole process can be applicated to heavier particles such as muons, tau and their antiparticle and to their formation by photons or by gluons. This is examined in the following.

Apart from electrons and positrons, the next stable elementary particles in mass order are quarks. These particles of charge –1/3 e or +2/3 e for matter (inverse charge for antimatter) are the basic constituents of neutrons and protons. They are therefore with electrons, the building blocks of all matter as we know it. We must therefore try here to understand how the present theory could explain the production of these particles in the context of Θ as was done previously for the electron.

The present theory advances to this effect that to achieve this, it is first necessary to product unstable particles similar to the electron-positron but more massive, namely the muons and the taus and their antiparticle. Subsequent decomposition of the tau particles would then lead to a sequence of formation leading to neutrons and subsequently protons. This will be explained in the section 10.6.

10.5 Formation of muon particles

Fig. 22 is a principle illustration of what the muon could be compared to the representation of the electron shown at the Fig. 21. Note that the muon is an unstable particle with the same charge and the same spin as the electron, but 207 times more massive.

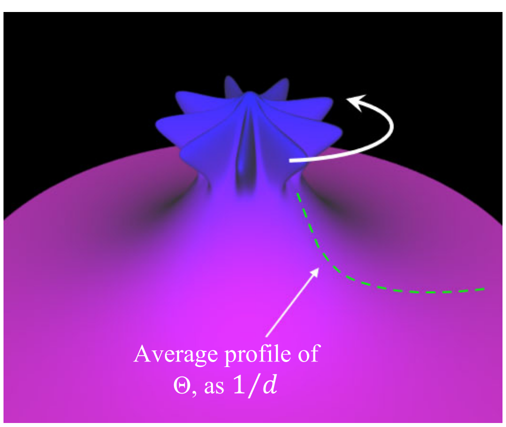


Fig. 22: Evolution of the waves towards the muon comparatively to the electron (Fig. 21).

In this case, a much higher energy level of the photons or gluons forming the particle will cause much higher centrifugal forces during its formation as explained in section 10.4. This energy level must then be greater than the mass energy of the muon and antimuon in formation.

This will then cause the ripples to have a lower position on the average strain curve of Θ and consequently a larger diameter. Remember that this curve is related to the charge and therefore remains identical to that of the electron because of their equivalent charge.

Here, the number of ripples represented is the same as for the representation of the electron in Fig. 21. However, it is not impossible that at this point, there are appearance of more ripples around the particle, which would explain the additional mass of the muon compared to the electron.

For photons or gluons of even higher energy, this process will lead to the formation of pairs of more massive particles. This is what is discussed in the following.

10.6 Big Bang nucleosynthesis

The present theory claims that in the instant following the Big Bang, there was an emission of an extraordinarily high quantity of L~ waves (photons, gluons, neutrinos). It is not impossible that there was also an emission of quarks at this time, but such an emission would have been the result of the collapse of an earlier Universe (see section 0). Thus, at the very beginning of the Big Bang, there would have been few or no quarks or particles emitted.

In the moments that followed, the present theory advances the following steps that led to the formation of nucleons:

1. The extreme energy density of this moment would have caused quantities of very massive and very energetic encounters between gluons and photons. This would then have caused a large formation of pairs of particles and antiparticles.
2. In addition to the formation of electron-positron pairs as described in section 6.1, there would have been formation of more massive pairs of particles of charge ±e, in order of energy, muons and tau.
3. There would also have been the formation of even more massive particles, beyond the energy level of the tau particles, which would then have caused the bursting of the particles in formation. This breakup would have been caused by the strong centrifugal force acting on the forming particles in the pair formation process explained the previous sections.
4. The bursting mentioned above would have led to the formation of a pair consisting of a particle formed on the one hand, of 3 quarks with a charge of −1/3 e (down quark or strange) and on the other hand, the antiparticle formed of the 3 corresponding antiquarks, the whole being bound by gluons.
5. The particles mentioned above are recognized by modern physics as being Delta⁻ particles or even hyperons⁻ (Sigma⁻, Xi⁻, Ohmega⁻) and their corresponding antiparticle. These particles will quickly break down into a series of cascades

leading from the most massive to the less massive and from there to neutrons or protons, all accompanied by a charge pion −e, 0 or +e.

6. This process can therefore lead to the formation of the nucleons (protons and neutrons) required to further structure matter as we know it.

7. At the time of the formation of these pairs of particles as mentioned above, the Universe was then in a phase of extremely rapid expansion called period of inflation. According to the present theory, this expansion was done along the R↑ axis as explained in section 0. The extreme accelerating force due to this rapid expansion then caused a huge imbalance of forces on the charged particles on either side of the Θ membrane. This then gave a faster formation advantage of down quarks over down antiquarks, which then allowed the domination of matter over antimatter. This is further explained in section 13.

10.7 Reflection on the universality of the ±1/3 e charge of down quarks and antiquarks

In the process of making quarks and neutrons described above, the ±1/3 e charge of down quarks and antiquarks seems to play a particular role. Indeed, according to the present theory, the production of neutrons and subsequently of protons must be done through the existence of 3 down quarks.

One can also ask the following question: how is it that the groupings of two forming half-photons, in this whole process, can ultimately separate into three down or antidown quarks? We then inevitably come to think that the formative photons are inherently composed of three relatively distinct parts. Thus, thereafter, the particles that are the electron-positron, the muons and the tau and their antiparticle would also be composed of 3 parts.

Fig. 23 then shows the appearance that the electron could take compared to its representation of section 10.4. The number of ripples here is quite arbitrary, but we can still visualize the separation into 3 parts explained previously.

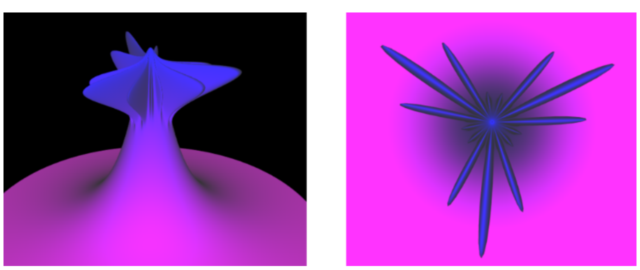


Fig. 23: Illustration of an electron seen from the side and from above showing its possible separation into 3 parts of -1/3 e.

This reflection thus leads to think that the electrons-positrons, the muons, the tau and their antiparticle would contain in themselves the roots of the quarks in the form of 3 charges ±1/3 e. These “roots” of quarks would also each have a color charge, the sum of which should give a white color, in the same way as for quarks. In this context, color charge can simply be seen as a vector of centrifugal force. The vector sum of the vectors of each color must thus be zero to ensure the stability of the particle (see Fig. 24).

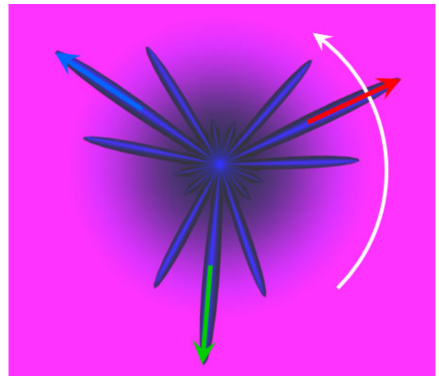


Fig. 24: Illustration of color charges as centrifugal force in particles

10.8 Behavior of waves in neutrons and other composite particles

In the process of particle formation during primordial nucleosynthesis, the first nucleon formed is the neutron. According to modern physics, this particle is formed by an association of 2 down quarks with charge −1/3 e and an up quark with charge −2/3 e, these three quarks being bound by as many gluons. We are now going to examine how to reconcile this conception with that conveyed by the 1st postulate of this theory which states that everything is only a wave.

Fig. 25 is an illustration of principle of what the neutron would be considering the 1st postulate of this theory. This is a view at about 30° inclination with respect to the plane formed by the 3 quarks of the neutron. In this figure, the three colored tips of the illustration represent the quarks with their respective color and whose sum of colors gives the white color required for the stability of the particle. The dotted lines represent the gluons binding the quarks in the neutron.

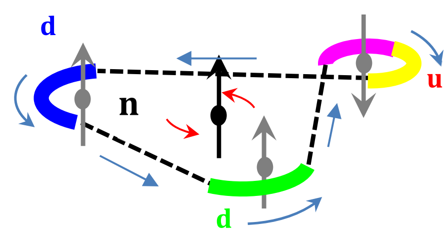


Fig. 25: Simplified illustration of a neutron according to the 1st postulate of this theory

To be consistent with the concept conveyed in section 10.7 of the universality of the −1/3 e charge, the up quark is here represented by 2 colors: yellow and magenta or even anti-blue and anti-green. This quark would normally be represented by a red color in this illustration. Magenta and yellow are secondary colors and their addition must be done according to the subtractive composition of the colors, which effectively gives red, therefore the equivalent.

In the concept illustrated here, the waves propagate in the direction of the blue arrows. The direction of rotation of the wave around the quarks gives the direction of the ±1/2 spin of these particles represented by gray arrows. The sum of these spins gives the global spin 1/2 of the neutron (black arrow).

In this particle, there is not only rotation of the wave between the 3 quarks, but there is also rotation of the entire particle on itself represented by the 2 red arrows. This rotation is much slower than the rotation of the waves which run at the speed of light. In addition, this rotation is done in a complex 3D rotation model, which means that the rotation plane represented here is constantly reoriented in 3D space.

All this system of rotation of the waves and of the particle itself ensures that the vectors of the centrifugal forces exerted on the quarks constantly change direction to always give however a zero total force (the equivalent of the white color in QCD). In all this, the gluons, representing the waves between the quarks, ensure the cohesion of this set to prevent it from bursting by the centrifugal forces acting on it.

According to this theory, these constant changes in orientation of the centrifugal forces exerted on the quarks and the cohesion ensured by the gluons between these same quarks are equivalent to the current QCD design of quarks and gluons binding these particles. It would therefore remain to define the mathematical formulations to standardize this concept with that of QCD.

Fig. 26 similarly illustrates what a proton would be.

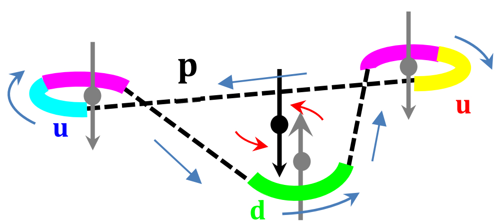


Fig. 26: Simplified illustration of a proton according to the 1st postulate of this theory

10.9 Process of electric charge creation by quarks and gluons

We saw at the end of section 10.4 the hypothesis that gluons are formed from a combination of Lt~ and Lr~ waves. This theory suggests that this combination plays an important role in the formation of quark charges. Fig. 27 and Fig. 28 help to explain this point.

In these figures, the blue arrows represent the oscillation of the Lt~ component of the gluons and the red arrows, the oscillation of the Lr~ component. The purple arrow is the resulting global oscillation. The black dotted lines represent the path of the gluons. The pale blue arrows indicate the direction of movement of the gluons.

In Fig. 27, the green curve represents a down quark. When the gluon arrives at this quark, it is forced to make a 120° turn to the left. This then creates a centrifugal force on the Lt~ component which will cause the whole system to rise upwards, thus creating the electric charge −1/3 e of the quark.

Fig. 28 illustrates the same principle, but this time for an up quark. When the gluon arrives at the quark, the rotation is then to the right over 240°. The centrifugal force on the Lt~ component will then cause this whole system to pull down. And as the rotation is 2 times longer, this will create an electric charge of 2/3 e.

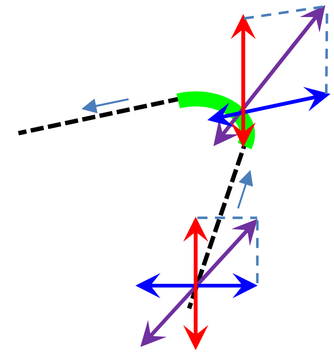


Fig. 27: Diagram explaining the formation of the electric charge of down quarks.

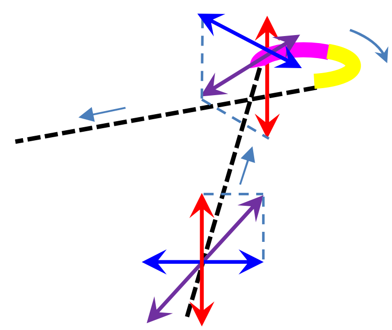


Fig. 28: Diagram explaining the formation of the electric charge of up quarks.

10.10 Possible O~ waves for dark matter

This theory does not deny the existence of dark matter. Moreover, the explanation provided by the apparent absence of matter in the galactic halos (see section 15) further confirms the need for dark matter in the Universe. Here then, in what follows, are some hypotheses for the formation of dark matter.

Pair formation by neutrinos

In section 10.6, it was mentioned that at the beginning of the Big Bang, there would have been emission of a very high quantity of gluons, photons and neutrinos. It was then explained how gluons and photons were then able to form increasingly massive pairs of particles to finally lead to nucleons. However, what about neutrinos? Since, according to this theory, they are L~ waves in major part, one can wonder if they could have formed at that moment, at least in part, pairs of particles in a process analogous to that described in section 6.1 and 10.3 for photons and gluons.

In this section 6.1, we saw that to form a pair, the photons had to have a direct polarity, i.e. a combination of right polarity and left polarity. However, it is known that neutrinos have only one polarity: left for neutrinos and right for antineutrinos. Thus, they could not split into two as for photons in the process described in section 6.1.

This theory therefore advances a hypothetical pair formation process slightly different from that explained in section 6.1. In this process, there would have to be a meeting between a neutrino and an antineutrino. At the time of their passage close to each other, these neutrino-antineutrino would interfere with each other, which would cause them to start rotating around each other. This is illustrated in Fig. 29. According to this representation, by virtue of the gyroscopic forces in play, the antineutrino, with its right rotation, would be driven to the right and the opposite would occur for the neutrino. The rotation of each neutrino-antineutrino would then cause them to collapse on themselves to finally form a particle and an antiparticle. The preliminary name given to them here is particle N for "Neutral" ($\overline{\mathrm{N}}$ for the antiparticle).

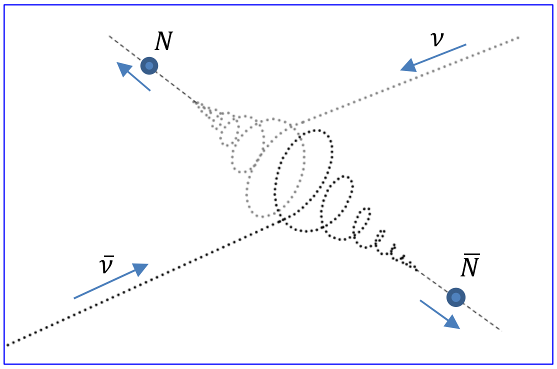


Fig. 29: Diagram of a hypothetical formation of a pair of neutral particles formed by the meeting of a neutrino and an antineutrino

It is understood that the combined energy of the forming neutrino-antineutrino must be greater than the mass of the particles formed.

As for the forming neutrino-antineutrino, these particles would be completely neutral and, consequently, without any electromagnetic effect. Their oscillations would only take place in the 3D volume of Θ and would thus be Ot~ waves.

It is not possible to establish at this stage what the mass of these particles would be. Moreover, it is not impossible that they can exist in 3 flavors: electronic, muonic and tauic, as for the forming neutrinos. More advanced studies on this subject would be required to see more clearly.

Due to their complete electromagnetic neutrality, these particles would be perfect candidates for dark matter. As they are of the same nature as neutrinos, one would be entitled to think that they would be detectable in the same way as these neutrinos. However, it is possible that during this detection, these particles convert back into neutrinos and are thus detected in this form. This is what would make them difficult to detect in their particle form.

Another possibility is that just after the Big Bang, neutrinos formed from a combination of a neutrino and an antineutrino exist and form a hypothetical linearly polarized neutrino. We could then evoke a formation process equivalent to that explained in section 6.1 for photons.

The axion particle

The present theory proposes that the axion particle, evoked by modern physics to explain dark matter, could be formed by the meeting of a photon of right circular polarization and another of left circular polarization. The formation process would then be the same as shown in Fig. 29.

However, to date, despite numerous experiments, the existence of this particle has still not been demonstrated.

11. The Neutrino, a combination of Lt~ and Ot~ waves

Modern physics states that neutrinos have an extremely low mass of the order of one millionth of that of the electron [30][31], already that it is the lowest among elementary particles. This mass would be required to explain the presence of oscillations between various neutrino "flavors" during their movement [32].

Yet, various experiments seem to show that neutrinos move at speed c. These observations combined with a non-zero mass of neutrinos seem contradictory with the SR and the Lorentz transformation which state that it takes infinite energy to carry a massive object to the speed c. It is to answer this dilemma that modern physics suggests that neutrinos propagate at a speed very slightly lower than the speed c, thus allowing them to have a very low mass.

We saw in section 10.3 a recognized mode of formation of pairs of neutrinos from the meeting of 2 gluons. In this process, illustrated in Fig. 18, we can deduce that the neutrinos would be the result of 2 parts of gluons rotating around each other, which would explain their helicity.

According to this theory, each of these parts would be a Lt~ waves, i.e. a wave limited to the hyper-membrane of Θ, therefore without electromagnetic effect. As seen in section 8.2, these Lt~ waves travel at speed c. However, the rotation of the 2 wave components around each other would slow down the progression of the neutrinos and give them an O~ wave component and therefore a low mass.

The figure illustrates this principle. The variable v_{rv} indicates the radial speed of rotation of the Lt~ waves, and the variable v_v indicates the speed of the neutrino.

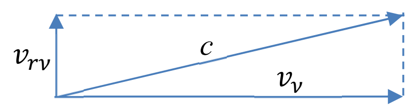


Fig. 30: Illustration of the slowing effect caused by the rotational speed of the Lt~ components on the neutrino speed.

As neutrinos propagate at a speed very close to c, the ratio v_{rv}/c would be very low, less than approximately 1/10000. This preliminary estimate is based on the difference in arrival time between neutrinos and photons during of supernova 1987A event.

Fig. 31 is a principle illustration of the neutrino ripples according to a section perpendicular to the plane of polarization of the neutrino. To simplify the representation, the rotation of the neutrino is not represented there. Thus, this representation plane is in fact a helicoid.

The white arrow indicates the direction of propagation of the waves. The 2 blue arrows indicate the 2 wave components mentioned above. The number of oscillations represented is arbitrary. The yellow curves indicate the bending forces or even the internal oscillations of Θ in this mode of propagation. Due to the angular stiffness of Θ explained in section 8.2, these oscillations occur both parallel and perpendicular to the axis of propagation. Thus, neutrino waves would be composed of the combined t1~ and t2~ oscillation modes.

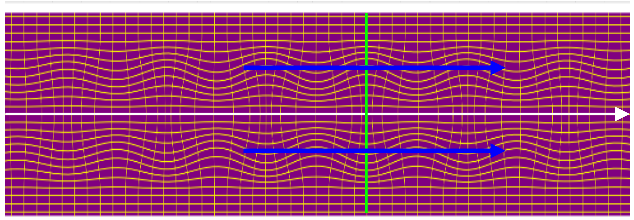


Fig. 31: Mode of propagation according to a section perpendicular to the plane of polarization of the neutrino

In this process of rotation, the total wavelength of oscillations would remain the same (constant energy level), but the projections of these oscillations along the axis of propagation would oscillate between them. This would then make it possible to obtain the mass variations between the 3 possible flavors of the neutrino as mentioned at the beginning of this section.

The green line is a section plane shown on Fig. 32. This figure represents a section of this mode of oscillation perpendicular to the axis of propagation at the place indicated by the green line in the Fig. 31. The blue and white circles represent the tips of the arrows in Fig. 31, so coming out of the sheet here. This is the representation of a neutrino. Thus, the 2 blue tips turn as it should counter-clockwise in the direction of progression indicated by the blue arrows. This whole system rotates with these arrows.

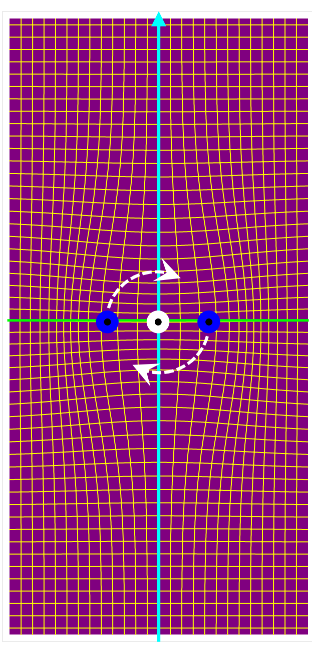


Fig. 32: Mode of oscillation perpendicular to the axis of propagation

In the path of the neutrino, its polarization rotates counterclockwise (seen from the source) for the neutrino and clockwise for the anti-neutrino.

Important note: the note in the box in section 9.2 concerning representations made of photons applies in the same way here. Thus, these representations remain approximate and are mainly intended to simply illustrate the concepts expressed.

12. The S↨ or standing fluctuations

12.1 Summary

We saw briefly in section 7 that the S↨ fluctuations are the result of the summation, at a given place, of the lateral waves of the O~ and L~ waves. Here we will analyze their nature in more detail.

These fluctuations are not strictly speaking waves, because they are not autonomous and depend entirely on the L~ and O~ waves which form them. They are in fact only the result of the summation of these L~ and O~ waves and can then take on different shapes and characteristics.

This theory posits that these S↨ fluctuations are no more and no less than what is called quantum fluctuations by modern physics.

The term "standing" used here refers to an average field. In fact, locally the so-called "standing" fluctuations will instead vibrate in various directions as the O~ and L~ waves pass randomly around. Moreover, they can move at the same time as the particle itself from which they come. This is why, in this theory, these fluctuations are called quasi-standing and are still designated by the abbreviation S↨.

Take note that these S↨ fluctuations will add in amplitude between them according to a quadratic sum. Thus, their individual energy will simply be summed in order to respect the law of conservation of energy. Note however that according to the explanation provided by this theory for the gravitational force, this total will be slightly reduced precisely to induce this force (see section 15).

12.2 S↨ fluctuations caused by O~ waves

Lateral O~ waves, rotating in all directions around a central point to form the particles, will necessarily cross or meet themselves in opposite directions. These multiple crossings or encounters will then give a field of standing fluctuations around the particles whose average amplitude will decrease as $1/d^2$, d being the distance of the particle. Because of their origin from the O~ waves, these waves are named here So↨ fluctuations.

It is not excluded that these So↨ fluctuations also form resonance fields with specific patterns around the particles, a bit like atomic orbitals, but whose average amplitude will always decrease like $1/d^2$.

In order not to exhaust the energy of the O~ waves, this transmission will stabilize according to an energy volume density of this field varying as $1/d^4$ as it moves away from the particle. Decreasing as $1/d^4$ allows the total energy value of this field to be limited to a finite value, which would not be the case with an exponent of d less than 4.

This means that the particle cannot be circumscribed to a very precise volume but rather to a decreasing energy field extending to infinity around a central point. In this sense, particles are not well-circumscribed objects as we conceive of them in our everyday life, but rather having an outline spreading out in a decreasing way with a probability of distribution. This is therefore in line with the uncertainty principle concerning particles.

Fig. 33 is a principle illustration of what such a field could look like around an electrically charged particle with, of course, all the limitations of such an exercise. Thus, the plane where the fluctuations are located represents the average hypersurface of Θ and has, in fact, 3 dimensions. Also, due to the complexity of the graphical representation, the fluctuations are all represented in the direction of the R↑ axis whereas they should be perpendicular to the hypersurface of Θ.

Note here that this hypersurface is curved upwards due to the deformation caused by the electric charge of the particle.

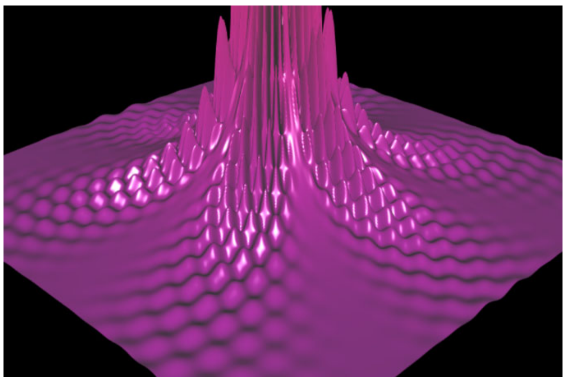


Fig. 33: Illustration of So↕ fluctuations formed around particles

For usual particles of matter, the fluctuations oscillate on either side of the average hypersurface of Θ and have a decreasing amplitude as $1/d^2$. These fluctuations do not propagate radially away from the particle. These are So↕ fluctuations that oscillate in place. There is therefore no radial propagation of energy (Poynting vector = 0).

This kinetic energy of the fluctuations is maximum when the wave moves at its maximum speed as it passes the height of the average hyper surface of Θ. For its part, the potential energy reached is maximum when the wave arrives opposite to its displacement, when the local curvature caused to Θ is at its maximum and its displacement speed is zero.

Fig. 33 shows six wave axes. This is based on the assumption that the resonances of these ripples around the particle would follow a pattern of the same shape as the 6 orbitals 2px, 2py and 2py of the atomic model (according to a projection of the faces of a cube).

This figure brings together several of the elements that could be evoked for such a ripple field around the particles. However, the present theory cannot claim that this representation is the only one possible. The main purpose here is to illustrate the principle. This model may therefore not be fully representative or complete. Also, other models could very well exist. One could, for example, imagine a model based on the example of the 12 orbitals $3d_{xy}$, $3d_{yz}$ and $3d_{xz}$ around atoms.

In the presence of a massive body, the number of elementary particles (electrons and quarks) quickly becomes extremely high due to their very low mass. We thus speak of some 10^{30} of such particles per kg of material.

It can be shown that these random fluctuations in a such immense field, their average amplitude will add up according to a quadratic sum (root of the sum of the squares). Since the energy density of the fluctuation field of each particle is proportional to the square of the average amplitude of the fluctuations, it can be deduced that the total energy density of this field around the massive body will be equivalent to the sum of the energy densities of the field of each particle. Note however that according to the explanation provided by this theory for the gravitational force, this total will be slightly reduced precisely to induce this force (see section 15).

The previously described fluctuations will thus create a relatively uniform fluctuation field whose average amplitude will decrease as $1/d^2$ as it moves away from the massive body. The energy volume density will decrease as $1/d^4$. By integrating this energy density on a spherical surface at equal distance from the massive body, one will obtain a decreasing linear energy density like $1/d^4$. The integration of this density from the particles of the massive body to infinity will then give the total energy of this field which will be a finite value proportional to the mass of the massive body.

These fluctuations are thus greater in the vicinity of particles and, by the very fact, of massive objects and this will play an important role in the formation of gravitational fields (see section 15).

12.3 S↕ fluctuations caused by L~ waves

This theory suggests that, in the same way as for O~ waves, part of the L~ waves emitted from different sources will meet in opposite or almost opposite directions to form S↕ fluctuations. Because of their origin from L~ waves, these fluctuations are denoted by the symbol Sl↕.

Unlike So↕ fluctuations which are more concentrated around massive objects, Sl↕ fluctuations would be distributed more evenly in space. However, their intensity would be related to the density of L~ wave emission sources in the surroundings. Thus, their density would increase when approaching the galactic centers given the greater presence of electromagnetic sources or neutrino sources at these places.

Moreover, this theory suggests that during the Big Bang, a large part of the L~ waves released at this time were not able to form particles and found themselves released into the surrounding space. These L~ waves being projected in all directions they were then able to form a large relatively uniform field of Sl↕ fluctuations. This fluctuation field is still present today, but much less dense due to the expansion of the Universe. If we consider that the total energy of these fluctuations is constant, then their energy density will decrease as $1/{R_\Theta}^3$.

This theory also advances the hypothesis of the presence of a primordial field of stationary fluctuations emitted with the Big Bang. This field would then not be dependent on O~ or L~ waves and would thus be self-sufficient. As mentioned above, this primordial field of fluctuation is still present today, but in a much less dense way due to the expansion of the Universe. Again, its density would be decreasing as $1/{R_\Theta}^3$.

It is also possible that after the Big Bang, with the significant residual energy having followed the formation of the particles of matter, there was one of very strong disturbances or residual ripples of Θ which were maintained until the current era. These ripples have gradually attenuated due to the expansion of the Universe and would be, in a way, a vestige of the events having succeeded the Big Bang as is the cosmic microwave background.

The present theory argues that these possible post-Big Bang primitive fluctuations and those previously described around particles are in fact nothing more than what modern physics calls quantum fluctuations.

12.4 Oscillation mode of S↕ fluctuations

Like the O~ and L~ waves, these S↕ fluctuations can oscillate in 2 modes depending on their source:

Along the R↑ axis: the oscillation takes place towards the 4th dimension, plus and minus the hypersurface Θ. These are fluctuations from particles for O~ waves and electromagnetic waves for L~ waves.

Perpendicular to the R↑ axis : the oscillation occurs along any axis limited to the 3D volume of the hypersurface Θ. The oscillation is therefore transverse or even perpendicular to the R↑ axis. These are fluctuations from hypothetical dark matter particles for O~ waves and neutrinos for L~ waves.

As mentioned earlier, the average amplitude of these fluctuations, regardless of their origin or mode of oscillation, is the quadratic sum of the amplitude of each fluctuation. In this way, the total energy of these fluctuations corresponds to the sum of the energy of each fluctuation. Note however that according to the explanation provided by this theory for the gravitational force, this total will be slightly reduced precisely to induce this force (see section 15).

13. Matter-Antimatter asymmetry

To explain the matter-antimatter asymmetry according to this theory, we must go back to the beginning of the formation of the Universe, just after the Big Bang. At that time, the Universe was only a small bubble of Θ of very high density and very strong expansion (period of cosmic inflation).

This very strong initial acceleration being done along the R↑ axis (perpendicular to the hypersurface of Θ), this created a significant asymmetry of the acceleration forces between its internal sides (negative side of the R↑ axis) and external (positive side of the R↑ axis).

In this context, let us return to the model of formation of elementary particles explained in sections 6.1.

The diagrams on the Fig. 34 are a section of the electron (top) and positron (bottom) formed following the process described in section 10.4. The purple lines represent the mean hypersurface of Θ. The blue vertical arrows represent the radial axis of Θ (axis towards which the acceleration takes place).

The black downward arrows are the strong acceleration forces acting on the particle just after the Big Bang.

These forces will act on the oscillations of the rotating waves and cause them to move more quickly towards the higher energy level in the case of the electron (top figure, this level is lower on the curvature of the electric field), and towards the lower energy level in the case of the positron (bottom of the Fig. 34).

This advantage will also be observed for more massive particles such as muons, tau and delta mentioned in section 10. In the end, the heavier particles will be formed earlier than their equivalent antiparticle.

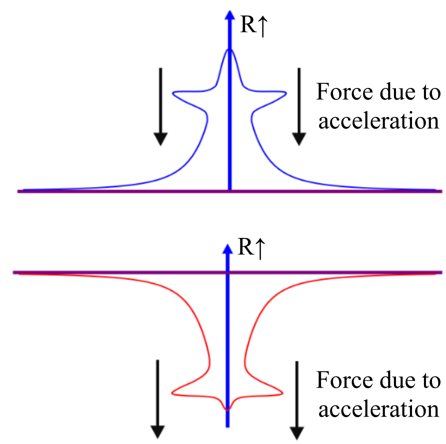


Fig. 34: Diagram illustrating the accelerating force that followed the Big Bang and acting differently on positrons and electrons.

Ultimately, this will lead to earlier and therefore greater production of negatively charged muon, tau, and delta particles relative to their positively charged antiparticles. The subsequent Delta⁻ particles will then transform earlier into neutrons and protons.

The antiparticles formed will then be destroyed by annihilation by the particles, and the surplus of these will gradually lead to a domination of matter over antimatter.

14. The electromagnetic field

14.1 The electric field

Let us return to the principle of creation of electron-positron pairs mentioned in sections 6.1 and 10. According to the present theory, the deformation of Θ caused by the rotation of the oscillations of the electron or the positron would create an electric tension positive for the positron and negative for the electron.

This deformation is the result of the centrifugal force exerted on Θ by the rotation of the photon waves following the formation of electron-positron pairs as explained in sections 6.1 and 10. The electric field would be the slope in V/m of the rise caused above or below the hypersurface of Θ (see Fig. 33).

Fig. 35 illustrates the principle of deformation of Θ by centrifugal force as explained above. This illustrates the need for the angular stiffness of Θ for this deformation to occur. This is well demonstrated in the Fig. 36.

Fig. 37 represents the global deformation of Θ by several negative charges located at the same point. The ripples of the particles are not shown so as not to clutter the illustration. The profile of this elevation varies as $1/d$, where d is the distance from the center of the elevation:

$$d_{R\Theta} = k_e \frac{Q}{d} \tag{17}$$

where Q is the electric charge (unit: C or A-s)
k_e is a constant of proportionality remaining to be defined (unit: m²/(A-s))
d is the distance from the axis of the charges (unit: m)

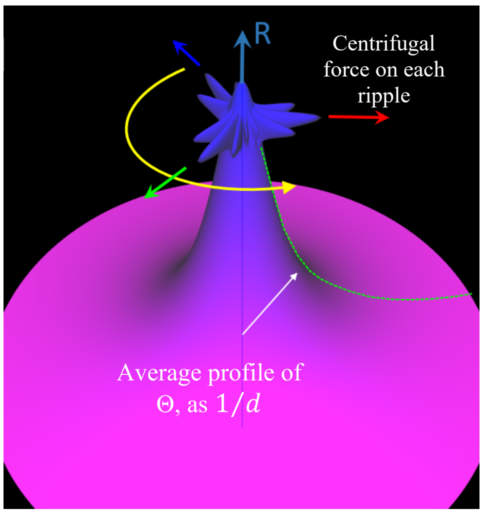


Fig. 35: Illustration of the effect of the centrifugal forces exerted by the O~ waves in the formation of the electric field

Fig. 36: Illustration of the lifting effect caused by a force on a rigid object.

In Fig. 37, the white arrows represent the electric field in one direction (the length is the amplitude and the orientation is the angle of this field). These arrows are repeated all around the elevation. Since the magnitude of the electric field is the slope of the elevation curve, it decreases from the center of elevation as $1/d^2$.

Fig. 38 is the deformation of Θ caused by 2 identical opposite charges. The profile of this elevation varies as $1/d_1 - 1/d_2$ where d_1 and d_2 are the respective distances of each positive and negative elevation. The white arrows represent the vectors of the electric field in one direction (here between the 2 charges or elevations). The field vectors at any point in the hypersurface of Θ are simply the vector sum of the field vectors of each charge taken individually at that point.

The overall profile of these vectors is identical seen from above (from the 4th dimension) to the profile of the electric field vectors between 2 opposite charges (Fig. 39). Various load models could thus be represented and the principle would remain the same.

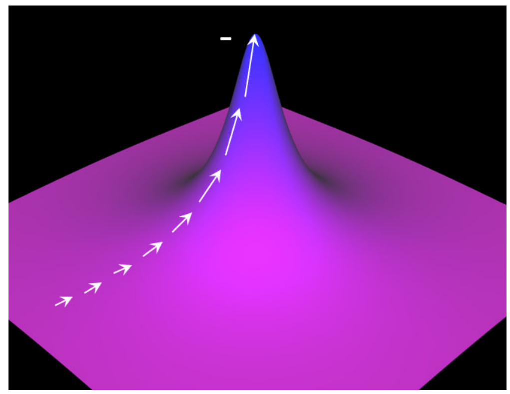


Fig. 37: Illustration of the deformation of Θ caused by an electric charge and thus causing the electric field

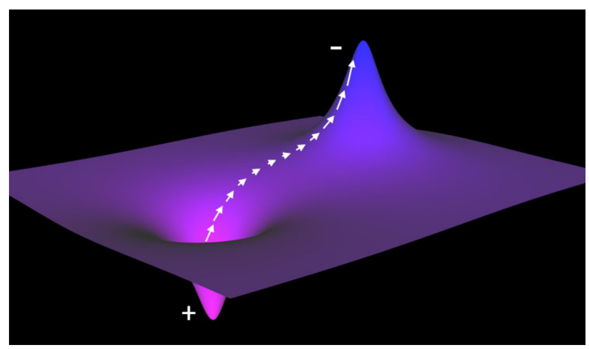


Fig. 38: Illustration of the deformation of Θ caused by positive and negative charges.

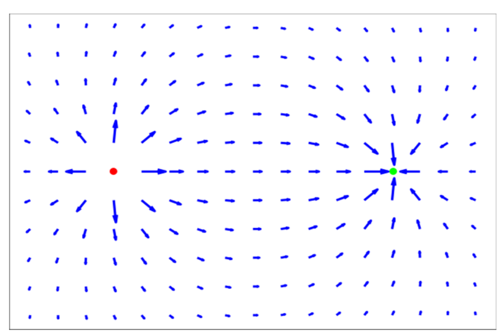


Fig. 39: Conventional illustration of electric field lines in the vicinity of positive and negative charges.

The slope of the strain of Θ is the derivative on d of the previous equation:

$$\vec{m}_{\Theta} = \frac{dd_{R\Theta}}{dd} = k_e \frac{Q}{d^2}\vec{u} \quad (18)$$

where $\vec{u}$ is a unit vector indicating the direction of the slope of Θ.

Note that the electric field is proportional to this slope:

$$\vec{E} = k_{mE}\,\vec{m}_{\Theta} = k_{mE}\,k_e \frac{Q}{d^2}\vec{u} = \frac{Q}{4\pi\,\varepsilon_0\,d^2}\vec{u} \quad (19)$$

Thus:

$$k_{mE}\,k_e = \frac{1}{4\pi\varepsilon_0} \quad (20)$$

The potential energy density associated with this slope of Θ is:

$$\rho_E = \frac{G_{A\Theta}}{2}|m_{\Theta}|^2 = {k_e}^2 \frac{G_{A\Theta}}{2}\frac{Q^2}{d^4} \quad (21)$$

In the presence of 2 electric charges as illustrated in Fig. 40, the energy density of each charge at point P is:

$$\rho_{E1P} = {k_e}^2 \frac{G_{A\Theta}}{2}\frac{{Q_1}^2}{{d_{1P}}^4} \quad (22)$$

$$\rho_{E2P} = {k_e}^2 \frac{G_{A\Theta}}{2}\frac{{Q_2}^2}{{d_{2P}}^4} \quad (23)$$

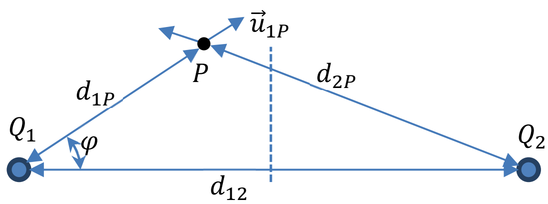


Fig. 40: Diagram illustrating the variables of the equations.

The total slope of the deformation of Θ caused by the 2 loads at point P is:

$$\vec{m}_{\Theta P} = k_e\left(\frac{Q_1}{d_{1P}}\vec{u}_{1P} + \frac{Q_2}{d_{2P}}\vec{u}_{2P}\right) \quad (24)$$

The energy density (J/m³ or N/m²) associated with this slope is:

$$\rho_{EP} = {k_e}^2 \frac{K_{f\Theta}}{2}\left|\frac{Q_1}{{d_{1P}}^2}\vec{u}_{1P} + \frac{Q_2}{{d_{2P}}^2}\vec{u}_{2P}\right|^2 \quad (25)$$

The energy density at point P associated with the proximity of the 2 loads is the difference between the energy density of the loads taken together and the sum of their energy density taken individually:

$$\rho_{EP} = {k_e}^2 \frac{G_{A\Theta}}{2}\left(\left|\frac{Q_1}{{d_{1P}}^2}\vec{u}_{1P} + \frac{Q_2}{{d_{2P}}^2}\vec{u}_{2P}\right|^2 - \frac{{Q_1}^2}{{d_{1P}}^4} - \frac{{Q_2}^2}{{d_{2P}}^4}\right) \quad (26)$$

To obtain the total energy associated with these 2 charges, it is necessary to integrate the previous equation on the volume surrounding them. As there is symmetry of this calculation around the line d_{12}, the integration can be done on the plane formed by the point P and the charges 1 and 2, by first multiplying the previous equation by the circumference around the line d_{12} at the point P given by $2\pi\, d_{1P} \sin\varphi$. This will give:

$$\Delta'\rho_{EP} = \pi\,{k_e}^2\,G_{A\Theta}\,d_{1P}\sin\varphi\left(\left|\frac{Q_1}{{d_{1P}}^2}\vec{u}_{1P} + \frac{Q_2}{{d_{2P}}^2}\vec{u}_{2P}\right|^2 - \frac{{Q_1}^2}{{d_{1P}}^4} - \frac{{Q_2}^2}{{d_{2P}}^4}\right) \quad (27)$$

To make this integration possible, it must be carried out for one of the loads (here the load 1) by limiting itself to the area delimited by the axis halfway between the 2 loads (dotted axis on the Fig. 40). It is then necessary to double the value obtained:

$$\Delta E = 2\pi\,{k_e}^2\,G_{A\Theta}\int_{\varphi=0}^{\pi}\int_{d_{1P}=d_{min}}^{d_{max}}\left(\left|\frac{Q_1}{{d_{1P}}^2}\vec{u}_{1P} + \frac{Q_2}{{d_{2P}}^2}\vec{u}_{2P}\right|^2 - \frac{{Q_1}^2}{{d_{1P}}^4} - \frac{{Q_2}^2}{{d_{2P}}^4}\right) d_{1P}\sin\varphi\; dd_{1P}\; d\varphi$$

$$\text{With } d_{max} = \begin{cases} \frac{d_{12}}{\cos\varphi} & if\ \varphi \le \pi \\ \infty & if\ \varphi > \pi \end{cases} \quad (28)$$

The integration over the distance d_{1P} is made from a minimum distance d_{min} in order to avoid divisions by 0 in the calculation.

The previous equation is particularly complex to solve mathematically. So, for the moment, it was solved numerically which gave the following simple equation for the accumulation of charges 1 and 2 (the constant A_e is approximate, within the limits of the numerical model of resolution (accuracy of approximately 99.99%)):

$$\Delta E = A_e\,{k_e}^2\,G_{A\Theta}\frac{Q_1\,Q_2}{d_{12}} \quad (29)$$

where $A_e \cong 12{,}565$ (~4π, to be validated) (without unit)

The numerical solution model shows that the integral remains finite when $d_{min} = 0$. This resolution also shows that if $d_{min} \ll d_{12}$, this same value d_{min} has a very negligible effect on the result (error of less than 0,0001%). Also, the Q^2 values are discarded and only the $Q_1\,Q_2$ component remains from the cross product inside the part $\left|\frac{Q_1}{{d_{1P}}^2}\vec{u}_{1P} + \frac{Q_2}{{d_{2P}}^2}\vec{u}_{2P}\right|^2$.

The derivative of this equation as a function of the distance d_{12} will give the force between the 2 charges:

$$F = \frac{d\Delta E}{dd_{12}} = -A_e\,{k_e}^2\,G_{A\Theta}\frac{Q_1\,Q_2}{{d_{12}}^2} \quad (30)$$

The sign – indicates a repulsive force for 2 charges of the same sign and an attractive force for 2 charges of opposite sign, which corresponds to the actual situation.

The formula recognized for this purpose by modern physics, without taking into account Θ, is:

$$F = -\frac{1}{4\pi\,\varepsilon_0}\,\frac{Q_1\,Q_2}{{d_{12}}^2} \cong -8{,}98755 \times 10^9\,\frac{Q_1\,Q_2}{{d_{12}}^2} \qquad (31)$$

It is thus deduced that:

$${k_e}^2 G_{A\Theta} = \frac{1}{4\pi\,A_e\,\varepsilon_0} \cong 7{,}1528 \times 10^8 \ \text{kg-m}^3/(\text{A}^2\text{-s}^4) \qquad (32)$$

This sequence of equations shows that it is possible to explain the force between 2 electric charges based solely on the membrane Θ. The energy of the electric field is then the equivalent of the potential energy associated with the deformations of Θ caused by the electric charges.

14.2 The magnetic field

As explained before, an electric charge causes a deformation of Θ, plus or minus the R↑ axis, with an amplitude decreasing like $1/d$ away from this charge. The slope of this deformation of Θ in turn creates the electric field which decreases like $1/d^2$ away from the charge. When this electric charge moves relative to other neighboring electric charges, this causes the displacement of the deformation of Θ caused by this charge. It is this displacement and the kinetic energy associated with it that causes the magnetic field.

In other words, if the electric field is caused by the deformations of Θ, the magnetic field is, for its part, caused by the speed of these deformations when the electric charge moves. The displacement of the electric charge therefore implies a path along an axis or a straight line, generally constituted by any electrical conductor. Moreover, if the electric field implies forces between specific points of charge, the magnetic field rather implies forces between lines of displacement of charges.

To cause the magnetic field, the movement of electric charges must however be relative to other charges, in order to respect the principles of SR. For example, 2 electric charges moving next to each other relative to an observer will not experience any magnetic forces between them since their relative displacement is zero. Only the force due to the electric field will act in this case.

Thus, to properly imagine this, it is necessary to take into account the relative displacement of the charges between them, because this is what will cause the magnetic field. For example, moving a charge at speed v should be analyzed as moving 2 opposite charges moving in opposite directions to each other at speed $v/2$. Thus, this analysis must be done according to the principles of relative displacement of objects as described in SR theory.

To understand this principle of 2 opposite charges, you have to imagine that when an electric charge moves on any conductive material, it leaves behind a hole of opposite charge. So, an electron with charge –e moving at speed v will leave behind a fixed hole with charge +e. In the context of SR, these 2 charges will move in opposite directions at speed $v/2$.

Fig. 41 illustrates this principle for 2 opposing currents along parallel conductors. In this case, the charge +e and –e of the 2 conductors do not move relative to each other so that no force due to the magnetic field will be exerted between them. On the other hand, the charges +e and +e as well as –e and –e on the 2 conductors will move at a relative speed v with respect to each other. A force due to the magnetic field will then appear between them.

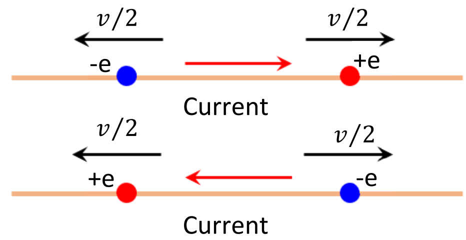


Fig. 41: Diagram illustrating the relative displacement of the charges between them.

As the magnetic field involves forces between straight lines where the charges circulate, it is important to consider a uniform charge distribution along these straight lines. In this way, the electric current I (unit: A or C/s) is the product of the linear density ρ_q (unit: C/m) of the charges along the line and the speed v_q of displacement of these charges:

$$I = \rho_q\, v_q \qquad (33)$$

When we are thus in the presence of a multitude of electrical charges distributed along a linear axis, such as an electrical conductor for example, the electrical field of each of these charges will be added vectorially. This will lead to an electric field which will decrease as $1/d$ moving away from this axis. In addition, the vectors of this field will point in the negative or positive direction of the rays perpendicular to this axis.

Fig. 42 illustrates this point. The red dot in the center is an axis crossing the sheet perpendicularly. The blue arrows give the directions of the electric field. Its intensity is inversely proportional to the distance between the arrows. Thus, the electric field decreases as $1/d$. Here the charges are positive so that, by convention, the electric field vectors move away. The reverse applies to negative charges. Fig. 43 is another representation of the same principle. The purple and blue surface represents Θ. The charges, here negative, are along the ridge (represented by signs –).

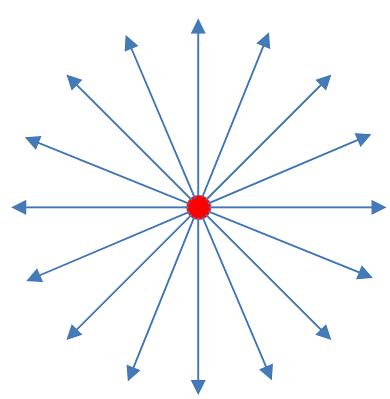


Fig. 42: Diagram illustrating the electric field around an electrically charged conductor

The membrane Θ follows a profile like $\ln(d)$ moving away from the axis of charges:

$$d_{R\Theta} = k_e\, \rho_q\, ln\left(\frac{d}{d_0}\right) \tag{34}$$

where ρ_q is the linear density of the charges along the axis (unit: C/m or A-s/m)

k_e is a proportionality constant previously used for the electric field (unit: m²/(A-s))

d is the distance from the axis of the electric charges (unit: m)

d_0 is the distance from the axis where the strain is zero (unit: m)

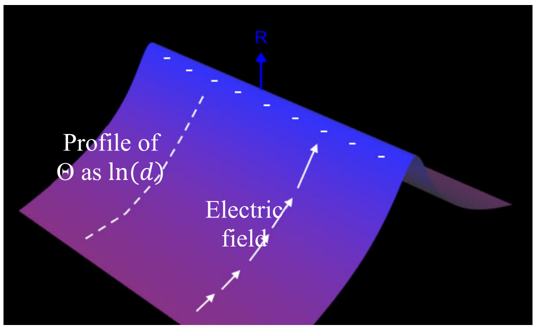


Fig. 43: Another representation of charges along an electrical conductor

It should be noted that, if we abstract from the neighboring charges, the distance d_0 is theoretically infinite and the energy required to thus deform Θ would also be infinite. However, in practice, there is always presence in the vicinity of charges of opposite sign, which means that the average elevation of Θ is never infinite. Anyway, what interests us for the following, is the derivative or the slope of the previous equation, which will eliminate the constant d_0.

The slope of the deformation of Θ is the derivative on d of the previous equation:

$$m_\Theta = \frac{dd_{R\Theta}}{dd} = k_e \frac{\rho_q}{d} \tag{35}$$

Note that the electric field is proportional to this slope:

$$\vec{E} = k_{mE}\, \vec{m}_\Theta = k_{mE}\, k_e \frac{\rho_q}{d}\vec{u} = \frac{\rho_q}{4\pi\, \varepsilon_0\, d}\vec{u} \tag{36}$$

The speed of movement along the axis R↑ of the deformation of Θ is then given by:

$$v_{R\Theta} = k_e \frac{\rho_q\, v_q}{d} = k_e \frac{I}{d} \tag{37}$$

where v_q is the speed of movement of the electric charges (m/s)

I is the current in the conductor that forms the axis (A)

The energy density associated with this velocity is:

$$\rho_E = {k_e}^2 \frac{\rho_\Theta\, I^2}{2\, d^2} \tag{38}$$

In the presence of 2 conductors as illustrated in Fig. 44, the energy density due to each conductor at any point P will be:

$$\rho_{E1P} = {k_e}^2 \frac{\rho_\Theta}{2} \frac{{I_1}^2}{{d_{1P}}^2} \tag{39}$$

$$\rho_{E2P} = {k_e}^2 \frac{\rho_\Theta}{2} \frac{{I_2}^2}{{d_{2P}}^2} \tag{40}$$

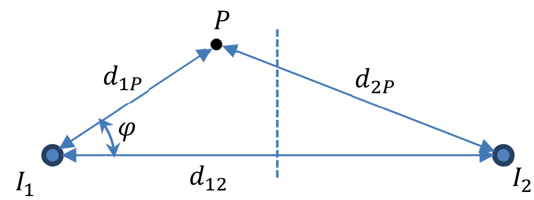


Fig. 44: Diagram illustrating the variables of the equations.

Always in the presence of 2 conductors, the total speed of the deformation from Θ to the point P is then given by:

$$v_{R\Theta P} = k_e \left(\frac{I_1}{d_{1P}} - \frac{I_2}{d_{2P}}\right) \tag{41}$$

It should be noted that there is a minus sign between the 2 components of this equation, because as explained previously, it takes 2 opposite displacements of charge for the magnetic forces to act. If, for example, there are two positive currents, it must be considered as on one side, a negative displacement of a negative charge and on the other side a positive displacement of a positive charge. The negative charge will cause a speed of Θ upwards (towards R↑) and the positive charge, a displacement downwards. These displacements will then contradict each other, hence the negative sign. The position of the − sign depends only on the direction convention adopted, i.e. here, the direction according to the current I_1.

The energy density (J/m³) associated with this velocity is:

$$\rho_{EP} = {k_e}^2 \frac{\rho_\Theta}{2} \left(\frac{I_1}{d_{1P}} - \frac{I_2}{d_{2P}}\right)^2 = {k_e}^2 \frac{\rho_\Theta}{2} \left(\frac{{I_1}^2}{{d_{1P}}^2} - 2\frac{I_1\, I_2}{d_{1P}\, d_{2P}} + \frac{{I_2}^2}{{d_{2P}}^2}\right) \tag{42}$$

The energy density associated with the proximity of the 2 conductors is then the differential between the density of the 2 conductors together and of the 2 conductors taken separately:

$$\Delta\rho_{EP} = -2\, {k_e}^2 \rho_\Theta \frac{I_1\, I_2}{d_{1P}\, d_{2P}} \tag{43}$$

By inserting the law of cosines into the previous equation, we obtain:

$$\Delta\rho_{EP} = -2\, {k_e}^2 \rho_\Theta \frac{I_1\, I_2}{d_{1P}\sqrt{{d_{1P}}^2 + {d_{12}}^2 - 2\, d_{1P}\, d_{12} \cos\varphi}} \tag{44}$$

To obtain the total energy associated with these 2 conductors, the previous equation must be integrated over the area of the plane perpendicular to the 2 conductors. To make this integration possible, it must be carried out for one of the conductors (here conductor 1) by limiting oneself to the area delimited by the axis halfway between the 2 conductors (dotted axis in the Fig. 44). Then multiply the result by 2.

The integration must be done from a non-zero distance d_{min} to avoid dividing by 0. It is considered here that d_{min} is equal for the 2 conductors:

$$\Delta E = -4\, {k_e}^2 \rho_\Theta\, L\, I_1\, I_2 \cdots$$

$$\int_{\varphi=0}^{2\pi} \int_{d_{12}=d_{min}}^{d_{max1}} \frac{1}{d_{1P}\sqrt{{d_{1P}}^2 + {d_{12}}^2 - 2\, d_{1P}\, d_{12} \cos\varphi}}\, dd_{1P} d\varphi$$

$$d_{max1} = \begin{cases} \dfrac{d_{12}}{\cos\varphi} & if \quad \varphi \le arccos\dfrac{d_{12}}{d_{max}} \\ d_{max} & if \quad \varphi > arccos\dfrac{d_{12}}{d_{max}} \end{cases} \tag{45}$$

where L is the length of the 2 conductors in parallel.

The previous equation is particularly complex to solve mathematically. Thus, for the moment, it was solved numerically which gave the following equation (the constants A_m, B_m and C_m are approximate, within the limits of precision of the numerical model of resolution (accuracy of approximately 99,99%)):

$$\Delta E = -{k_e}^2 \rho_\Theta\, L\, I_1\, I_2 \left[A_m\, ln\left(\frac{d_{max}}{d_{12}}\right) - 2\, A_m \frac{d_{min}}{d_{12}} + B_m\right] \tag{46}$$

$A_m \cong 12{,}565$ (~4π, to be validated) and $B_m \cong 17{,}423$ (both 2 without unit)

The previous equation shows that the result of integration remains finite when $d_{min} = 0$. So, for $d_{min} = 0$, the equation becomes:

$$\Delta E = -{k_e}^2 \rho_\Theta\, L\, I_1\, I_2 \left[A_m\, ln\left(\frac{d_{max}}{d_{12}}\right) + B_m\right] \tag{47}$$

Considering d_{max} constant, the derivative of this equation on the distance d_{12} will give the force between the 2 conductors:

$$F = \frac{d\Delta E}{dd_{12}} = A_m\, {k_e}^2 \rho_\Theta\, L \frac{I_1\, I_2}{d_{12}} \tag{48}$$

The sign + implicit in the previous equation indicates an attractive force for 2 currents of the same sign and a repulsive force for 2 currents of opposite signs, which corresponds to the actual situation.

The formula recognized for this purpose by modern physics, without taking into account Θ, is:

$$F = \frac{\mu_0}{2\pi} L \frac{I_1\, I_2}{d_{12}} = 2 \times 10^{-7}\, L \frac{I_1\, I_2}{d_{12}} \tag{49}$$

It is thus deduced that:

$${k_e}^2 \rho_\Theta \cong 1{,}5915 \times 10^{-8} \text{ kg-m/(A}^2\text{-s}^2) \tag{50}$$

This series of equations shows that it is possible to explain the force between 2 conductors carrying currents based solely on the hyper-membrane Θ. The energy of the magnetic field is then the equivalent of the kinetic energy associated with the displacement of Θ at the time of the passage of its deformations caused by the electric charges.

15. Gravitational Force

The gravitational force remains, in this theory as in many others, a phenomenon difficult to explain in its root cause: why do 2 massive bodies attract each other? The GR law explains that this is because these objects create a distortion of spacetime. But that does not explain why precisely these objects distort spacetime. What is the exact nature of the force related to these objects that causes this deformation?

To make masses accelerate in a gravitational field, of course, you need a source of energy to achieve this acceleration. We can then wonder where this energy is located. The present theory proposes that this energy resides in the gravitational field surrounding massive objects and more precisely in the quantum fluctuations found in this field.

Process by which gravitational force takes place:

As explained in section 12.2, a quantum fluctuation field appears around particles following their formation. When several particles are found in a massive body, the cumulative energy density of these fluctuation fields, called here base field ρ_{EP_B}, at any point P in the space surrounding these particles is determined by:

$$\rho_{EP_B} = k_B \frac{m}{d^4} \tag{51}$$

where: ρ_{EP_B} is the energy density of the base field of quantum fluctuations from particles in a massive body m (unit: J/m³)

k_B is a proportionality constant associated with the base field of quantum fluctuations (unit: m³/s²)

However, this basic energy density is not found entirely in the fluctuation field of Θ, because it causes an inertial increase there, which has a slowing effect on the fluctuations and on their energy. This theory argues that the reduction in energy density caused by this effect is the source of the gravitational force. This field is thus called here gravitational field ρ_{EP_G}. As this field is in fact constituted by a reduction of energy, it is then a negative energy field since it subtracts from the base field described above. Consequently, this ρ_{EP_G} must always be less than ρ_{EP_B}.

The rate of change of the field ρ_{EP_G} would then be proportional to the intensity of the residual fluctuation field of Θ (ρ_{EP_Θ}) according to the following formula:

$$\frac{d\rho_{EP_G}}{dm} = k\,\rho_{EP_\Theta} \tag{52}$$

As $\rho_{EP_\Theta} = \rho_{EP_B} - \rho_{EP_G}$, we get:

$$\frac{d\rho_{EP_G}}{dm} = k\left(\rho_{EP_B} - \rho_{EP_G}\right) \tag{53}$$

$$\frac{d\rho_{EP_G}}{dm} + k\,\rho_{EP_G} = \frac{k\,k_B}{d^4} m \tag{54}$$

The preceding equation is a differential equation whose resolution is:

$$\rho_{EP_G}\, e^{\int k\,dm} = \frac{k\,k_B}{d^4} \int m\, e^{\int k\,dm}\, dm + C \tag{55}$$

$$\rho_{EP_G}\, e^{k\,m} = \frac{k\,k_B}{d^4} \int m\, e^{k\,m}\, dm + C \tag{56}$$

$$\rho_{EP_G} = \frac{k_B}{d^4}\left(m - \frac{1}{k}\right) + C\,e^{-k\,m} \tag{57}$$

$$\rho_{EP_G} = \frac{k_B}{d^4} m - \frac{k_B}{k\,d^4} + C\,e^{-k\,m} \tag{58}$$

We now need to determine the values of k and C. For this, we must base ourselves on the theoretical value of the gravitational field ρ_{EP_T}, i.e.:

$$\rho_{EP_T} = \frac{k_T}{d^4} m^2 \tag{59}$$

In order to best follow the profile of ρ_{EP_T} when m is small, we must ensure that for $m = 0$, the values of ρ_{EP_G} as well as its first and second derivatives are equivalent to those of ρ_{EP_T}.

At $m = 0$, the values of ρ_{EP_T} and ρ_{EP_G} are:

$$\rho_{EP_T} = 0 \qquad \text{and} \qquad \rho_{EP_G} = -\frac{k_B}{k\,d^4} + C = 0 \tag{60}$$

We have thus

$$C = \frac{k_B}{k\,d^4} \tag{61}$$

This gives:

$$\rho_{EP_G} = \frac{k_B}{d^4} m - \frac{k_B}{k\,d^4} + \frac{k_B}{k\,d^4} e^{-k\,m} \tag{62}$$

At $m = 0$, the first derivatives (slope) of ρ_{EP_T} and ρ_{EP_G} are both already equal to 0.

At $m = 0$, the second derivatives (curvature) of ρ_{EP_T} and ρ_{EP_G} are:

$$\frac{d^2\rho_{EP_T}}{dm^2} = 2\frac{k_T}{d^4} \tag{63}$$

$$\frac{d^2\rho_{EP_G}}{dm^2} = \frac{k\,k_B}{d^4} e^{-k\,m} \tag{64}$$

At $m = 0$, we thus have:

$$k = 2\frac{k_T}{k_B} \tag{65}$$

We finally get:

$$\rho_{EP_G} = \frac{k_B}{d^4}\left(m - \frac{k_B}{2\,k_T} + \frac{k_B}{2\,k_T} e^{-2\frac{k_T}{k_B} m}\right) \tag{66}$$

$$\boldsymbol{\rho_{EP_G} = \rho_{EP_B} - \rho_{EP_\Theta}}$$

where:

$$\rho_{EP_B} = k_B \frac{m}{d^4} \tag{67}$$

$$\rho_{EP_\Theta} = \frac{{k_B}^2}{2k_T\,d^4}\left(1 - e^{-2\frac{k_T}{k_B} m}\right) \tag{68}$$

The graph of the Fig. 45 illustrates the principle of these components of the quantum fluctuation field in the vicinity of massive bodies. The red curve represents ρ_{EP_G} according to the previous equation. We can note there that when m is small (zone A), this curve approximately follows the expected curve of the gravitational field ρ_{EP_T} (green curve) i.e. a growth like m^2.

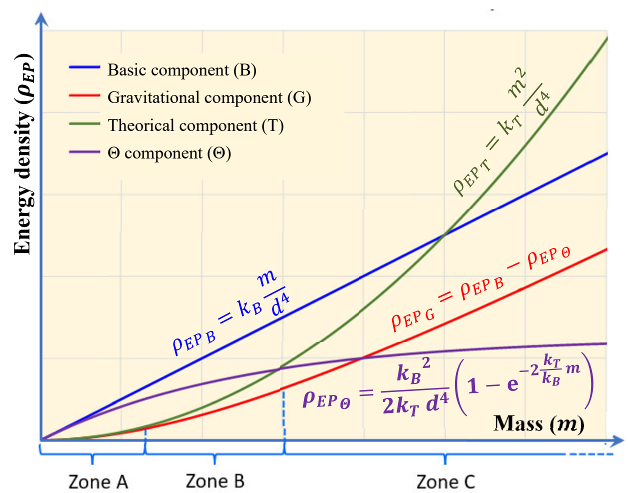


Fig. 45: Energy density of the quantum fluctuation field as a function of the mass of the massive body

However, the energy of this gravitational field cannot be greater than the cumulative energy of the fluctuations of each particle of the massive body (ρ_{EP_B}, blue curve), because the energy of the fluctuations on Θ would become negative, which does not make sense. This ensures that there is a gradual saturation of this red curve from ρ_{EP_G} towards zone C where this field then tends to increase proportionally to m.

Note also the gradual capping towards zone C of the energy density of fluctuations on Θ. We can deduce that from a certain point, any attempt to increase this energy density on Θ results in an equivalent reduction in the field ρ_{EP_Θ}.

Zone B is a transition zone between zones A and C.

Zone A is that which translates the current and known behavior of the gravitational force. It would be very risky to advance here up to what quantity of mass this zone can apply. Further analyzes of the gravitational behavior of massive bodies (massive stars, galaxies and dwarf galaxies, etc.) would be necessary to allow more precision on this subject.

The graph on the Fig. 46 shows the similarities between the curves of ${\rho_{EP}}_G$ and ${\rho_{EP}}_T$ for low values of m (here, in the beginning of zone A, at a scale magnified about 75 times compared to the graph on Fig. 45). With all reserve, this theory suggests that the zone A could apply to masses of up to several billion solar masses. Thus, the mass of the galactic centers would rather be in the zone C.

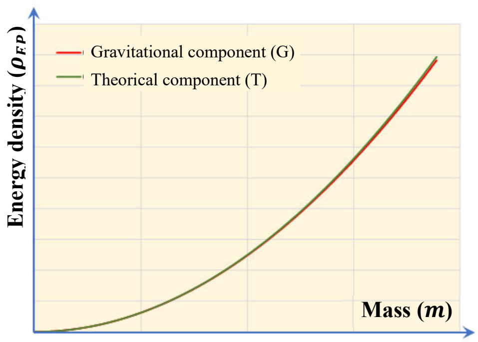


Fig. 46: Energy density of the quantum fluctuation field in the zone A

In this way, the galactic centers would be much more massive than what their gravitational effect suggests. This could then potentially explain, in whole or in part, phenomena such as:

- the flattening of the rotation curve of galaxies,
- the dark matter halo concentration problem

It should be noted that the model presented here does not question the presence of dark matter in the Universe. However, this model could explain, or at least better explain, certain observations or contradictions such as the problem of concentration of the halo. To verify this point, this theory suggests that N-body simulations be performed considering the saturation of the gravitational force explained here.

Behavior of this model in the presence of 2 masses:

According to the present model, the gravitational force is caused by the reduction of the energy density ${\rho_E}_G$ of 2 massive bodies compared to the sum of this same density considered individually for each body. The following transformations make it possible to determine the energy density differential in the presence of 2 massive bodies:

$$\rho_{E1P_G} = \frac{k_B}{d^4}\left(m_1 - \frac{k_B}{2\,k_T} + \frac{k_B}{2\,k_T} e^{-2\frac{k_T}{k_B}m_1}\right) \quad (69)$$

$$\rho_{E2P_G} = \frac{k_B}{d^4}\left(m_2 - \frac{k_B}{2\,k_T} + \frac{k_B}{2\,k_T} e^{-2\frac{k_T}{k_B}m_2}\right) \quad (70)$$

$$\rho_{EtP_G} = \frac{k_B}{d^4}\left[m_1 + m_2 - \frac{k_B}{2\,k_T} + \frac{k_B}{2\,k_T} e^{-2\frac{k_T}{k_B}(m_1+m_2)}\right] \quad (71)$$

$$\boldsymbol{\Delta\rho_{EP_G}} = \rho_{EPt_G} - \rho_{E1P_G} - \rho_{E2P_G} = \frac{\boldsymbol{k_B}^2}{\boldsymbol{2\,k_T\,d^4}}\left[\mathbf{1} + \mathbf{e}^{-2\frac{k_T}{k_B}(m_1+m_2)} - \mathbf{e}^{-2\frac{k_T}{k_B}m_1} - \mathbf{e}^{-2\frac{k_T}{k_B}m_2}\right] \quad (72)$$

The graphs on Fig. 47 and Fig. 48 illustrate the effect of the previous formula. The following effects can be noted:

- When m_1 and m_2 are weak, so both are in area A, (area circled in yellow and enlarged in Fig. 47), conventional gravitational effects apply.
- When m_1 is in area A and m_2 is very large so in area C (or vice versa), m_1 will see m_2 as having less and constant mass (capped effect of m_2).
- When m_1 and m_2 are very large so both are in zone C, the 2 bodies will see each other as 2 weaker and constant masses (capped effect of m_1 and m_2).

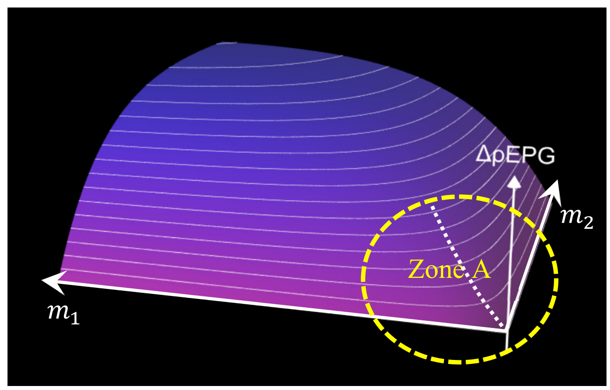


Fig. 47: Profile of the variation of the energy density of the quantum fluctuation field in the presence of 2 massive bodies

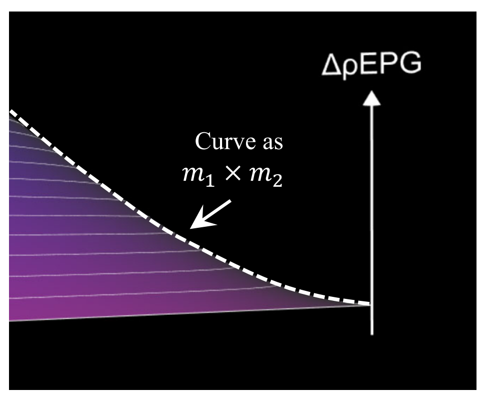


Fig. 48: Profile of the energy density variation in zone A

The graph on the Fig. 49 illustrates, for simple purposes of comparison, the conventional gravitational effect where there is no capping of the gravitational effect, as described above.

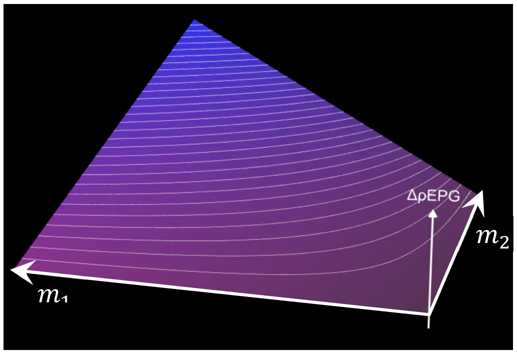


Fig. 49: Profile of the energy density variation without ceiling effect

Analysis of the situation for 2 bodies in area A:

Let us now analyze the whole thing in the context of 2 massive bodies, both located in zone A. In this zone A, the gravitational effects of the present model are similar to those currently known.

Let us first assume the existence of 2 massive bodies of respective masses m_1 and m_2 and separated by a distance d_{12} as shown in the Fig. 50.

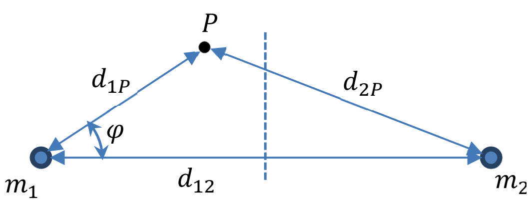


Fig. 50: Diagram illustrating the variables of the equations.

By virtue of what has been presented on the previous pages, the energy density of the gravitational field of each of these bodies, taken individually, at point P is:

$$\rho_{E1P_T} = k_T \frac{{m_1}^2}{{d_{1P}}^4} \quad (73)$$

$$\rho_{E2P_T} = k_T \frac{{m_2}^2}{{d_{2P}}^4} \quad (74)$$

If we now consider the combined effect of the 2 bodies, we must add the effects of each of the bodies before squaring everything according to the following formula:

$$\rho_{EtP_T} = k_T \left(\frac{m_1}{{d_{1P}}^2} + \frac{m_2}{{d_{2P}}^2}\right)^2 = k_T \frac{{m_1}^2}{{d_{1P}}^4} + 2\,k_T \frac{m_1\,m_2}{{d_{1P}}^2 {d_{2P}}^2} + k_T \frac{{m_2}^2}{{d_{2P}}^4} \quad (75)$$

Finally, the energy density differential between the 2 bodies considered together and the same 2 bodies considered individually is:

$$\Delta\rho_{EP_T} = \rho_{EtP_T} - \rho_{E1P_T} - \rho_{E2P_T} = -2\,k_T \frac{m_1\,m_2}{{d_{1P}}^2 {d_{2P}}^2} \quad (76)$$

By inserting the law of cosines into the previous equation, we obtain:

$$\Delta\rho_{EP_T} = 2\,k_T \frac{m_1\,m_2}{{d_{1P}}^2\left({d_{1P}}^2 + {d_{12}}^2 - 2\,d_{1P}\,d_{12}\cos\varphi\right)} \quad (77)$$

The previous formula shows a reduction in the energy density at point P by considering the combined effect of the 2 bodies. To obtain the total energy associated with these 2 masses, it is necessary to integrate the previous equation on the volume surrounding them. As there is symmetry of this calculation around the line d_{12}, the integration can be done on the plane formed by the point P and the masses 1 and 2, by first multiplying the previous equation by the circumference around the line d_{12} at the point P which is $2\pi\, d_{1P} \sin\varphi$. This will give:

$$\Delta'\rho_{EP_T} = 4\pi\, k_T\, d_{1P} \sin\varphi\; \frac{m_1\,m_2}{{d_{1P}}^2\left({d_{1P}}^2 + {d_{12}}^2 - 2\,d_{1P}\,d_{12}\cos\varphi\right)} \quad (78)$$

To make this integration possible, it must be carried out for one of the masses (here mass 1) by limiting oneself to the area delimited by the axis halfway between the 2 masses (dotted axis in the Fig. 50). Then double the value obtained:

$$\Delta E = 8\pi\, k_T\, m_1\, m_2 \cdots \int_{\varphi=0}^{\pi} \int_{d_{1P}=d_{min}}^{d_{max}} \frac{d_{1P}\sin\varphi}{{d_{1P}}^2\left({d_{1P}}^2 + {d_{12}}^2 - 2\,d_{1P}\,d_{12}\cos\varphi\right)}\, dd_{1P} d\varphi$$

$$d_{max} = \begin{cases} \dfrac{d_{12}}{\cos\varphi} & if\ \ \varphi \le \pi \\ \infty & if\ \ \varphi > \pi \end{cases} \quad (79)$$

The integration over the distance d_{1P} is done from a minimum distance d_{min} in order to avoid divisions by 0 in the calculation. The previous equation is particularly complex to solve mathematically. Thus, for the moment, it was solved numerically which gave the following simple equation (valid for low values of d_{min}, also the constants A_g and B_g are approximate, within the limits of precision of the numerical model of resolution (accuracy of approximately 99,99%)):

$$\Delta E = \left(A_g + B_g \frac{d_{min}}{d_{12}}\right) k_T \frac{m_1 m_2}{d_{12}} \quad (80)$$

where $A_g \cong 62{,}005$ and $B_g \cong 50{,}241$ (both 2 without unit)

The previous equation shows that the result of integration remains finite when $d_{min} = 0$. So, for $d_{min} = 0$, the equation becomes:

$$\Delta E = A_g\, k_T \frac{m_1 m_2}{d_{12}} \quad (81)$$

The gravitational force is then simply the negative value of the derivative of ΔE as a function of d_{12}. The negative value is required since, as mentioned at the beginning of this section, it is considered that the energy densities used in the previous calculations are negative (reduction of the energy density of the quantum fluctuation field). This will therefore give:

$$F = -\frac{d\Delta E}{dd_{12}} = A_g\, k_T\, \frac{m_1 m_2}{{d_{12}}^2} \quad (82)$$

The implicit positive sign at the beginning of the result of the derivative indicates an attractive force for the 2 masses which corresponds to the actual situation.

Since, according to the known formula $F = G\,\frac{m_1 m_2}{{d_{12}}^2}$, we get that:

$$A_g\, k_T = G \quad (83)$$

Where G is the gravitational constant (6,6743×10^{-11} m³/(kg-s²))

We can thus define the value of k_T to be:

$$k_T = \frac{G}{A_g} = \frac{G}{62{,}005} \cong 1{,}076 \times 10^{-12}\, m^3/(kg - s^2) \quad (84)$$

Effects on c, lengths and time

We have seen previously that the more intense field of quantum fluctuations near massive objects will have the effect of increasing the inertial density of Θ there. This same increase in density will then induce a slowing down of the speed of progression of the light waves. This will also have the effect of contracting the lengths and the passage of time.

Due to the decreasing density gradient of the inertial density of Θ while moving away from massive objects, the component of *c* perpendicular to this gradient will be deflected towards the increasing inertial density of Θ.

The effects mentioned above are equivalent to those described by GR for the curvature of space-time near massive objects. It should however be noted here that Θ is not really curved in the objective sense of the term. Only, the contractions brought to the lengths and the passage of time can be interpreted as a curvature of space and time as described by the GR.

16. The accelerated expansion of the Universe

Modern physics has established some well-known things about the expansion of the Universe:

1. The Universe would have originated in a huge explosion named Big Bang.
2. In the ensuing period of approximately 10^{-35} seconds, the Universe would have expanded extremely rapidly in a phenomenon named “cosmic inflation”.
3. Thereafter, the Universe would have continued its expansion until the present moment, where it continues its expansion in an accelerated way.
4. The rest remains for the moment expectant: continuation of the acceleration until the dislocation of the Universe in a Big Rip, continuation of the expansion until total cooling in a Big Freeze or expansion followed by contraction until a singularity in a Big Crunch.

Concerning the previous point 4, the present theory favors that of the Big Crunch. The reason is that for the Big Bang to take place, it needs a significant priming energy which can only be provided by a major event such as the Big Crunch (Theory of Cycling Universes).

This Big Crunch event would have been of such power that it would have allowed the release of all the O~ waves of the particles. The new L~ waves thus formed would then have created a sudden and significant centrifugal force on a hyper-membrane Θ of very small volume (Sling effect). This would then have violently reversed the Big Crunch process into a Big Bang process.

This can be imaged by the explosion of a supernova previously initiated by the immense impact brought by the gravitational collapse of the star at the source of the supernova. This sudden reversal from Big Crunch to Big Bang is called Big Bounce by modern physics.

Thus, the Big Crunch being prior to the Big Bang, the present theory favors the theory of cyclic universes.

Note that this theory does not necessarily exclude the possibility that the existence of the Universe is only done on one cycle (Big Bang, Expansion, Contraction and Big Crunch). The Universe would then be born from a singularity and would ultimately return to this singularity at the end of its life. However, the theory of cyclic universes seems to present more affinity with the present theory.

Furthermore, to support the Big Bang process, the present theory suggests that the bulk modulus of Θ (K_Θ, unit: N/m²) must have been very strongly positive at this time (force in the same direction as R↑), or very strongly compressed. Thus, at the time of the Big Bang, Θ was very strongly compressed and this compression energy was released together with the centrifugal force mentioned before to give even more force to the Big Bang.

The present theory claims that this modulus of elasticity becomes negative at low density of Θ. This would slow down, then stop, the process of expansion and initiate the reverse process of contraction of the Universe leading to the Big Crunch.

In order to reconcile this with the previous points and sub-points, the present theory proposes that the force of expansion or contraction exerted by Θ follows a law of the style:

$$F_\Theta = \frac{k_{En}}{{R_\Theta}^n} - k_{Cm}\, {R_\Theta}^m \quad (85)$$

Where F_Θ is the total force exerted on Θ (unit: N)
k_{En} is a constant for the internal expansion force of Θ (unit: N-m^n)
k_{Cm} is a constant for the internal contraction force of Θ (unit: N/m^m)

The value of the exponent n and m remains speculative at this time. Advanced studies or modeling of the cosmic inflation process would be required to establish it with more certainty. For the moment, they will be considered equal both to 1. In this way, we will have:

$$F_\Theta = \frac{k_{E\Theta}}{R_\Theta} - k_{C\Theta}\, R_\Theta \quad (86)$$

Where $k_{E\Theta}$ is a constant for the internal expansion force of Θ (unit: N-m)
$k_{C\Theta}$ is a constant for the internal contraction force of Θ (unit: N/m)

The graph on the Fig. 51 shows the radial force F_Θ exerted on Θ in the direction of the R↑ axis according to the previous equation (blue curve). A positive value of F_Θ indicates an expansion force of Θ and a negative value a contraction force. The bulk modulus K_Θ is obtained by dividing the force F_Θ by the area of Θ resulting from a cut by a hypersurface passing through Θ_0. This surface is given, with all reserve, by $4\pi\, {R_\Theta}^2$. This will give:

$$K_\Theta = \frac{F_\Theta}{4\pi\, {R_\Theta}^2} = \frac{1}{4\pi}\left(\frac{k_{E\Theta}}{{R_\Theta}^3} - \frac{k_{C\Theta}}{R_\Theta}\right) \tag{87}$$

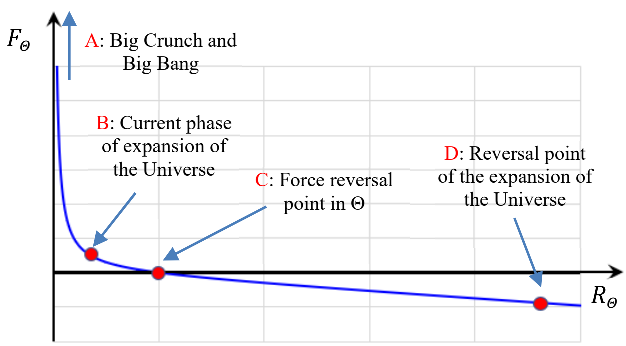


Fig. 51: Graph of the radial force F_Θ exerted on Θ in the direction of the R↑ axis.

Here are the various stages of evolution of the Universe according to this curve:

1. At the time of the Big Bang (at $R_\Theta = 0^+$, phase A on the graph), F_Θ would be very high causing, with the huge centrifugal force caused by the release of energy following the Big Crunch of the previous Universe, the Big Bang and the subsequent event called "cosmic inflation".
2. Also, this curve profile prohibits a Universe ending in a singularity during the Big Crunch since the repulsion force would become infinite at this time.
3. After cosmic inflation, the force of expansion will decrease rapidly and continue to decrease until it reaches zero (phase C), after which it will reverse. The Universe would currently be in this phase of accelerated expansion before reaching this zero force in Θ (phase B).
4. After this phase of zero force in Θ, the force will reverse and consequently, the speed of expansion will then decrease to reach zero speed after a certain time (phase D).
5. After that, the Universe will undertake a phase of contraction which will go on accelerating until the return to the point of zero force in Θ. Then the Universe will continue to contract but with increasing deceleration.
6. Eventually, the Universe will contract like this until the event called Big Crunch. At this stage, due to the very nature of the force in Θ, the Universe will not end up in a singularity, but rather in a very small dimension.
7. Following this, the present theory favors the theory of cyclic universes. Thus, at this stage of very high compression, all matter will be merged and released from its O~ waves mode to give only L~ waves.
8. As these L~ waves naturally seek to propagate in a straight line, this will cause an enormous outward pushing force on Θ (sling effect), which combined with the increasing repulsive force in Θ, will then violently reverse the contraction phase to give the Big Bang, i.e. a very rapid phase of growth named "period of cosmic inflation" by modern physics.

Note that the implosion energy of the Big Crunch of a previous Universe is required to initiate the Big Bang. This is the reason why this theory favors that of cyclic universes. We can image this by the energy of the collapse of a very massive star which would thus initiate a supernova.

Fig. 52 is a principle illustration of Θ (surface with a 90° slice cut to see the interior) representing the forces acting on it that would cause the current accelerated expansion phase of the Universe.

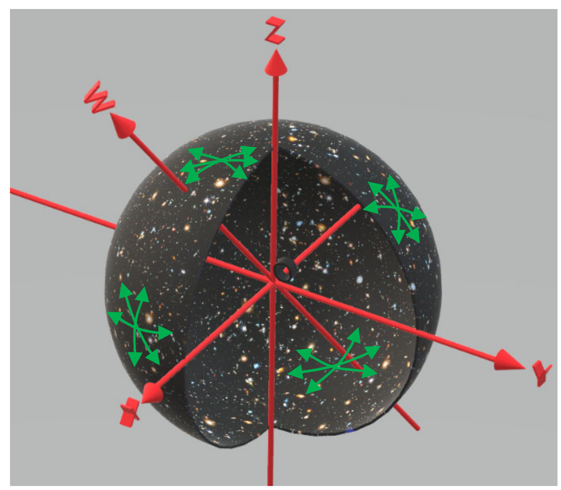


Fig. 52: illustration of Θ (surface with a 90° slice cut to see the interior) representing the forces acting on it.

Possible validation experience:

According to what is stated previously, the acceleration of the expansion of the Universe must have been stronger in the past.

To validate this point, it would be necessary to check the variations in the rate of acceleration of the galaxies according to their distance, insofar as the methods of measurement of distances and redshift can allow it and do not cause observation bias (see to this effect section 18).

A measurement of a stronger rate of acceleration at greater distance would confirm the hypothesis put forward previously. This would also make plausible the hypothesis of an eventual slowdown in expansion followed by a phase of contraction.

17. Dark energy

According to the principles laid down in this theory, Θ is very good at explaining dark energy. It is simply the decompression energy of Θ, which exists at the current stage of the evolution of the Universe. It is this elastic energy of Θ that causes the Universe to expand and the galaxies to move away from each other. Since this force is currently positive towards the positive side of the R↑ axis, this explains the current accelerated expansion phase.

18. The variability of c, lengths and time with the expansion of the Universe

When we look at distant objects in the Universe, we of course see them as they were in the past when their light waves were emitted towards our point of observation. The interpretations that are then made of these observations are based on the unquestioned basis of a constancy in the past with regard to the speed of light, the speed of the passage of time or even the measurement of lengths.

But what is it really? Are these fundamental parameters that are the speed of light, the speed of the passage of time or the measurement of lengths really constants? This theory argues not. This will be dealt with in what follows.

We saw in section 8.2, that the speed c in Θ was given by $c_\Theta = \sqrt{G_{A\Theta}/\rho_\Theta}$.

The angular stiffness modulus $G_{A\Theta}$ of Θ varies as $1/{R_\Theta}^2$ and its density ρ_Θ as $1/{R_\Theta}^3$. So, the velocity c will vary as $\sqrt{R_\Theta}$. As a result, at the beginning of the Universe, c was much slower than it is today and its speed will continue to increase with the expansion of the Universe (reduction in its density).

This will then cause length and time dilation. So, to keep the observation of c constant for a local observer, and if we consider the same modification ratio for the lengths and for the time, these will vary as $\sqrt[4]{R_\Theta}$. For example, for a Universe with a radius 4 times larger, c will be 2 times larger while passage of time and lengths will vary by a ratio $\sqrt{2}$.

In other words, if we could see ourselves on any planet earlier in our Universe (smaller Universe), we would see ourselves smaller, moving slower and living longer than we do now, like a Hobbit movie revolving in slow motion. And, if we could observe ourselves in the same way in the future, we would see ourselves taller, moving faster and living shorter. But for all of these "guys", their local distances, their sense of the passage of time, and their sense of lifespan would remain the same.

This situation of time flowing more slowly in the past necessarily has a consequence on the interpretation that we make of the speed of removal of distant galaxies. Thus, considering this time flowing more slowly in the past, the light frequencies emitted by the galaxies will naturally be lower. They will thus have an accentuated shift towards the red, at least more than that caused by their speed of removal (Doppler effect).

We must also take into account the lower speed c in the past. This would have the effect of decreasing the evaluation of the distances of distant objects. Taking these effects into account would lead to a downward evaluation of the distance and the speed of distant galaxies and therefore of the interpretation currently made of the expansion of the Universe, particularly of an accelerated expansion.

This can therefore have a significant impact on the ΛCDM model used to assess the age, size and expansion rate of the Universe (Hubble constant). It would therefore be necessary to adapt the ΛCDM model according to what is put forward here and see if this could make it possible to reduce or eliminate certain inexplicable discrepancies with the current model, mainly the Hubble tension.

Another effect that should be taken into account according to the present theory is the magnifying effect created by the roundness of Θ. Indeed, if we look further and further into the past, we will observe a Universe much smaller than the current one and this, because of its expansion. However, this smaller Universe will appear to us in all directions of observation, which explains this magnifying glass effect.

A fine example on this point is the cosmic microwave background which is seen in all directions as it dates back to the beginnings of the Universe when it was significantly smaller in diameter than it is today.

We will now examine how the photon ripple amplitude will be affected considering that its energy will be, as it should, conserved during the expansion of the Universe.

We saw in section 9.3 that photon energy was given by $E = 2\,\pi^2\, S_{lat}\, n_\lambda\, G_{A\Theta}\, A^2/\lambda$. If we consider, like previously mentioned, that its lateral area spread S_{lat} will vary as $\sqrt[2]{R_\Theta}$ that its wavelength λ will vary as $\sqrt[4]{R_\Theta}$, and the angular stiffness modulus $G_{A\Theta}$ will vary as $1/{R_\Theta}^2$, then the amplitude A should vary as ${R_\Theta}^{0{,}875}$ to maintain constant the value of E.

For the local observer, the speed c will remain the same and photon energy not varying, Planck's constant, h, will also remain the same.

19. The fine structure of Θ

If we zoom smaller and smaller on Θ, we can wonder if we will eventually get to a point where we will observe a fine structure there, as is the case of particles for matter, or if so, we can zoom in this way to infinity without ever arriving at such a structure.

The 2nd cited case of absence of fine structure seems to be counter-intuitive since it would go against the smallest objects currently observed which have such a structure. If however this is the case, then Θ would be a strictly 3-dimensional object curved in the 4th dimension.

The other possibility cited is that Θ has a fine structure. What we would expect then is that at a certain zoom level, Θ would be formed of points (0D) connected together by straight lines (1D). These straight lines would carry the expansion-contraction forces of Θ. The points, on their side, would carry the inertia of Θ. The straight lines and the points would be carriers at their point of junction of the angular stiffness force of Θ.

It is well understood that this fine structure must appear at an extremely small level of dimension, i.e. much lower than that of the smallest particles, so that this same structure cannot thus interfere, by this fine structure, with the functioning of these particles and of the waves which are there. We can think here that the length of the lines of the fine structure of Θ, would be of the order of the Planck length ($1{,}616\times10^{-35}$ m) or even smaller.

Now, if this fine structure exists, what would be its type of assembly between the points and the lines? In our 3D world, we can imagine this with one dimension less, like a sort of geodesic structure as shown on the Fig. 53, based on the regular structure of the icosahedron (regular polyhedron with 20 faces).

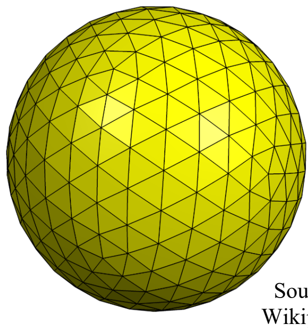


Fig. 53: Geodesic structure based on the regular structure of the icosahedron

In a 4D world, of course, you have to use much more complex geometries. Modern mathematics identifies 6 kinds of polytope (4D polyhedron). The most complex which is the equivalent of the icosahedron, but in 4D, is named 600-cell or the unusual name of hexacosichore (see Fig. 54).

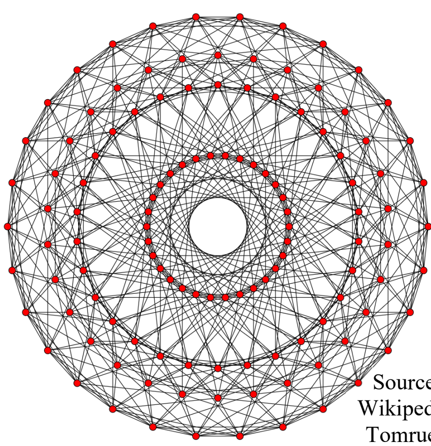


Fig. 54: Plane projection of the hexacosichore

The hexacosichore is composed of 600 volumes (tetrahedra), whose 120 vertices are all equidistant from its 4D center. These 120 vertices are interconnected by 720 edges. Fig. 54 is a 2D projection of this polytope. This figure shows its 120 vertices (points) and the 720 edges (straight lines) that unite them (12 starting from each vertex).

Due to its structure formed by tetrahedrons, it could constitute a good candidate for the fine structure of Θ. Indeed, the tetrahedra composing it could be made up of points and straight lines assembled according to the face-centered cubic structure, also called, compact stacking (example on Fig. 55).

Fig. 55: Example of a compact stacking, here, of clementines

In this structure, if we exclude the spheres on the sides, each sphere is in contact with 12 other neighboring spheres. For the fine structure of Θ, this could be represented by points linking to 12 other neighboring points.

Fig. 56 illustrates these straight lines connecting 12 points. The central point is the one connecting to 12 other points. In this figure, these points are grouped by 4 in three different colors in order to better visualize this assembly. The pale gray lines make it possible to visualize the global cubic structure of this set, even if this assembly can also be represented in the form of a tetrahedron as in the compact stack. It is indeed the same assembly.

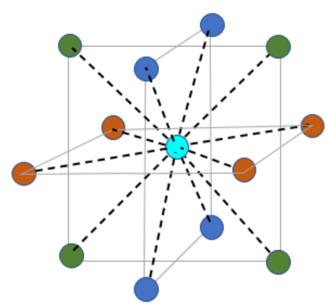


Fig. 56: In a compact stacking, each point is connected to 12 other points

This structure can also be presented as the lines connecting the central point of the edges of a cube or an octahedron to the central point of these polyhedra. In the following, this structure will be referred to as a "compact structure".

It should be noted that the compact structure makes it possible to obtain the greatest density of points. If we take the example of compact stacking again, it is this assembly that makes it possible to stack the most spheres per m^3 (Kepler conjecture, demonstration started in 1998 and completed in 2014 by the mathematician Thomas Hales and his team [33].

Moreover, this structure being able to form a tetrahedron, it can be well integrated into the hexacosichore, each of the volumes of which is precisely a tetrahedron. This polytope has the particularity that each vertex is linked to 12 other vertices as is the case for the compact structure. Thus, such a structure curved in 4D and of which each of the tetrahedrons would have a compact structure could contain an unlimited quantity of points which would always be linked each to 12 other points.

At each point of the compact structure, the adjacent volumes are formed by 8 tetrahedra and 6 octahedra. If these polyhedra are regular, the volume formed will not curve in 4D and will thus extend into a 3D volume not curved in 4D, like equilateral triangles assemble continuously on a plane. To ensure its closure in 4D, the hexacosichore has at each of its 120 vertices of adjacent volumes formed rather of 20 tetrahedrons. Thus, to ensure this curvature, the 6 octahedra mentioned above are each replaced by 2 tetrahedra at the 120 vertices of the hexacosichore, which makes it possible to obtain the 20 tetrahedra mentioned earlier. This replacement at these 120 vertices then makes it possible to gradually close this structure into a hypersphere.

It should be noted that other regular polytopes exist including the 120-cell. This however is the opposite of the 600-cell (as the dodecahedron is the opposite of the isocahedron) so the final assembly could probably be the same as described above.

From all this, another question remains: is the fine structure of Θ perfectly regular like that of the 600-cell or are the points of curvature at its 120 vertices distributed rather randomly? If the first hypothesis is valid, we could argue that at this dimension of the view of the Universe, it would become close to a pure mathematical object. Unless an internal characteristic of the structure of Θ makes it have a perfect geometry, a bit like crystals in nature.

20. Quantum mechanics in the context of Θ

Quantum mechanics is a vast and complex subject. Also, the word “puzzling” would probably be more appropriate than “complex”. Indeed, anyone who knows this mechanics a little knows how much it can hit our common sense head on and succeed in confusing even the greatest physicists as to its deep interpretation, and this since its beginnings in the 1920s.

Yet this mechanics manages to establish very well mathematically the behavior of particles at the atomic level. Many experiments have shown that it is adequate, even if its deeper meaning (also called determinism) is still subject to debate. We are talking here about phenomena such as wave-particle duality, superposition of states, quantum entanglement, to name but a few.

As already mentioned, the subject is vast and only a few aspects of this mechanism will be analyzed with regard to this theory. This will be done without any pretense and the subject can be improved as needed in the future.

Note that to satisfy or at least try to respond to certain phenomena of quantum mechanics, this theory considers that the particles have a wave behavior which extends around the particle with a decreasing amplitude of oscillation as $1/d^2$ (see section 12.2). The particles therefore do not have a clear outline as one might consider with everyday things.

Let us now look at this under the aspect of some phenomena of quantum mechanics.

20.1 Instantaneous transmission of quantum information

One of the most intriguing particularities of quantum mechanics is its capacity for instantaneous transmission, or at least at a speed well above the speed c, of the wave function around a particle or between two entangled particles.

This characteristic is well illustrated in the phenomenon of quantum entanglement. This phenomenon is one of the most difficult, if not the most difficult, questions in quantum physics and indeed in physics as a whole. Indeed, how to explain that according to this principle, widely verified, certain properties of these 2 particles (spin, polarization etc.), whose individual measurement results are totally random, are fully correlated regardless of the distance separating them.

Take, for example, the case of 2 entangled particles having a random individual spin of −1/2 or +1/2 and whose total spin is zero. Well, by measuring the spin of each of these particles at the same time, regardless of the distance separating them, their total measured spin will always be zero, even if we know that the individual measurement is totally random.

This may seem paradoxical in the sense that it is as if these particles could instantly transmit information about their state, which contravenes the sacred principle of SR which says that no information can be conveyed faster than the speed of light. However, it has been shown that this principle cannot be used to transmit information faster than light [34][35]. It should rather be seen as if the 2 particles formed only one regardless of the distance separating them.

It should be noted that this defies common sense and strains the thinking on this subject of many physicists. This is why this particular characteristic, calling into question the principle of the locality of events, has been contested since its discovery and this, on several occasions, by a number of recognized physicists including Einstein himself. However, recent experiments taking into account the multiple counter-arguments put forward, have confirmed with almost certainty the validity of the non-locality of quantum mechanics [36].

In this process of very rapid, even instantaneous, transmission of quantum information, we must first ask ourselves via which channel this transmission of information takes place. Two hypotheses can then be considered:

1. Quantum information is transferred using an abstract channel, a purely mathematical channel that does not take into account the propagation time. In other words, the equations governing this information transfer do not contain the time variable. The information is thus transmitted regardless of time, regardless of the transmission distance. This hypothesis is consistent with the understanding of this phenomenon supported by the Copenhagen school.
2. Quantum information is transferred using a physical channel yet to be determined. It is therefore necessary here to use a particular communication channel since in the known channels, the information cannot be conveyed faster than the speed c.

The present theory cannot immediately exclude hypothesis no. 1. Thus, in addition to the hyper-membrane Θ mentioned in this document, there would exist, in the domain of particles, an additional characteristic based on a mathematical or statistical formulation making it possible to instantly define in space the field of deployment or state of a particle.

With the other possibility mentioned in point 2, this theory advances the hypothesis that the hyper-membrane Θ would be able to ensure the instantaneous propagation of this information via its structure. In this transmission, the inertia of Θ would not be involved, because there would then be propagation of a wave at speed *c*. Thus, the transmission would be done by another mechanism without causing the mechanical oscillation of Θ. The information would thus be transmitted thanks to an additional particularity for this purpose of Θ.

We saw in the section 19 a possible fine structure of Θ similar to a geodesic structure. This structure is made up of points, or nodes (0D), connected together by lines (1D). This theory argues that these lines are capable of instantly transmitting quantum information to all neighboring nodes, like a gigantic neural network.

This ability of these lines would be possible in the context of their zero inertia. Let us recall that this inertia is concentrated in the points or nodes of the structure of Θ. Thus, considering the formula presented in the section 8.2 of the wave propagation velocity $v = \sqrt{G_{A\Theta}/\rho}$, the propagation velocity would be infinite in these lines due to their zero inertial density ρ.

Moreover, this characteristic of these straight lines would also make it possible to instantly convey the force exerted on them. However, the ripple, involving the displacement of the points carrying the inertia, would allow its displacement only at the speed *c*. In other words, as soon as inertia is present, the speed of propagation is limited.

Finally, this theory concludes that Θ, by the connecting lines insides its structure, would naturally have a characteristic allowing it to transmit instantaneously, if not at a speed much greater than *c*, the quantum information of the particle wave functions.

20.2 Wave-corpuscle duality

We will now examine this theory from the angle of the wave-particle duality observed in quantum mechanics. According to this principle, a particle can behave both as a wave with an infinite extension and both as a particle with a very local position. This very confusing phenomenon is very well illustrated by Young's slit experiment.

How, indeed, to explain that in this experiment, the photons projected individually and randomly passing through the 2 slits can all the same in the end form the same interference pattern as if they were pure waves?

Starting from the characteristic of Θ described previously to be able to convey quantum information instantaneously, here is how the present theory explains the behavior of photons in the Young slit experiment:

1. As soon as the photon is emitted from its light source, it acquires a new quantum state. According to the present theory, as soon as a particle thus acquires a new quantum state, its wave function is conveyed instantaneously via the structure of Θ throughout the environment of the emission (see section 20.1). This function will be blocked by any obstacle, in the same way as the light wave seen in wave form.
2. The quantum state conveyed here is the wave state of the particle, or its wave function. Each point of Θ is then instantly informed of the wave emitted, with its frequency and its amplitude. Please note that this is for information only. The points of Θ do not change position. They just gather information. The change of position of the points of Θ will only occur when the particle passes through the speed *c*.
3. It now remains to determine how the photon will use this information to get to the places where it is found in Young's slit experiment. The following hypotheses can be formulated for this purpose:
   - The photon follows a path guided by this quantum information transmitted to Θ. Thus, as soon as it crosses one of the slits, it is thus automatically guided towards the zones of greatest amplitude of the information of the wave initially transmitted to Θ.
   - Upon departure, due to the instantaneous transmission of quantum information, the initial and final states of the photon are determined. Thus, at its departure, its arrival point is already fixed randomly, but respecting the expected distribution pattern.
   - The photon follows a random path as if there were only one slit. However, its fluctuation amplitude pattern is directly affected by that of the wave function such that when it arrives at the wave receiving wall, it will materialize at or near the place of its strongest amplitude thus modified.
4. When the photon reaches the receiving plate, it assimilates to one of the particles of this panel. The photon then loses its quantum state and the receiving particle receives a new one. At this moment, the initial quantum states and their wave function disappear instantaneously from Θ and the new quantum states appear there instantaneously with their wave function.

This process requires a kind of communication between the photon in its wave packet form and its wave function inscribed in Θ. It would be risky to suggest how this could be done. However, one hypothesis would be that the angular stiffness of Θ could be directly affected by the instantaneously transmitted wave function, which would thus guide or influence the photon to where it must finally go.

20.3 Quantum entanglement

We will examine the possible operation of all this under the magnifying glass of the phenomenon of the wave-particle duality of the Young slit experiment and the instantaneous transmission of quantum state between two entangled particles.

From the characteristic of Θ previously described to be able to convey quantum information instantaneously, here is how the present theory explains the behavior of photons in this phenomenon of quantum entanglement:

1. We will consider here the experience of Alain Aspect [36]. This experiment consists of emitting 2 oppositely entangled photons (one to the left and the other to the right) towards 2 polarization cubes positioned at a variable angle. The photons are polarized one in right circular polarization and

the other in left circular polarization, giving zero total angular momentum. Since they are entangled, their total angular momentum must always be zero.

2. As soon as the 2 entangled photons are emitted from their source, they acquire a new common quantum state for the 2 photons. As explained before, the information of this quantum state and its associated wave function is automatically and instantaneously transmitted to the whole extent of Θ.

It now remains to determine how the 2 photons will use this information to respond to the results of this experiment. The following hypotheses can be formulated for this purpose:

3. As soon as they leave, due to the instantaneous transmission of quantum information, the initial and final states of each photon are determined. These are, in a way, the hidden variables mentioned in the EPR paradox. If the polarization of the cubes changes along the way, the wave function is instantly readjusted, and the behavior of the photons is instantly adjusted accordingly. The "hidden variables" here are therefore non-local.
4. In their journey, as soon as the quantum state of a photon changes on its arrival at a polarization cube, the wave function is instantly readjusted and transmitted to the 2nd photon. This one then takes the same quantum state as his friend, therefore the same polarization. It then retains this polarization angle.
5. In this way, the 2nd photon on its arrival at its polarization cube is always found to have a polarization angle corresponding to the 1st photon. He then continues on his way and crosses its cube of polarization. As it already has the polarization angle of the 1st photon, its probability of going straight or of being deviated at 90° only depends on the angular difference between the 2 cubes.

This behavior, well described by the Aspect experiment, demonstrates the violation of Bell's inequalities, the validity of quantum mechanics and the absence of local hidden variables of the determinism model.

20.4 Uncertainty principle

One of the first principles of quantum mechanics was the uncertainty principle. This principle states that there is a fundamental limit to the precision with which it is possible to simultaneously know the position and the momentum of a particle, or even its position and its speed.

This principle is summarized in the following formula: $\sigma_x \sigma_v \geq \hbar/2m$, where σ_x is the standard deviation of the position, σ_v is the standard deviation of the velocity and m is the mass of the particle [37][38].

The present theory advances that this principle arises from the fact that the particles do not have a precise contour, due to their undulatory spreading around their circumference, as explained previously. This therefore leads to inaccuracies both in their position and in their speed.

When the object becomes more massive and is thus composed of several particles, a large part of these inaccurate contours are found inside the object itself, which has the effect of reducing the importance of these inaccuracies on the contours of the object.

20.5 Wave function

According to this principle, the particles have a probability of presence defined by a statistical formulation of probability density called wave function. This principle is very well illustrated by the orbitals of electrons around an atom.

Fig. 57 is an illustration of one of the possible wave functions of the electron around a hydrogen atom. The whiter the areas, the higher the probability of finding an electron there.

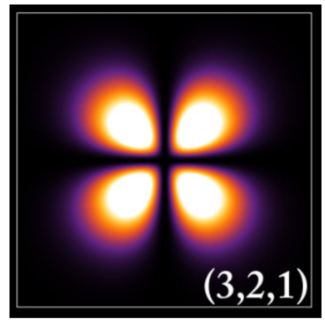


Fig. 57: Illustration of the wave function (3,2,1) of the hydrogen atomic orbitals

How to explain that these 4 orbitals are thus separated by zones of absence of the electron whereas one knows that this one, to maintain itself at a distance from the nucleus, must turn around to obtain the centrifugal force necessary to maintain it at distance?

According to this theory, the electron as explained in section 10.4, passes from one orbital to another in the following way:

1. When the electron arrives at the edges of the orbital, it will then begin to flatten and reverse its spin at the start of the black zone. It is this spin inversion at this location that will ensure that the electron is flattened so that it no longer has any electrical charge.
2. The electron will then partially cross this black zone and it will begin to appear on the other orbital, but with reverse spin. It will then find itself temporarily overlapping the 2 orbitals, part of its charge being on one and the other part on the other with reverse spin. The electron will be flattened in the black transition zone.

   Fig. 58 is an illustration of this in principle with here a transition at about 40% - 60% from one zone to another. To simplify the illustration, the ripples around the electron are not shown like in the section 10.4, but their path is represented by yellow dotted double lines. The black zone represents the zone of non-probability of the presence of the electron.
3. Eventually, the electron will end up completely on the new orbital with reverse spin compared to the previous orbital. The spin inversion will then have allowed it to cross the black zone between these orbitals.

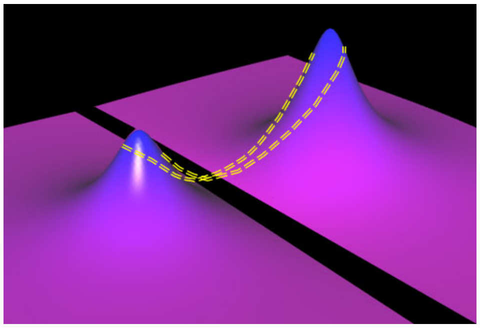


Fig. 58: Passage of the electron from one orbital to another with spin inversion

The passage principle described above then becomes possible if the electron is seen as the result of rotating waves. This then acts like a wave that can split into 2 and then reconstitute itself on the other side of an apparently impassable zone.

20.6 Superposition principle

According to this principle, a particle can present 2 states simultaneously which normally cannot coexist in the same particle. This can be the case of spin direction, excitation state, position etc.

To explain or attempt to explain this according to this theory, we can take as an example the explanation of the passage of the electron from one orbital to another as explained previously in the section 20.5. In this passage, the electron temporarily takes, the time of the passage, 2 states of spin and 2 states of position. If the electron passed to an orbital of higher excitation level, it would then have, during the passage, 2 states of excitation.

20.7 Quantum fluctuations

According to this theory, during the very strong release of energy that followed the Big Bang, a very large amount of fluctuations of Θ were emitted in all directions. Given the very chaotic nature of this event, these fluctuations were not synchronized. They could therefore be sometimes in phase, sometimes in opposition, or any situation between these 2 possibilities.

Their residual sum then quickly became chaotic and formed a field of fluctuations of Θ of variable amplitude a bit like non-coherent waves on a body of water. Fig. 59 is a simplified illustration of this phenomenon on the hypersurface of Θ.

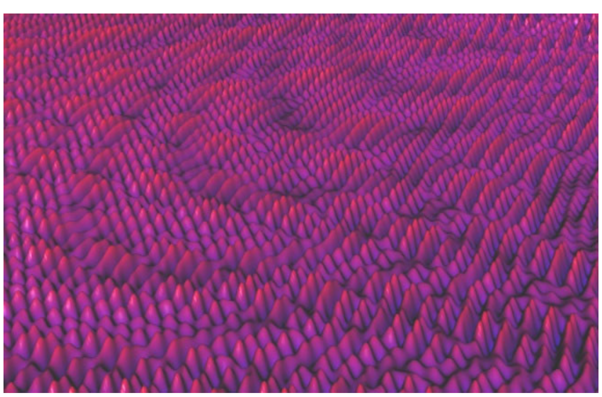


Fig. 59: Simplified representation of quantum fluctuations on Θ

According to this theory, these varying ripples are the equivalent of the phenomenon called “quantum fluctuations”.

Since Θ does not exhibit any friction, these fluctuations are still present as a residual background noise on the entire hypersurface of Θ.

In section 12.2, it is explained that these fluctuations can become more important when approaching massive objects.

21. Conclusion

This theory is comprehensive and therefore touches on multiple aspects. Some checks could be made to validate principles such as the variation in the acceleration of the Universe in the past.

One of the main validation problems that arise is the difficulty, even the impossibility, of any experiment whatsoever to validate the existence or not of Θ. This membrane appears quite elusive because it has no friction.

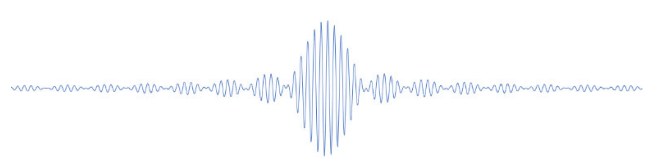
Another difficulty is more of a psychological order, namely that of accepting the concept of Θ, when we know how taboo it may be, even almost heretical, to speak of such a concept which may resemble that of the aether. It should however be pointed out that Θ is quite different from the notions of aether rejected in the past. The author therefore asks physicists to consider this from an entirely new angle.

A good example on this subject is the evolution led by Copernicus from geocentrism to heliocentrism [12]. Geocentrism was able to explain things but heliocentrism, more in line with reality, has greatly simplified its understanding and mathematical formulation.

The current attitude of rejection of any theory that can approach the notion of Aether is also quite incomprehensible when we know that no study has proven the non-existence of such a kind of wave propagation medium. Even the SR theory did not. This theory simply mentioned that the Aether was not useful for the demonstration, which logically does not mean that it does not exist.

Moreover, a theory like this can still gain ground if it manages to explain in an elegant and simplified way phenomena that are currently not explained or that are not entirely satisfactory. This is what the author firmly believes.

To succeed in supporting all this, the author needs the help of physicists, mathematicians, researchers or students specialized in the areas covered here. This theory can also open several interesting avenues of research in the academic world or elsewhere. Admitting that it is founded in whole or in part, it should make it possible to make the current observations stick well or better with their modeling or mathematical formulation, reinforcing at the same time its validity.



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