Ulianov String Theory

A new representation for fundamental particles

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Summary

This article introduces a new model for fundamental particles representation, named Ulianov String Theory (UST).
In the UST model, the space is composed of eight dimensions, being four of them "rolled up" dimensions while the other four are "ordinary" dimensions. Moreover, in the UST, time dimension is modeled as a complex variable and can also be "rolled up".
This new string model also defines point-like particles named Ulianov Holes (uholes), which, from the imaginary time collapse, is transformed into strings. These strings allow generation of a series of structures, which can be associated to configurations of the observed matter and energy in our universe.

1 – Introduction

The current standard atomic model [1] was defined on Quantum Mechanics [2] principles and considers a division of the matter/energy in three main "blocks": Fermions, Hadrons and Bosons.
In this atomic model, the fundamental particles of the matter are composed of six types of Leptons and six Quarks [3] types, and the four fundamental forces are associated to five Bosons types.
This model presents a high degree of predictability on practical applications and laboratorial experiments, with a few opened or not yet explained aspects.
However, there is a disparity between the results foreseen for the Quantum Mechanics and for the General Theory of Relativity formulated by Albert Einstein [4], mainly when extreme cases are studied, such as black holes formation and the first instants of the universe creation.
This leads to believe that the currently used standard atomic model may not be a definitive theory and leaves space so that other theories search for new explanations for the basic operation and composition of the fundamental particles that form our universe. One of these theories is the String Theory [5], which actually congregates a great set of related theories.
The String Theory starts from the hypothesis that the fundamental particles of our universe are formed by strings, instead of point-like particles considered in the standard model.
The use of strings as basic elements prevents a series of problems, such as the singularities that appear when operating with point-like particles. However, the models considered in the string theory predict the existence of more than three space dimensions, where the extra dimensions would be "rolled up", and cannot be directly perceivable.
The M Theory [6], for example, considers a total of eleven dimensions, being one temporal dimension, three space dimensions and seven rolled up space dimensions.
In this context, the Ulianov String Theory (UST), presented in this article can be classified as a new type of string theory, with the following innovations:

- Time is modeled as a complex variable, thus containing a real part (real time) and an imaginary part (imaginary time);
- Time is also considered a dimension subjected to "rolling up";
- The rolled up dimensions are associated to "mirror spaces", which are separated from the "ordinary" space by "time walls" or "space walls".

These points lead to the definition of a space with eight dimensions, called General Octo-Dimension Universe (GODU space) which gives one of the basis to the UST model and will be described in the next section.

2 – Space-time defined in the UST

The GODU space is defined considering a space-time of eight dimensions where the trajectory of a point-like particle is defined by the following function:

$$\varphi = F(x, y, z, s, \bar{x}, \bar{y}, \bar{z}, \bar{s}) \qquad (1)$$

Where (x, y, z) are coordinates of ordinary space and ($\bar{x}, \bar{y}, \bar{z}$) are coordinates of rolled up space, while the coordinate s represents the ordinary complex time and $\bar{s}$ represents the rolled up complex time.
Being the complex time defined by:

$$s = t + \mathrm{i}\, q \qquad (2)$$

Where *t* represents real time and *q* represents the imaginary time.

2.1 – Rolled up dimensions

The rolled up dimensions foreseen in M theory are difficult to model because they have seven dimensions and are placed in a space of only three dimensions.
In the UST, the spatial rolled up dimensions will count only three coordinates ($\bar{x}, \bar{y}, \bar{z}$), that can be easily represented in the three-dimensional ordinary space (x, y, z), just like spheres of infinitesimal size that repeat themselves on each point of the space.
An alternative way of visualizing the rolled up space dimensions is to consider them as ordinary ones, except for the fact that they are situated in another space (which exists in parallel to the first ordinary space considered). In this case, we can model a single set of space dimensions (ordinary and rolled up) as two distinct spaces (both with only ordinary dimensions), which are separated by a "space wall" situated in a height order dimension.

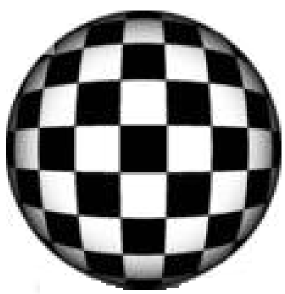

Figure 1 - Two-dimensional space defined on a rubber ball.

A simple analogy that illustrates this aspect of the UST is shown in figure 1, in which a two-dimensional space, represented in the figure by a chessboard, was drawn on the external surface of a rubber ball.
Considering that a second board is drawn on the internal ball surface, an observer from outside the ball could look through a small hole on the surface (made on any point of the ball) and observe the entire internal board "inside" this hole as if it was a rolled up dimension.
In this analogy, we can consider a four-dimension space, being two of them ordinary (external board from the ball) and two rolled up (holes which allow to visualize the internal board).
However, an observer inside the ball could affirm the internal board is composed by two ordinary dimensions, and the external board is composed by two rolled up dimensions.
Thus, instead of dealing with rolled up dimensions, it can be considered that there are four ordinary dimensions grouped two by two (two boards), which are placed in distinct spaces (internal surface and external surface of the ball) and that they are separated by a "space wall" (rubber film that forms the ball wall).
As rubber film has a thickness measured in a perpendicular axis to the plan of boards, this represents a distance measured in a height order dimension of the considered spaces.

Based on this analogy, instead of considering four rolled up dimensions, on GODU space, we can use only ordinary dimensions distributed in a total of four distinct spaces.
In this case, the point-like particle observed in equation (1) becomes a "block" of four particles, in which each one of them is defined in function of the considered space coordinates:

$$\varphi_1 = F_1(x, y, z, s) \tag{3}$$

$$\varphi_2 = F_2(x, y, z, \bar{s}) \tag{4}$$

$$\varphi_3 = F_3(\bar{x}, \bar{y}, \bar{z}, s) \tag{5}$$

$$\varphi_4 = F_4(\bar{x}, \bar{y}, \bar{z}, \bar{s}) \tag{6}$$

This block of particles will behave interdependently, which may be associated with an object placed in front of two mirrors forming a straight angle, as shown in Figure 2.

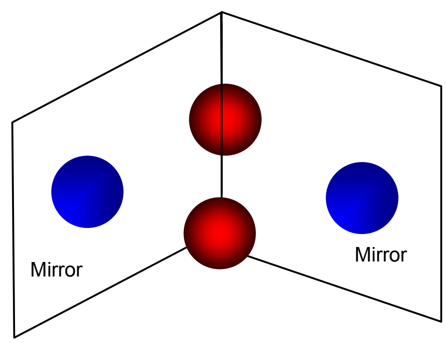

Figure 2 - Object placed in front of two mirrors generating three images.

A time/space model equivalent to that used in UST was proposed on 1966 by Isaac Asimov in an article entitled "I'm Looking Over a Four-Leaf Clover" [7].
In this technical article, Asimov assumes the existence of a type of "negative energy" (or anti-energy) that would cancel the "positive energy" generating a total energy equal to zero.
Thus, Asimov starts from a null condition, generating two universes (one of energy and another anti-energy) separated by a "space wall".
The universe of energy is also divided into two new universes (a universe of matter and one of antimatter) separated by a "wall" of time.
In the anti-energy universe a similar process occurs generating a model formed by four universes, as shown in Figure 3.

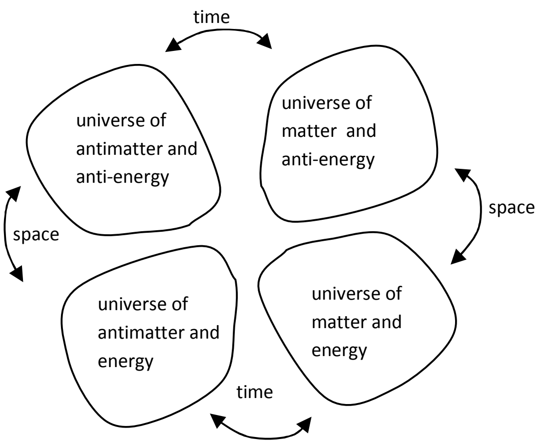

Figure 3 - Four-leaf clover of Isaac Asimov representing four universes separated by "walls" of time and space.

The "four-leaf clover" universe proposed by Asimov was used by the author in the definition of UST model, with four distinct spaces, shown in Figure 4, which contains the block of four particles that were defined in equations (3) to (6).

Thus, the UST considers that all physical properties (mass, charge, linear momentum, spin, energy, etc ...) of a particle of eight dimensions (defined in GODU space) will always be equal to zero.

Therefore, certain physical properties will only exist when the original particle is divided into a block of four particles and each one of them is observed individually.

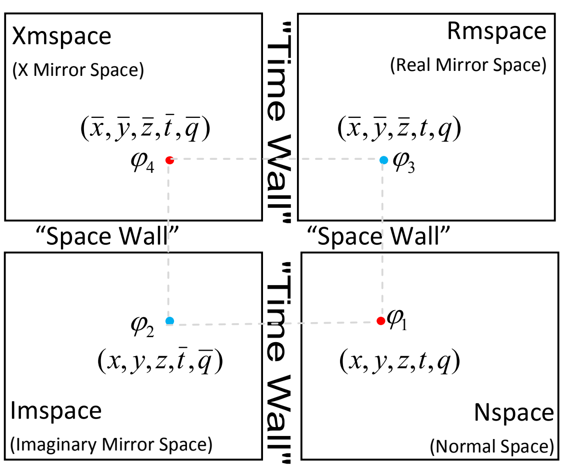

Figure 4 – The GODU space being divided into four new spaces.

Due to the symmetrical behavior presented by any block of four particles in the UST model, the "walls" of time and the "walls" of space proposed by Asimov can also be associated to the mirrors shown in Figure 2.

Thus, a particle in front of mirrors will exist in a "normal" space (Nspace) while the three particles "behind" the mirrors will exist in "mirror spaces".

As in the UST model, time has an imaginary component; the "mirror space of time" was named Imaginary Mirror Space (Imspace). The remaining spaces were in turn called Real Mirror Space (Rmspace) and X Mirror Space (Xmspace) as shown in Figure 4.

It is important to observe that establishing the properties and trajectories of a particle in the Nspace, the properties and trajectories of the other three particles (in the same block) are also established.

Thus, we can usually study only the particles in the Nspace, with no concern with the particles in the other spaces.

2.2 – The meaning of the imaginary time

To better understand the meaning of imaginary time, we can make an analogy with images being displayed on a cathode ray tube (for example, an old black and white TV).

In this case, the real component of complex time is associated with each new image that appears on the screen, and the imaginary component of complex time can be associated to the scanning processes that move an electron beam on the screen.

Considering that the formation process of each image is associated with the imaginary time, a light point shall be observed moving on the screen and changing intensity.

Since the human eye can see a typical variation of only 60 frames per second, a human observer cannot perceive the scanning process, and thus we can say that for him, the scanning time (imaginary time) doesn´t exist. And so, a human observer will only perceive a succession of images on the screen (real time).

2.3 – Extension of the imaginary time

In UST model, imaginary time has a limited extension, thus, the complex plane of time can be defined on a cylinder surface.

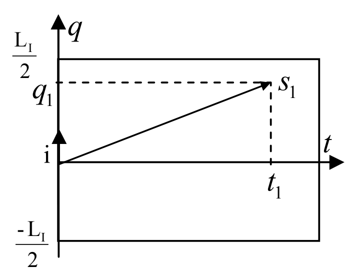

Figure 5 - Flattened representation of the complex time.

By flattening this cylinder, we will obtain the representation shown in Figure 5, in which a given complex time s_1 is formed by a vector sum of an imaginary time q_1 and a real time t_1. The parameter L_1, in this figure, represents the total extension of imaginary time, which is equal to the circumference of this cylinder.

The real time, in turn, starts at the base of the cylinder, growing continuously with no limitation.
This feature can also be observed in the analogy of black and white TV, in which the scanning time has a duration that is always limited, whereas the real time given by the sequence of images has no defined limit.

2.4 – Collapse of the imaginary time

In the same way as the scanning time of the TV is not perceived by human eye, the UST model considers that the imaginary time doesn't exist for certain observers.
For these observers, the imaginary time is "collapsed", and thus, a point-like particle defined in a five dimensions space becomes a string, defined in a four dimensions space.
The UST model still considers that the imaginary time has a digital behavior, and thus, the strings defined in this model are similar to bead necklaces, in which the number of points in each string is always equal to the length of imaginary time dimension.
More generally, depending on the movement of the point-like particle (in five dimensions), the imaginary time collapse will generate a brane, which may assume the form of a flat surface or a volume and that can behave like a compact three-dimensional object.

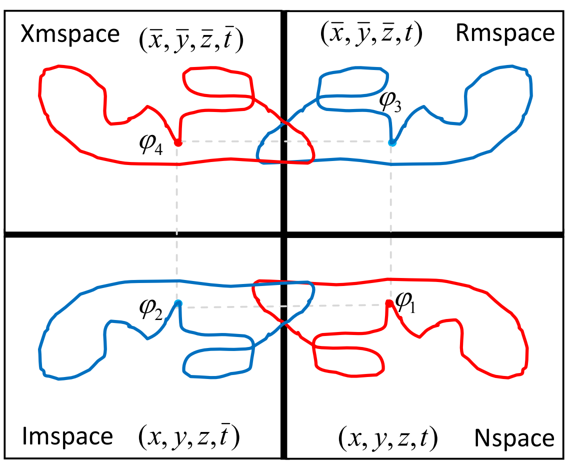

Figure 6 - Particles that are turned into strings due to the collapse of imaginary time.

Figure 6 shows the same block of four particles presented in Figure 4, but with imaginary time being collapsed. It is possible to observe that the four points in Figure 4 are transformed into four lines or strings.
These strings are normally closed lines, except when the particle moves from one space to another, as shown in Figure 6. In this case the particle can generate multiple opened strings, which can behave as distinct objects.

3 –Fundamental particles in the UST model

In the UST model, the fundamental particles are associated with "elastic holes" appearing at the "space walls" and "time walls", presented in Figure 4. These "elastic holes" were named Ulianov Holes (uholes).
Figure 7 shows an example of an uhole linking two two-dimensional spaces. In this figure, we observe that the uhole behaves as a tube that crosses both spaces, thus generating a hole in each crossed plan.

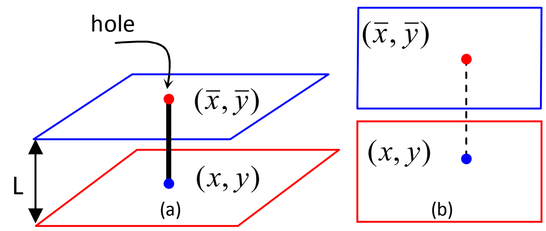

Figure 7 - Uhole connecting two two-dimensional spaces.

An uhole exists in a height order dimension of connected spaces. This means for the three-dimensional spaces (x,y,z) and ($\bar{x},\bar{y},\bar{z}$), the tube that forms one uhole will have four dimensions, which is harder to visualize. This four-dimensional tube will generate a sphere when cutting each space.
If the uhole tube diameter is infinitesimal, we can model the generated spheres as point-like particles.
In the same way that a hole made on a wood wall has two sides, one uhole will also have two sides; thus, the uhole located "on the other side of the wall" can be associated with an "antiuhole".
In UST model, when one uhole finds its antiuhole, in the same space, a mutual annihilation process occurs, in which the two holes cease to exist.

3.1 – Properties of the uholes

Figure 8 illustrates the elastic property of one uhole that can be "stretched" by the application of a pair of opposing forces. In this figure we observe that, although the forces that stretch the uhole exist in a height order dimension, they can be decomposed, generating forces of same dimension of the considered space.

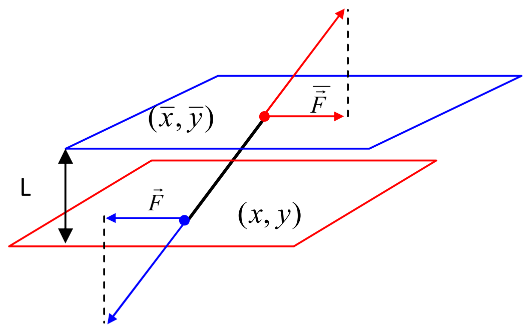

Figure 8 - Uhole being stretched due to the application of a pair of opposing force.

In figure 9, we observe the same two-dimensional spaces defined in Figure 8, in which an uhole is "stretched" due to the application of a pair of forces (one in each space).
In this case, both ends of the uhole are displaced by a distance *d*, defined in relation to the rest position.
The UST identifies an uhole with an ideal spring, in which the displacement distance will be equal to the applied force multiplied by the uhole elasticity constant.

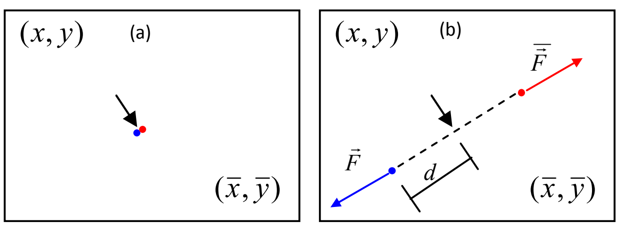

Figure 9 - uhole being stretched. In (a) a position at rest.
In (b) a pair of forces is applied, generating a displacement *d* from the starting position.

The elasticity of an uhole allows storing potential energy. Thus, when the imaginary time is collapsed generating a string, a certain amount of energy will be stored. This energy is given by summing the potential energy of each uhole that forms the string.

3.2 – Types of uholes

In the UST model, there are two types of "walls" separating the defined spaces; thus, for each one of them we have an associated uhole type:

- In the "time walls", holes called Imaginary Ulianov Holes (uhole_I) will emerge. An uhole_I "resists" moving in the space and has a property that can be associated with mass;
- In the "space walls", holes called Real Ulianov Holes (uhole_R) will emerge. An uhole_R "resists" moving in the time. When a uhole_R moves in a real time, have a property that can be associated with electric charge.

NOTE: A uhole_R moving in a imaginary time, have a property that can be associated with magnetic field, but for simplicity, in this paper only the electrical charge of uhole_R will be considered.

Figure 10 shows these two types of uholes and also the antiuholes associated with them. In this figure, the uhole_R (indicated by the letter R) has a negative charge and is associated with red dots and antiuhole_R (indicated by the letter $\bar{R}$), it has positive charge and is associated with blue dots.

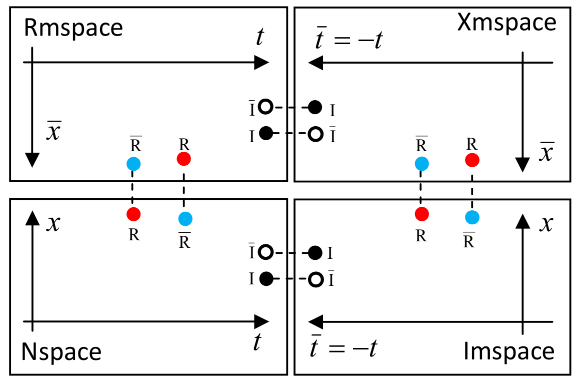

Figure 10 - Basic uholes found in each space.

NOTE: The representation of the uhole_R charge shown in Figure 10 is only valid for a particle moving in the direction of positive real time axis (in a positive imaginary time trajetory). If an uhole_R reverses its direction of displacement in time (heading into the past), its electric charge value is also reversed. One way of avoid worrying about what is the meaning of particle displacement in time is to change the name of an uhole_R that displaces towards the past (and has a positive charge) to Uhole_$\bar{R}$ (antiuhole_R). Therefore, an uhole_R will always be associated with a negative charge and an Uhole_$\bar{R}$ will always be associated with a positive charge, regardless of these displacements in time.
For each defined uhole_R, in a given space, we will see an Uhole_$\bar{R}$ defined in the opposite space. This indicates that the total charge of the uhole (considering both ends) will always be null.
The behavior of the uhole_I and the antiuhole_I follows a similar logic and it is used for defining the uhole_R and the Uhole_$\bar{R}$. An uhole_I, indicated in Figure 10 by a black circle, represents a positive mass associated with the matter in the Nspace. Likewise, an antiuhole_I (indicated by $\bar{I}$) is represented by a white circle, and is associated with a negative mass which represents the antimatter in the Nspace. Thus, the total mass of an uhole_I (considering both ends) will also be zero.

3.3 – Grouping of uholes

According to UST model, the four basic types of uholes (two uholes and two antiuholes) can be combined in sequences of two or three uholes, as shown in figures 11 and 12.

A sequence of four uholes is not possible because it returns to the original space, destroying the uhole formed.

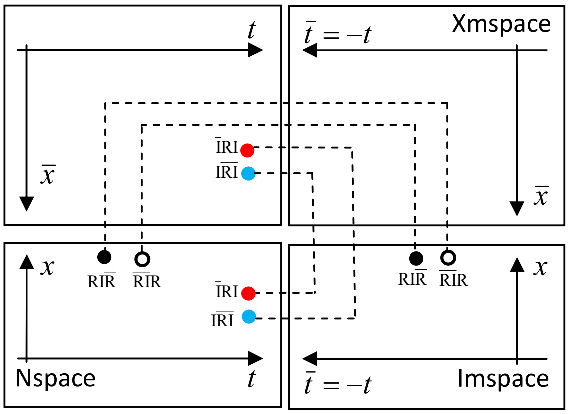

Figure 11 - Combinations of three uholes.

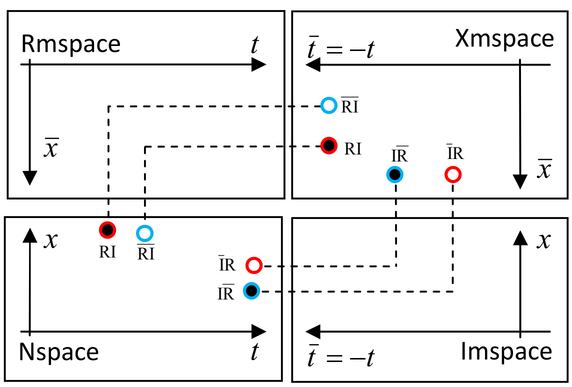

Figure 12 - Combinations of two uholes.

The basic properties of twelve uholes types observed in Nspace are shown in Table 1.

This table adopts a unitary system defined in the UST, which is similar to the unitary system of Planck [8]. In this system, the maximum absolute value of electric charge and mass of an uhole is considered unitary.

Table 1 - Mass and charges of 12 uholes observed in the Nspace.

Uholes			Antiuholes		
	Mass	Charge		Mass	Charge
R	0	-1	$\overline{R}$	0	1
RI	1	-1	$\overline{RI}$	-1	1
$RI\overline{R}$	1	0	$\overline{RI}R$	-1	0
I	1	0	$\overline{I}$	-1	0
$I\overline{R}$	1	1	$\overline{I}R$	-1	1
$I\overline{RI}$	0	1	$\overline{I}RI$	0	1

NOTE: In the UST model the mass of antimatter is considered negative. This artifice gives some advantages to study the process of matter/antimatter separation, but implies in replace de mass value for the module value in some formulas, such as:

$$E = |m|\, c^2 \tag{7}$$

4 – Universe created by UST

In the UST model, the motion of fundamental point-like particles (composed of twelve uhole types), inside the defined spaces, generates trajectories that, along with the collapse of imaginary time, will form a series of geometric figures that may be associated to strings or branes.

In the following section, the main branes defined in the scope of the UST will be introduced, which may be related to a series of elements that exist in our universe.

A complete mathematical analysis of the trajectory of these branes and their physical properties is not very complex to be done in the UST model, but it goes beyond the space available in an introductory article.

Thus, a more general expository approach will be made, without going deep into the mathematical formulation that was developed for each case. The magnetic field behavior of uholes not will be considerate on this approach.

4.1 – Ulianov photon

An Ulianov Photon (or uphoton) is a string that can be associated with photons observed in our universe.

As in all cases of strings defined in the UST, the uphoton consists of a block of four particles, as shown in Figure 13.

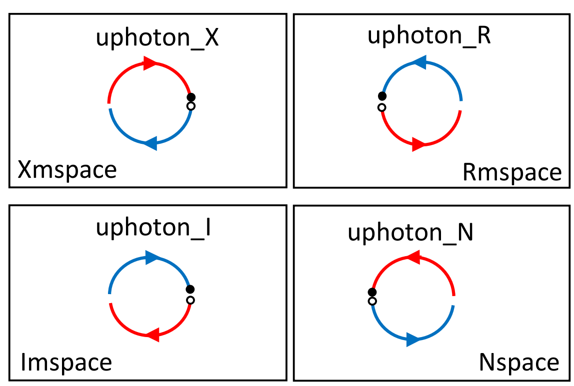

Figure 13 - Strings that make up the uphoton.

Watching the uphoton_N, we will see that the string that makes it up consists of two semi circles, one with positive charge and the other with negative charge.

The union of semi circles creates a ring structure named photonic ring.

At the point in which the semicircles meet each other, we could observe an uhole_I and an antiuhole_I on the same side, and thus the total mass of uphoton_N is equal to zero.

The uphoton is characterized primarily by the length of its photonic ring, which will be linked to its wavelength (λ). The string forming each uphoton has a fixed length equal to L_I particles that are aligned forming the photonic ring.

As the length of the ring is usually much smaller than the length of this string, it rolls up in multiple turns. Thus, a photonic ring that has the double of the wavelength will have only half of the number of turns.

If for each uhole is associated an unit length equal to the Planck length, taking the wavelength, also in the Planck unitary system, the number N of turns on the same photonic ring will be given by:

$$N = \frac{L_I}{\lambda} \qquad (8)$$

Despite the mass of uphoton_N is null, its total kinetic energy will be equal to the sum of kinetic energies of matter and antimatter that exist in it.

The positive mass of an uphoton is equal to the mass of an uhole_I multiplied by the number of turns.

This way, as the number of turns is directly associated with the kinetic energy, on equation 8 we can observe that the energy of the uphoton_N is inversely proportional to its wavelength.

In order to study the motion of a photonic ring in the space, it is necessary to define a coordinate system, such as the one shown in Figure 14, in which the photonic ring is defined on a plane (x, y) and displaced toward the z-axis.

Using the Planck unitary system, we will see that the ring displaces itself in the z-axis with unitary speed, “skipping” a Planck distance for each Planck time that is elapsed.

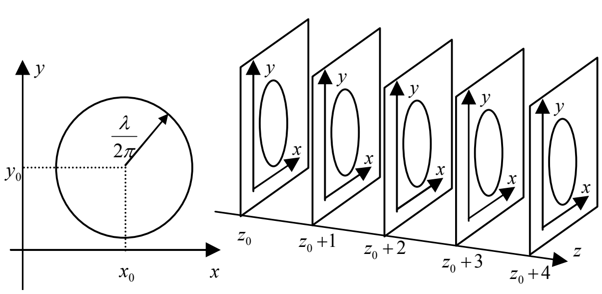

Figure 14 - Displacement of the uphoton_N in the space.

The uphoton_N is composed of multiple laps (N photonic rings) that will be aligned in a sequence along the z-axis forming a tubular structure, which was named photonic tube.

Since the photonic ring rotates while it is moving, the photonic tube formed will present a variation of charges, as if it were composed by two colored ribbons rolled on a cylinder, as shown in Figure 15. If the time dimensions is considered the photonic tube become a hiper-cylinder.

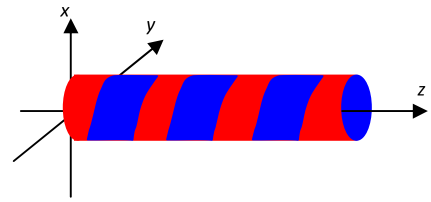

Figure 15 - Photonic tube associated to the uphoton_N.

By taking a closer observation of a single photonic ring, we will see that the electric charge throughout the ring is not uniform, but it varies, as shown in Figure 16.

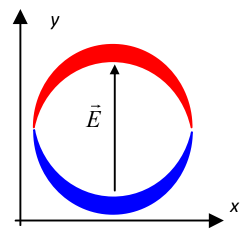

Figure 16 - Variation of charges in a photonic ring.

Since the intensity of the charges is inversely proportional to the distance between the two rings at a given point, the electric field inside the ring tends to be uniform and can be represented by a vector in the center of the ring, as shown in Figure 16.

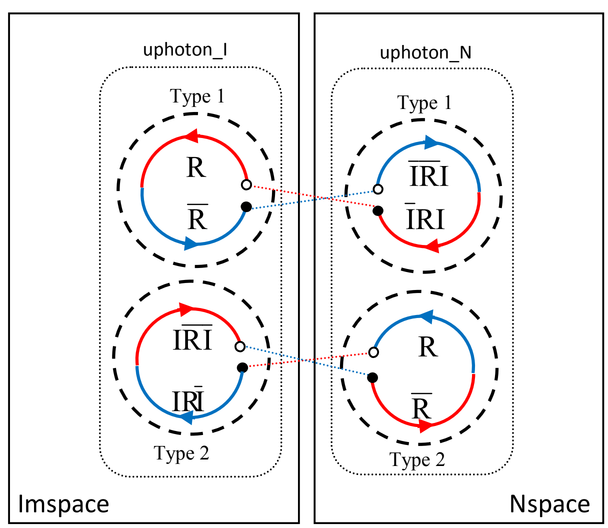

Figure 17 - Types of uholes forming the uphoton_N and uphoton_I.

If we look more closely the uholes forming an uphoton, we will see two possibilities for uphoton definition, which are presented in Figure 17.

In this figure, we can observe that a particular string is not formed by a fixed type of uholes, but change its type along the route.

For example, the uphoton_N type 1, shown in Figure 17, has a string formed by sequences of uhole_R, which turns into a uhole_I and "jumps" into the Imspace, composing a $\mathrm{Uhole\_\bar{I}}$ and a sequence of $\mathrm{Uhole\_\bar{I}R\bar{I}}$ that returns to Nspace and closes the cycle.

Figure 18 shows the trajectories of the uholes that form the uphoton_N and the uphoton_I of type 1 in complex time.

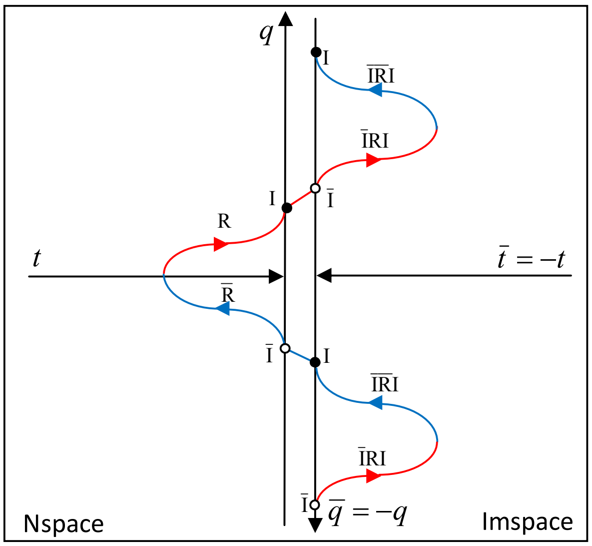

Figure 18 - Evolution in the complex time of the uphoton_N and uphoton_I type 1.

In this figure, the generation of multiple rounds of the photonic ring in function of the trajectory evolution of the particle in imaginary time can also be observed.

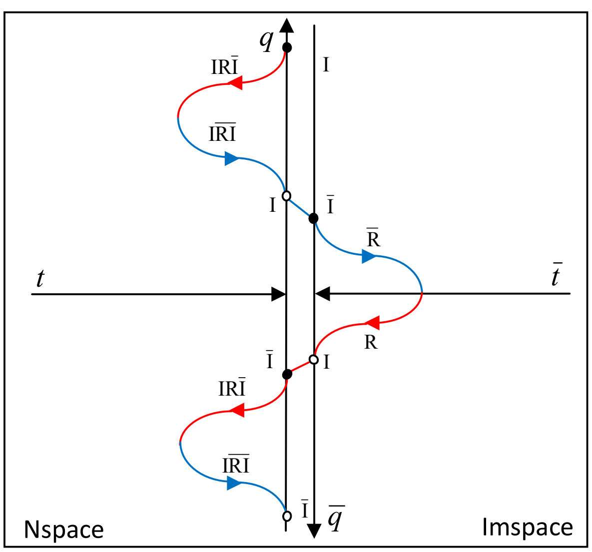

Figure 19 - Evolution in complex time of the uphoton_N and uphoton_I type 2.

Figure 19 shows the trajectories of the uholes that form the uphoton_N and the uphoton_I type 2 in complex time. In this case, we can consider that the uholes evolve in a negative direction of the imaginary time.

As the imaginary time dimension is described on the surface of a cylinder, we can say that uholes of uphotons type 1 rotate clockwise and the imaginary time uphotons type 2 rotate in a counterclockwise direction.

Associating the strings shown in Figures 18 and 19 and considering only the first round in imaginary time, it will obtain the diagram shown in Figure 20. Note that in this figure the imaginary time axis $\bar{q}$ is reversed.

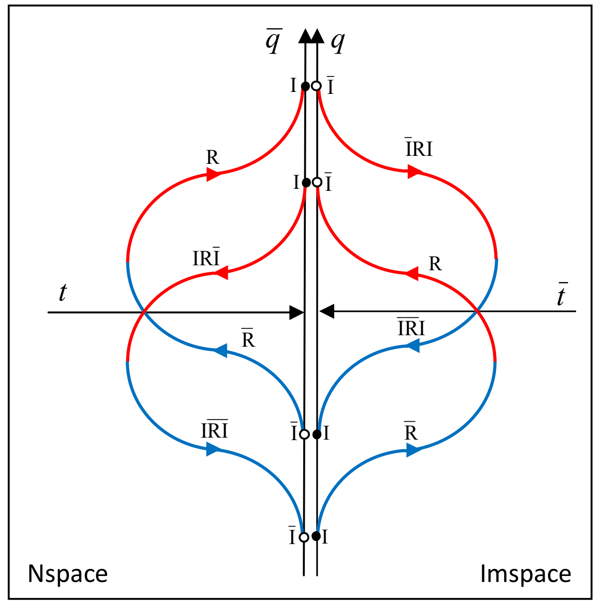

Figure 20 - Evolution in complex time of the uphoton_N and uphoton_I, types 1 and 2.

In Figure 20, if we take any string, we will see that it describes a trajectory that jumps from one space to another, but this trajectory may also have other interpretation, which is illustrated in Figure 21.

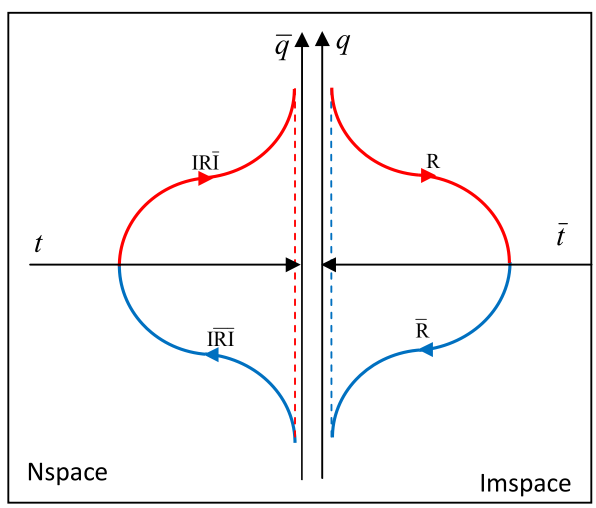

Figure 21 - Evolution in complex time of the uphoton_N and uphoton_I type 3.

We can observe that the diagram of Figure 21 is basically the same as Figure 20, but the particles don't jump for one space to another. In this case the string formed has no mass because don't have imaginary uholes, as shown in Figure 22.
In this figure, we can see that the uphoton is composed of particles that "turn in time", which is equivalent to say that uphoton is "frozen" in real time.

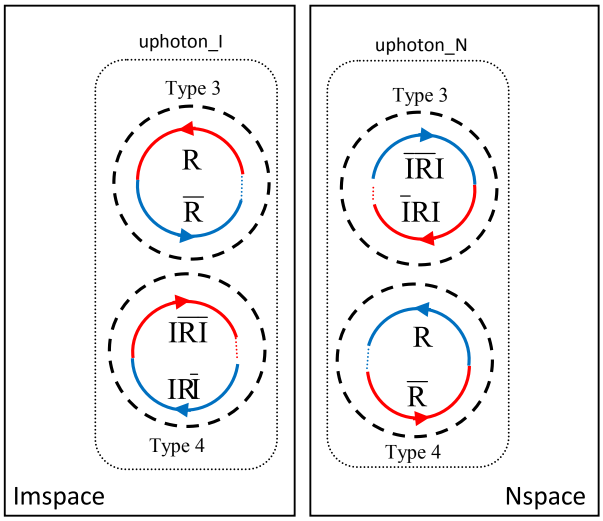

Figure 22 - uholes forming the uphoton_N and the uphoton_I, type 3 and type 4.

We can observe that the types of uphotons shown in Figures 17 and 22 are indistinguishable, since it is impossible to know whether in fact the string jumps for the other space (as shown in Figure 20) or the uhole reverses its "temporal speed" going to future and again back to the past (as shown in Figure 21).
According to the UST, the uphoton always comes in pairs (type 1 and 2 or type 3 and 4) making up two photonic rings that overlap in space.
In the space, these rings always rotate in opposite directions, as shown in Figure 23.

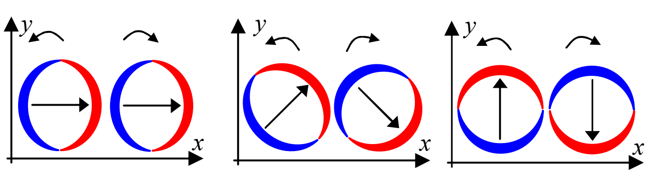

Figure 23 - Effect of electric fields of uphoton_N type 1 and 2. The two photonic rings should be overlapped, but they were moved away to make it easier of viewing.

This makes the electric field resultant in the y-axis to be nullified, leaving only the effect of field on the x-axis.
As the uphotons always occur in pairs, we will use the term uphoton in a more generic way of contemplating the union of the uphotons type 1 and 2 (or 3 and 4) as shown in Figure 24.

If using only one particle type is necessary, it will be referenced by its type number.

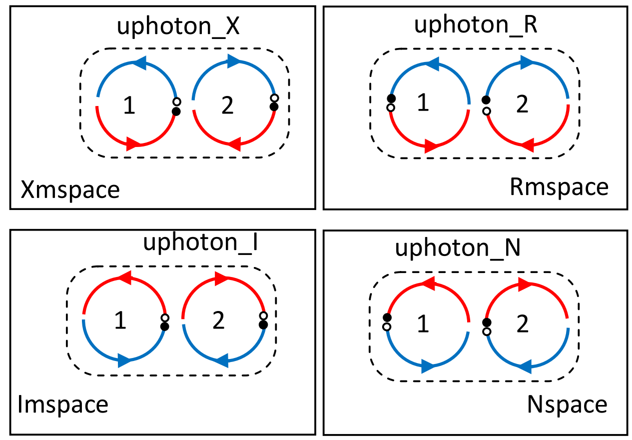

Figure 24 - Strings that make up the uphoton.

Considering that multiple turns of one uphoton will generate two photonic tubes turning in opposing directions, the resultant electric field will spread into the space-time, keeping components only in axis x which varies of amplitude in function of the time and of the position in the considered space, as shown in Figure 25.

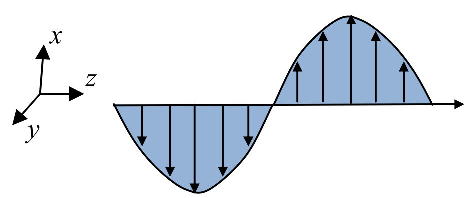

Figure 25 - Electric field arising from the overlap of the photonic tubes of uphoton_N type 1 and type 2.

4.2 – Ulianov electron and Ulianov positron

In UST model, two uphotons might collide creating two new structures that were named as Ulianov Electron (uelectron) and Positron Ulianov (upositron), which are shown in Figure 26. Observing only the Nspace, we will see that the positive masses of the original uphotons and the negative charges pass to the uelectron_N, whereas the negative masses and positive charges pass to upositron_N.

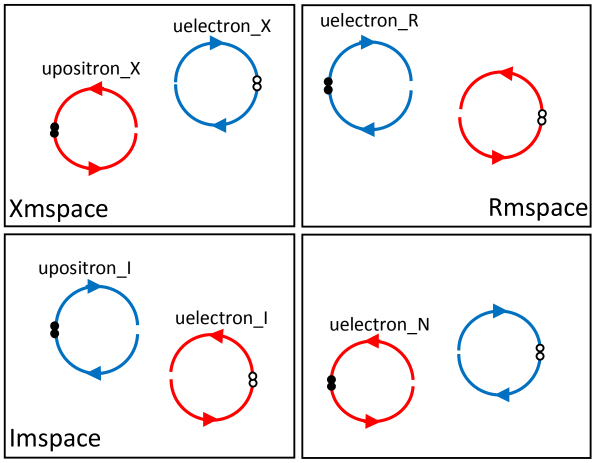

Figure 26 - Strings that form the uelectron and the upositron.

Figure 27 shows details of uholes that form the upositron and uelectron in the Nspace and Imspace.

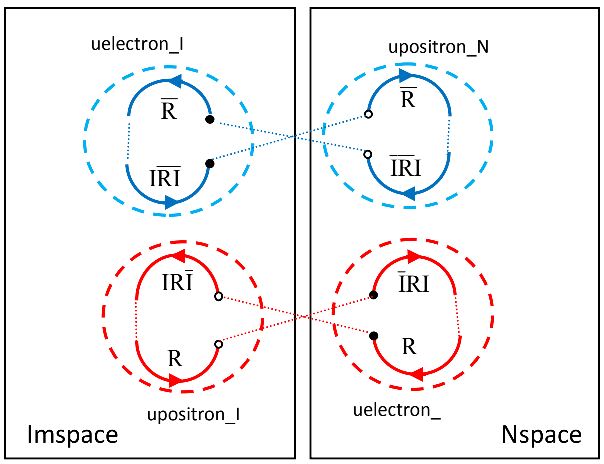

Figure 27 - Detailing of the uholes of the uelectron and upositron.

We can observe that the strings that formed the uphotons always moved at a full speed through space, but they were "frozen in time."

These strings now compose the uelectron and the upositron, moving at a full speed in time and can stand still in space.

According to the UST, uholes when considered as five-dimensional point-like particles always moving at a constant speed, skipping one position (Planck distance) at each new imaginary time.

This unitary speed when associated to the displacement in space is equal to the light speed and when it is combined with a displacement in real time indicates a maximum "temporal speed".

According to the UST, an uhole in its trajectory should choose travelling in time or travelling in space. This model leads to a scenario in which the branes formed tend to move more slowly in time when their space speed increases, thus creating a connection between the UST and the Restrict Relativity Theory that will be presented in UST future papers.

The strings forming the uphoton can be viewed as two colored ribbons, one red and the other one blue, that are being rolled up on themselves to form a colored cylindrical roller, as it was shown in Figure 15. For each new real-time this tube advancing one spiral forward. In the process of formation of the uelectron and upositron, these two ribbons are separated with the red ribbon going to the uelectron and the blue one going to the upositron.

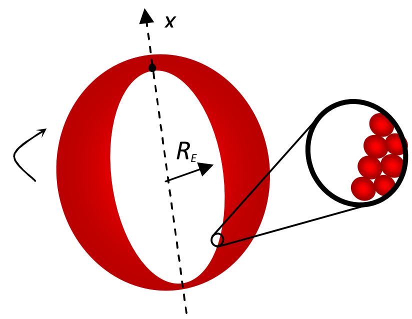

Figure 28 - Spherical shell format assumed by uelectron_N.

Besides that, the ribbons are no longer rolling in the shape of a tube, but they assume the shape of a spherical shell, as shown in Figure 28.

This occurs because the photonic rings stop moving forward (toward the z-axis) and start spinning around themselves.

Thus, the uelectron_N takes the form of a spherical shell composed by uholes that have negative charge (uhole_R and uhole_$\bar{I}$RI).

The black spot found on one pole of the sphere shown in Figure 28 is associated with an uhole_IR that will contain the mass of the uelectron_N.

As the uelectron_N rotates around its polar axis, if we take the pole containing mass as reference, we will note that there are two possible directions of rotation, which define two distinct conditions of "spin" for the ulectron_N.

The spatial shape of the upositron is almost the same as the uelectron distribution, also forming a spherical shell, but in this case it will consist of uholes that have positive charge. Besides that, in one of the upositron poles, the existence of antiuholes_IR will generate a negative mass.

In Figure 29, we observe that despite the uelectron_N and upositron_N rotates in the same direction, as their masses are at opposite poles, in this case these two particles will have opposite spin.

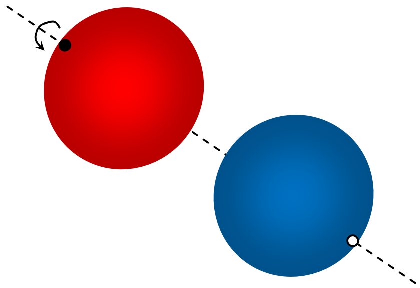

Figure 29 - Relationship between the uelectron_N and the upositron_N.

4.3 – Ulianov proton

The Ulianov Proton (uproton) is defined in the UST model in a condition in which two uphotons collide and generate a uelectron and a uproton, as shown in Figure 30.

In this figure, to make it easier to visualize, the two semicircles that form the uelectron_N (see Figure 26) were presented overlapped on a single semicircle, the same being valid for the other strings shown in this figure.

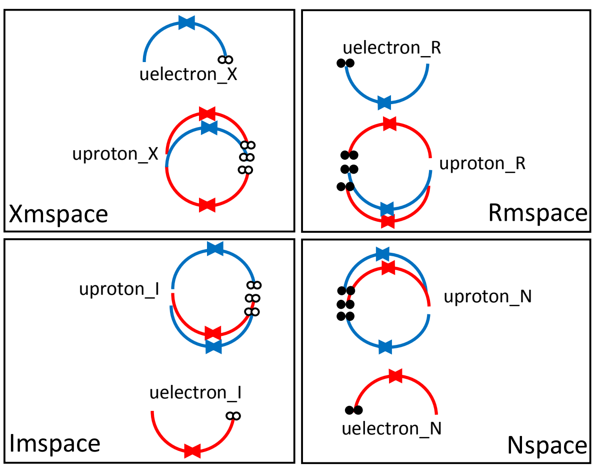

Figure 30 - Strings forming the uelectron and the uproton.

According to UST, when Imspace and Nspace are united (and so Xmspace and Rmspace also are united) the real time does not exist and the distribution of matter and antimatter is the same in the four spaces. In this case all existing uphotons are "frozen" at time zero.

In UST model, the matter and antimatter separation will occur when real time becomes to exist and the Imspace is separated from the Nspace.

In Figure 30, we can see that the positive masses of the original uphotons went to the Nspace and Rmspace, while the negative masses went to the Imspace and Xmspace.

Figure 31 shows uholes that forming the string of the uproton_N and the uproton_I. In this figure, for each string, two types of uholes are overlapped to make it easier to view.

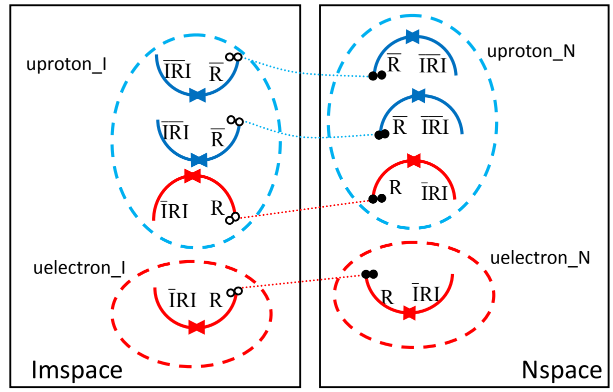

Figure 31 - Details of the uholes forming the uproton_N and the uproton_I.

From the matter distribution in Figure 31, the mass of the uproton_N is 3 times bigger than that of uelectron_N. However the greatest concentration of mass near to the uproton_N distorts the adjacent space and makes the strings of uproton_N are wrap in a larger number of turns. This process are illustrated in Figure 32, and so the mass of uproton_N is much larger than uelectron_N mass.

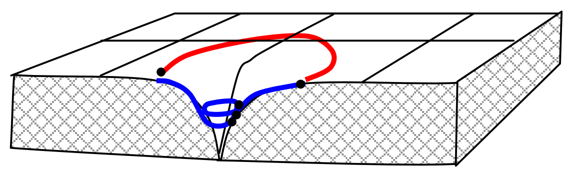

Figure 32 - Strings that make up the uelectron and the uproton observed in a space distorted by mass.

In Figure 33, the resultant charges in the uproton and its respective trajectories are presented.

We can observe that uproton semicircle tends to be rolled up concentrically, and therefore, it takes the form of a semi-circular area.

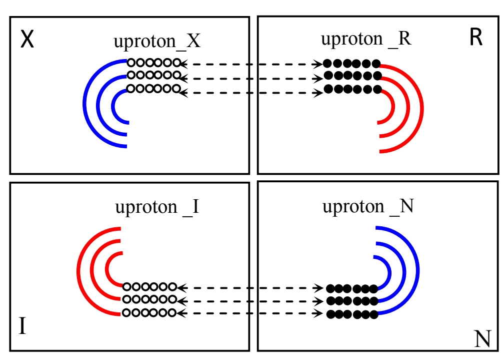

Figure 33 - Strings that make up the uproton rolled into multiple concentric loops.

In Figure 33, only three concentric semicircles were presented, but in principle this number could be much higher

When the semicircular area of uproton_N rotate on its central axis, a solid sphere composed of positive charges will be generated. In this sphere the positive mass extends itself in a radial line from one pole to the center, as shown in Figure 34.

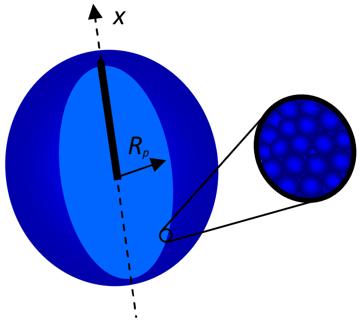

Figure 34 - Spatial arrangement of the strings forming the uproton.

4.4 – Ulianov neutron and Ulianov neutrino

The collision of two uprotons, as shown in Figure 35, can make one string "inflate" and be expelled, creating an upositron and two new structures called Ulianov Neutron (uneutron) and Ulianov Neutrino (uneutrino).

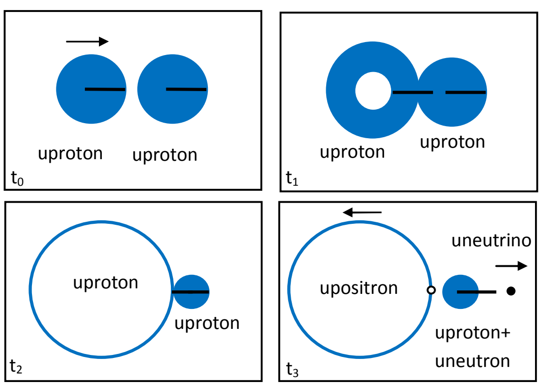

Figure 35 - Collision between two uprotons.

Figure 36 shows the strings that form the uneutron, upositron and uneutrino.

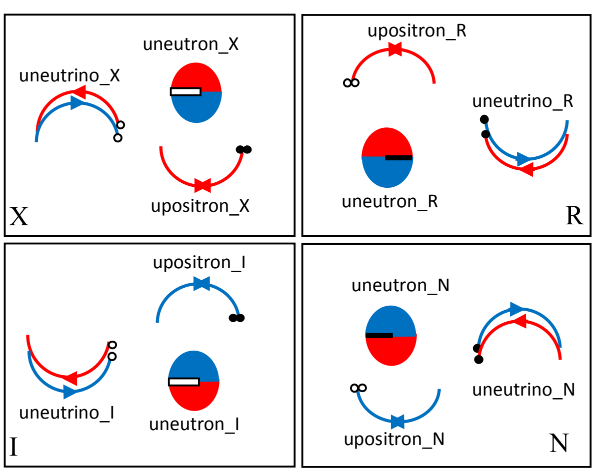

Figure 36 - Strings generated from two uproton collision.

Figure 37 details the uholes that make up each particle generated in uproton collision. In this figure, we can observe that the uneutron_N basically inherits the core of mass of the uproton_N, keeping the five strings of charges (two negative and three positive) and changing a string of positive charge by a negative charge.

Thus the total charge of uneutron_N is zero and its mass remains equal to the uproton_N mass.

The spatial arrangement of uneutron_N generates a massive cylinder, similar to that found inside the uproton_N, marked in black in Figure 34.

The string with a positive charge lost by uproton_N goes to the uneutrino_N, as it can be seen in Figure 37. Besides that, the upositron_N, as expected, must have negative mass and positive charge.

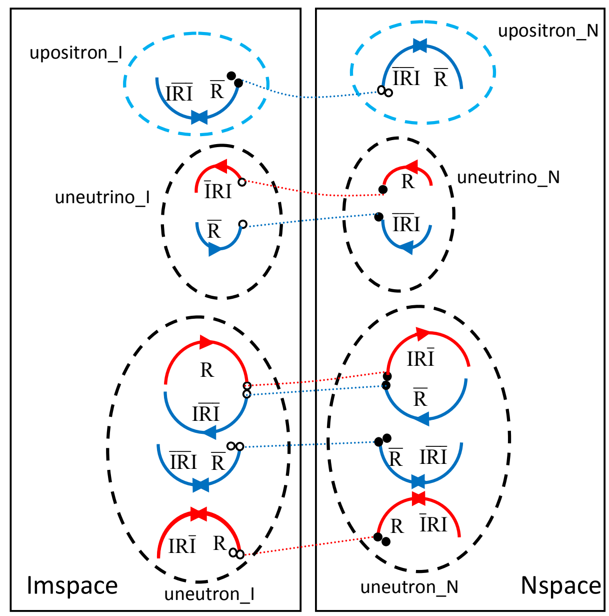

Figure 37 - Details of the strings associated with the particles shown in figure 36.

Figure 38 shows the detailed uneutron formation process. We can observe in this figure that initially, an uproton is placed next to two complementary uphotons (an uphoton type 1 and an antiproton type 2) which together tend to nullify themselves.

Although the total mass and total charge of these uphotons is null, they can be divided into four semi circular rings.

The union of positive charges and negative masses of two of these rings will form the upositron. Also, one semi circular ring that has positive mass collides with the uproton and generates an exchange of electrical charges.

Before this collision, the negative charges remain in the uproton, which turns into an uneutron.

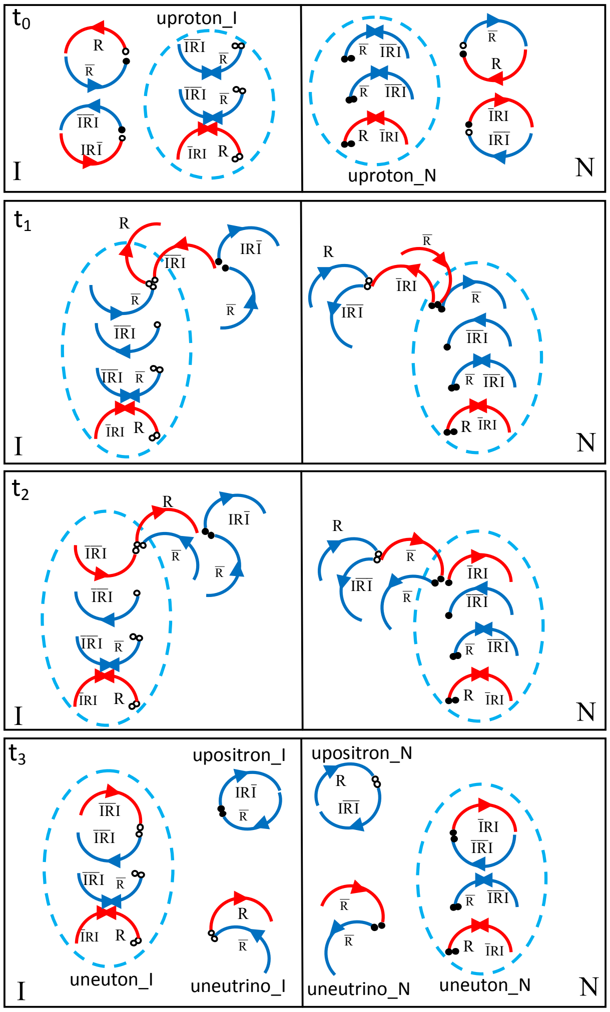

Figure 38 - Complete process of the uneutron formation.

At the end of this process, the uphoton_N positive masses will be connected with two opposite charges strings and will generate the uneutrino_N. This particle will have positive mass but its electrical charge is null. From Figure 38, we could affirm that the uneutrino_N has a mass equal (with opposite sign) to the upositron_N. However, the upositron_N will roll itself in the shape of a spherical shell as showing in Figure 29. The uneutrino, which has no electric charge can assumes a linear configuration, and its mass is "spread out in time", and seems less massive that the upositron.

4.5 – Other particles

The UST scheme presented above can be used to define a series of other particles.
The uelectron string, for example, may receive an additional amount of positive mass coiling in concentric loops and generating new particles that could be associated with Ulianov Muon (umuon) and Ulianov Tau (utau) shown in Figure 39.

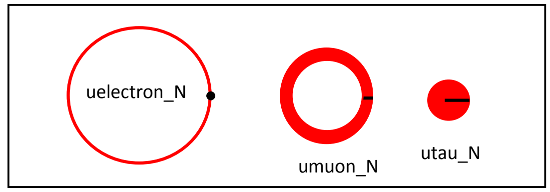

Figure 39 - Uelectron_N being "compressed" in order to get more mass retaining the same electrical charge.

The uneutrino structure, presented in Figure 39 is related to the uelectron mass. This structure can be associated also to the umuon and utal particles. In this way we can define a uneutrino_N_Ve (associated to the uelectron_N), a uneutrino_N_Vm (associated to the umuon_N) and a uneutrino_N_Vt (associated to the utau_N) as shown in Figure 40.

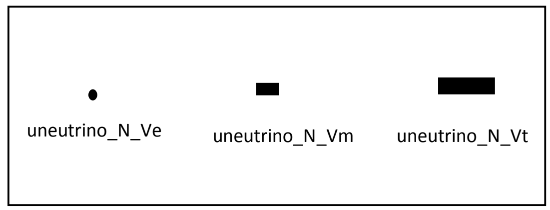

Figure 40 – Types of uneutrinos.

A more detailed analysis of the particles, shown in Figures 39 and 40, can be performed based on UST model in order to define the strings and uholes that compose them, as performed in previous sections.

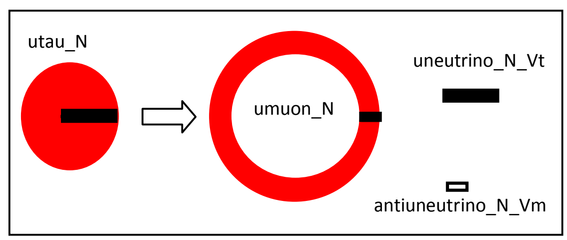

Figure 41 - Utau_N decay.

This analysis will show that an utau_N decays generating an umuon_N and two types of uneutrinos as shown in Figure 41.

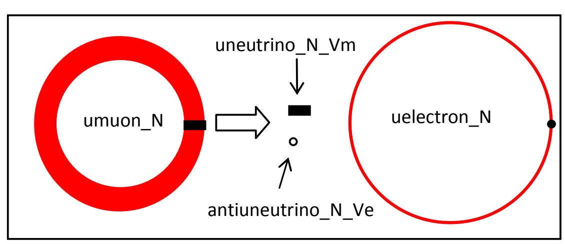

Figure 42 - Umuon_N decay

The umuon_N on this way, decays generating an uelectron_N and two types of uneutrinos as shown in Figure 42.

5 – Application of the UST model to our universe

All structures and particles presented in this work were obtained from the UST and based on fundamental causes defined intuitively with no any experimental basis. Nevertheless, the effects generated by the application of UST model are compatible with several points found in the standard atomic model and in some aspects defined in the context of the Quantum Mechanics and also in the General Theory of Relativity.
The model of uphoton defined in the UST, for example, starts with two photonic tubes turning in opposing directions that when interacting form plain waves.
Thus, although a photonic tube, at first, cannot be observed alone, its use in the UST model allows the explanation of a series of phenomena, as for example, the generation of electron/positron pairs and the separation of the matter and the antimatter, when proton/electron pairs are formed.
Moreover, the considered model of uphoton allows the deduction of diverse aspects of the photons, as for example, this refraction and the polarization properties and the dual wave-particle behavior assumed by the light.
The uelectron_N, uproton_N and uneutron_N models, if associated with electrons, protons and neutrons also allow the explanation of a series of open points in the standard model, such as the fact that the gravitational force is far smaller than the electromagnetic force or the physical meaning of spins of electrons and the anomalous behavior observed in the neutrino spin.
Despite the many points of convergence, there are also big differences between the particles defined in the UST and in the standard atomic model.
For example, an electron in the standard model is associated to a "little ball" with a negative charge rotating around the nucleus, while the uelectron_N takes the form of a spherical shell composed of a very large number of "little balls" with negative charge.
On the other hand, due to the uncertainty principle defined by Heisenberg [9], it is not possible to precise the location of the electron around the nucleus. So, the position of the electron is modeled by a wave function which is basically a distribution of probability of the occurrence of the electron.
In case of hydrogen atom, this wave function assumes a spherical shape, creating something that is very close to the uelectron_N model described in the UST. However, in UST model instead of a probability distribution function of one point-like particle, we will have a physics distribution function of a large number of point-like particles.
Besides, in UST model, when the uelectron_N is ejected from an atom, it keeps the spherical shape while the electron is ejected in the form of a point-like particle.
Another fundamental difference between the UST and the standard model is the explanation for the binding of protons in the nucleus. As the gravitational force attraction between the masses of two protons is much smaller than the electrical repulsion generated by their charges, the standard model explains the union of protons in the atomic nucleon by the introduction of the strong nuclear force.
According to the UST, uproton_N has an asymmetric charge/mass distribution with the mass distributed throughout its polar axis.
It allows the uneutron_N to be "plugged" into the uproton_N with two overlapping pairs of these particles which will generate a dumbbell-shaped structure, as in the helium atom model shown in Figure 43.

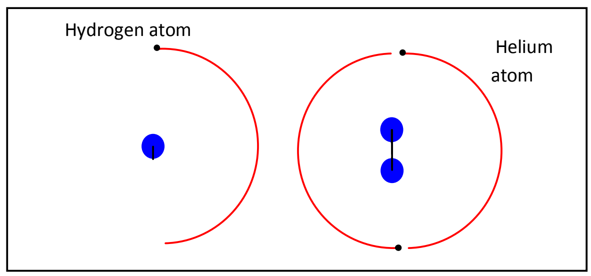

Figure 43 - Strings defined in the UST, associated with electrons, protons and neutrons composing atoms of hydrogen and helium.

In UST model, the distances between the mass of uprotons and uneutrons, which form each end of the "dumbbell", tend to zero, and so, the gravitational forces generated are very high and exceed the electrical repulsion of positive charges of the two uprotons, which, despite being much greater in number, are farther from each other.
The UST model also allows the use of the particles defined (uelectron, uproton and uneutron) in the atoms formation, as presented in Figure 43. This leads to a series of interesting considerations in the area of chemistry, but are beyond the scope of this article.

6 – Conclusion

The Ulianov String Theory presented in this article brings several interesting ideas. One of them is the use of time as a complex variable, so that the collapse of imaginary time transforms point-like particles into strings and branes.
The use of a basic space (GODU space) in a form of a “four-leaf clover” as considered by Isaac Asimov, generates a good explanation for the preponderance of

matter in our universe. Besides that, the space model presented allows the construction of a set of basic particles that interact to compose structures that may be associated with the manifestations of matter and energy that we observe in our universe.

Although the equations describing the trajectories of particles presented, as for example of the uphoton, are sufficiently simple, a more expositive presentation of the model UST and the structures that emerge from it was initially prioritized.

The equations describing the movement of particles and their physical properties will be presented in details in future works.

It should be remembered that the bases used in the UST were defined intuitively from few logical principles, but have no experimental basis.

Furthermore, some concepts used, such as the imaginary time and the mirror spaces, can never be fully proven, because it cannot be directly accessed through experiments.

On the other hand, if the bases of UST model are somehow compatible with the foundations that gave rise to our universe, the properties that emerge from the application of UST concepts will generate a theoretical model of the universe very closely to what we observe experimentally.

We believe the UST may be a source of inspiration for theoretical physicists and represent a new step towards a more complete model of the universe.

NOTE: The Ulianov String Theory is part of a larger picture of theories developed by the author, called Ulianov Theory (UT) [10] [11].

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