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Space and Time

Three articles on the physics of our universe

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1. Relative or Absolute?

1.1. Introduction

Does the relativity of motion represent the most defining feature of our Universe? Or is it only a facet, a partial interpretation of a reality that hides different rules and a totally new fundamental mechanism?

Wherever we would gaze into the vastness of space, a lot of cosmic bodies (stars, galaxies, planets) can be seen moving continuously, each one relative to all the others. We cannot pinpoint one of these bodies and say that we found a truly fixed point in space; therefore, it is easy to state that the relativity of motion must be a given of our universe. Consequently, the Theory of Relativity (special) should be able to decipher all the mysteries of motion and to formalize all the laws of physics related to this subject.

However, based on the current model of our universe's birth, the Theory of the Absolute [2] has identified an absolute "point" within this vast expanse of space and tries to harmonize the two interpretations of the cosmic symphony. It starts from the same simple premise, namely the speed of light is a universal constant. As it was previously stated in my Prime Theory series, the intergalactic space (the regions of space that are far away from any cosmic object) provides an ideal, uniform framework in which the movement of a body or a simpler granular structure can have any absolute speed - up to the maximum value **c**. This limitation also applies to fields and photons of any kind, being determined by the intrinsic characteristics of the spatial granular fluid.

But things are more complex than that, check out Chapter 11 of [3] - "A unique reality". The presence of a body with significant mass (planet, moon, star) produces an important perturbation (sub-quantum fluctuations) to all the gravitational fluxes in the neighborhood and changes the characteristics of space within a large radius around. Practically, this creates a new granularization (on a larger scale) of the spatial fluid from the big sphere circumscribed to the cosmic object, imprinting this whole region with a special feature of *local absolute*. If a certain cosmic area is populated by several cosmic bodies, there will be the same number of regions (separate or overlapping) with absolute features, and each region will follow the trajectory of its source and will inherit its rotational movements.

Once we come very close to a cosmic object and a certain limit is passed, the absolute feature of its surrounding space becomes dominant and will determine all the movements inside this region. The photons, for example, will move at the speed limit **c** relative to this absolute framework. Consequently, a laboratory placed on the Earth's surface is lying inside its region of absolute space (for now, we will ignore the direct effects of gravitation and planetary rotation). It will rotate in sync with the planet - therefore, with the local absolute - and, for any experience made with light, it may be considered a perfect Absolute Frame of Reference (AFR). This also represents the minimal frame in which we can study the relative motion, considering that one or several Inertial Frames of Reference (IFR) are moving uniformly in regard to it.

In all my previous articles it was clearly assumed that photons are the only granular structures that can constitute a global indicator of the absolute in our universe and which can help us reveal the relative movement of any cosmic body against this spatial "background". Now, once we have theoretically identified the regions of absolute space around any object with significant mass, photons will be included in some experiments designed to confirm my new idea and to make a few necessary additions to the initial version of the "Theory of the Absolute".

1.2. The General Postulates of TA

First of all, we must say that the major theoretical support is provided by the Fundamental Laws of the Universe (TP) and by their consequences. All the features of the spatial granular fluid are currently known, also the way in which it facilitates the movement of any granular structure, simple or complex.

The Theory of Relativity (TR), as it was shown in The Universe [2], is contradictory in several respects and does not provide a complete framework for our analysis on motion, neither at quantum nor macroscopic levels. As the relative motion is present all over the universe, TR should provide a complete descriptive mechanism of the moving frames in the absence of an absolute point. The whole foundation of TR consists of two simple postulates whose apparent correctness is, however, based on numerous experimental results (invariance and equivalence):

- The speed of light is a universal physical constant, a maximum speed of propagation of interactions; it is invariant with respect to any IFR (the direction of its motion does not matter).
- The laws of physics are identical in different inertial frames, all the IFRs are equivalent (Lorentz symmetry).

At the first sight, these two postulates seem to be perfectly logical, also intuitive, depicting coherently and completely an "elegant" and uniform universe; in this type of universe, all the movements have an upper limit of speed and the uniform motion does not change the laws of physics. Moreover, the Lorentz transformations can connect the space-time coordinates from various IFRs and the famous formulae of TR will come up immediately; they show the dependence of some fundamental physical quantities, like time and space, on the relative speed. However, the PT's perspective on these things differs significantly; the movement of a material structure through space automatically produces some changes at the quantum level, and these state changes are depending only on its absolute speed. Therefore, the two postulates above must be rephrased to correctly reflect the new paradigm, to add *realism*. Thus, we may start from the original TA premises:

- The speed of light is invariant in relation to any absolute frame of reference (local or universal) and, at the same time, it represents an upper limit for the speed of any granular structures;
- The laws of physics are identical in all frames of reference, but their parameters depend on the value and direction of the IFR's absolute velocity (relative to its *parent** AFR).

A series of observations and classifications can be made at this time:

- The speed of light in a vacuum, as a maximum value, is characteristic to the local absolute (it only depends on the local granular density). There are different maxima in different absolute regions; however, at the scale of our universe, all of these values are lower than the well-known speed threshold ***C*** (***C* > 1.4 c**, as it was previously shown in TP).
- The trajectory of all photons follows the local absolute, they are copying its global movement (and its eventual curvature, but this aspect will not be considered here).
- The speed of light (observed from the AFR) gets now an **apparent** character; its value is no longer the same in the *child* IFRs, as it now depends on the absolute velocity's magnitude and direction. Therefore, we must evaluate the **directionality** of physics in a certain IFR, the potential asymmetry that might exist in its direction of travel.
- Various child IFRs of a certain AFR are **equivalent** if they have identical absolute velocities (direction and value); we may apply the Lorentz transformations to these frames, and their rates of time are all identical. The child IFRs can be called **twins** if only their absolute speeds are identical.
- As time is in fact a reflection and a consequence of the quantum level movements, its rate in an IFR must be lower than the *background* value of the parent AFR. But all the uniform movements we see in mobile frames are having a directional character; therefore, their rate of time might also depend on direction.

* The attribute *parent* for an AFR means it has one or more attached *child* IFRs.

1.3. Famous experiments and their new interpretations

The outcome of some trials may confirm a theory or a specific formula, may reject it, or may be inconclusive. Let's take a look at a few famous experiments and at their conclusions, then check if some different explanations can be found for those results in the new context given by the model of absolute space (which is somehow similar to the concept of aether from the 1900s).

1.3.1. Michelson-Morley experiment

Essentially, the MM experiment has tried to confirm the existence of some kind of ether, in fact an ether wind that would change its direction as the Earth is moving through space. They used a simple device named interferometer; it contains a light source **L**, two mirrors **M1** and **M2**, a beam-splitting mirror **M3**, and a screen **S** on which the interference pattern can be seen (as shown in Figure 1). Mirror **M1** is precisely adjusted to set the same distance **D** between the normal mirrors and beam splitter. The half-silvered mirror splits the light beam into two perpendicular beams which are reflected back by the two mirrors and finally interfere on the screen.

The interference pattern displayed on screen **S** will depend on the path difference between the two beams, and this difference can be easily calculated. If we assume that the ether moves from left to right with the speed **u**, the total time it takes light to cover the horizontal and vertical distances would be:

$$t_{12} = t_1 + t_2 = \frac{D}{c-u} + \frac{D}{c+u} = \frac{2D}{c}\frac{1}{1-u^2/c^2}$$

$$t_{34} = t_3 + t_4 = \frac{D}{\sqrt{c^2-v^2}} + \frac{D}{\sqrt{c^2-v^2}} = \frac{2D}{c}\frac{1}{\sqrt{1-u^2/c^2}}$$

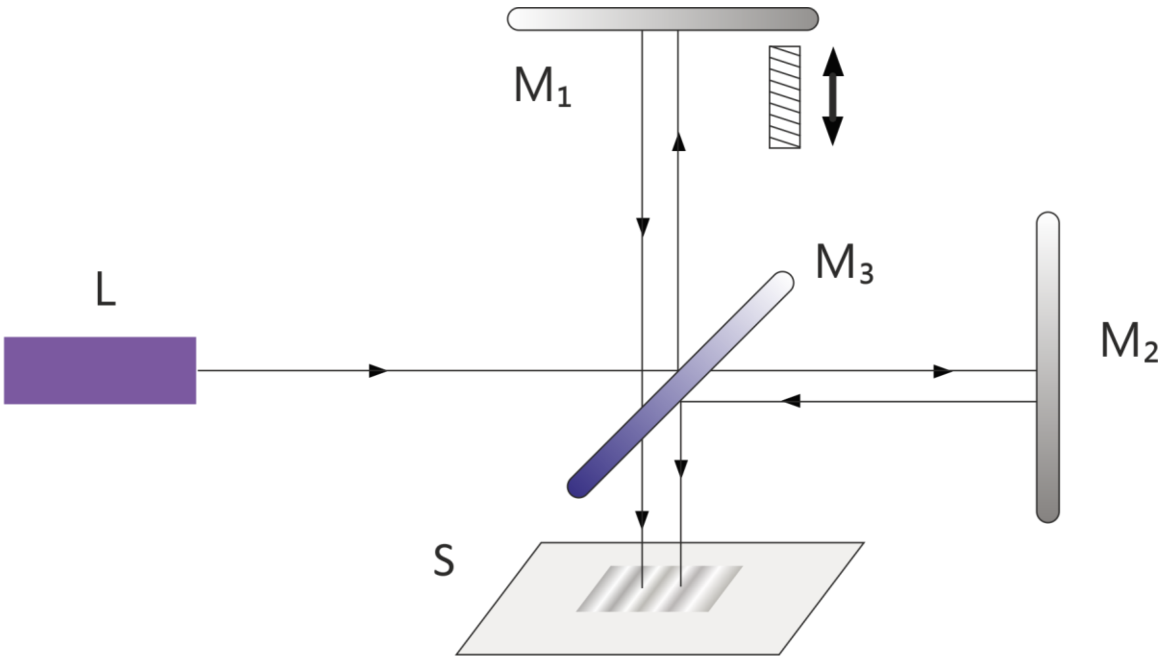

Figure 1 - *The Michelson-Morley interferometer*

The interference pattern shows a fringe shift equal to one fringe when the time difference is equal to the period of the wave, i.e. an interval **T = λ / c**. Moreover, the difference between these time intervals will double if the apparatus is rotated by 90 degrees. Therefore, the total fringe shift **N** of the interference pattern will be:

$$N = \frac{4D}{\lambda}\left(\frac{1}{1-\frac{u^2}{c^2}} - \frac{1}{\sqrt{1-\frac{u^2}{c^2}}}\right)$$

This concrete result, the number of fringes, was virtually zero; no fringe shift was noticed during one or more days. Therefore, this implies that a normal addition of velocities (Galilean transformations) is not applicable in this case. Moreover, the general conclusion of the experiment was: the ether is undetectable and the speed of light is independent of the inertial frame of reference. Consequently, Einstein abandoned the concept of ether and, implicitly, the notion of absolute universal time [4][5].

But let's take one more look at the MM experiment, as the logical conclusion we can draw from its results seems to be more nuanced. Namely, if the ether really exists, it does not flow relative to the device - it moves at the same speed as the device moves (dragging effect). Ignoring the low accuracy of the instrument, the phase shift of reflected light, and other experimental errors, a fringe shift **N = 0.44** was expected for equal-length arms of **D = 11m** and a wavelength of **λ = 500 nm**. The idea of an ether that is "fixed" in the reference frame of the laboratory (of the Earth) now makes perfect sense. A beam of light would then have an absolute path and a constant speed, independent of direction. However, we cannot conclude yet that the speed of light does not depend on the speed of the source. Other experiments and other devices, as the one imagined in Chapter 3.3 of "The Universe" [2] (which would detect any deviation in the trajectory of light), or a simpler version of the MM interferometer (as the *mobile* one shown in Figure 2, oriented along its velocity vector) would be able to detect the movement in regard to the "fixed" frame of the Earth.

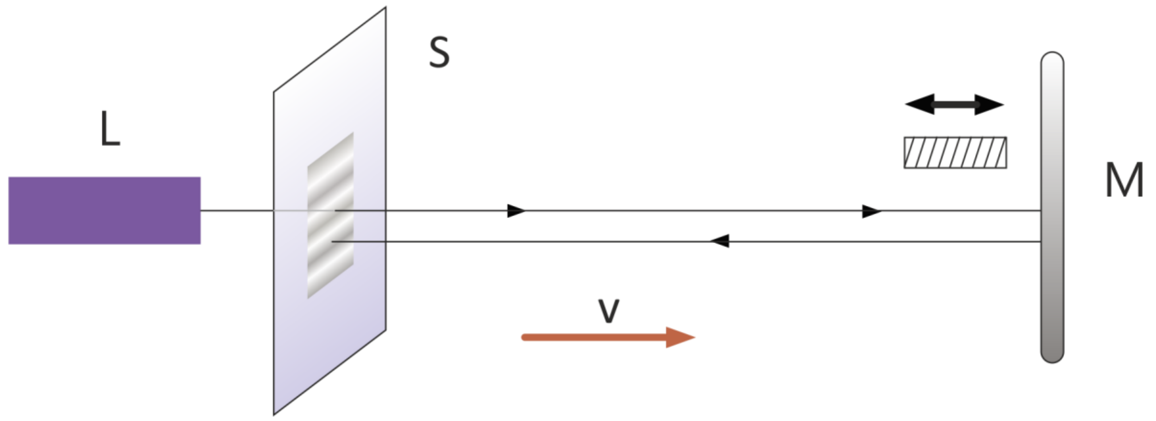

Figure 2 - *The mobile interferometer*

Simplified calculations, for a **3m** arm length and red light (**λ = 600Nm**), would give us the results from Table 1 (similar to those of a *fixed, normal MM interferometer*).

Significant variations in the fringe shift practically occur after 30km/s and the fringes become countable after 100km/s. If such a mobile device would revolve on a high orbit around the planet, having a tangential speed in this range, it might permanently elucidate the mystery of the ether - or of a local absolute, as in the TA perspective.

Note 1. We have presumed that the movement of the ether relative to our laboratory and the movement of an apparatus through a fixed ether are equivalent things, both theoretically and practically. Therefore, the null result that is given by the fixed interferometer and a positive result from the mobile one does not exclude each other, even more, this would represent the proof for the existence of the local absolute.

Note 2. It is hard to discriminate between a source-related speed of photons and an absolute one, given by the local absolute - as long as the results of the experiments are identical or inconclusive in this respect. It seems that any experiment you would perform using something "fixed" and something "mobile", a possible point of absolute and its absolute reference frame cannot be revealed (due to the intrinsic relativism). Anyway, when speeds are very low in comparison with **c**. A variable light speed means a variable propagation speed of all fields, implying that the entire "mechanics" of interactions in an IFR must have a "relative" character. In this case, we may not detect easily in which frame (at source or receptor) the speed changes in fact, or where the Doppler effect of visible light is actually produced, for example.

v	N
1 m/s	10^{-10}
10 m/s	10^{-8}
100 m/s	10^{-6}
1000 m/s	10^{-4}
10 km/s	0.01
20 km/s	0.04
30 km/s	0.1
50 km/s	0.3
70 km/s	0.5
100 km/s	1.1
1000 km/s	110

Table 1

1.3.2. The stellar aberration

Stellar aberration is an astronomical phenomenon that produces an apparent change in direction to the light coming from the stars; this is due to the relative movement of the observer about the source of light and due to the finite speed of light. Aberration causes sources of light to appear to be displaced towards the direction of motion (see Figure 3). Thus, if **S** is a star and **E** is the Earth which revolves with the speed **v** around the Sun, the direction of the stellar light should form the angle θ with the horizontal axis; instead, the star is observed at the angle $\boldsymbol{\varphi}$, $\boldsymbol{\varphi < \theta}$.

In a classical approach, by adding the axial components of the light coming from a fixed star and of velocity **v**, we can easily find the angle of the light beam in Earth's frame of reference:

$$\tan \varphi = \frac{\sin \theta}{{}^{v}/_{c} + \cos \theta}$$

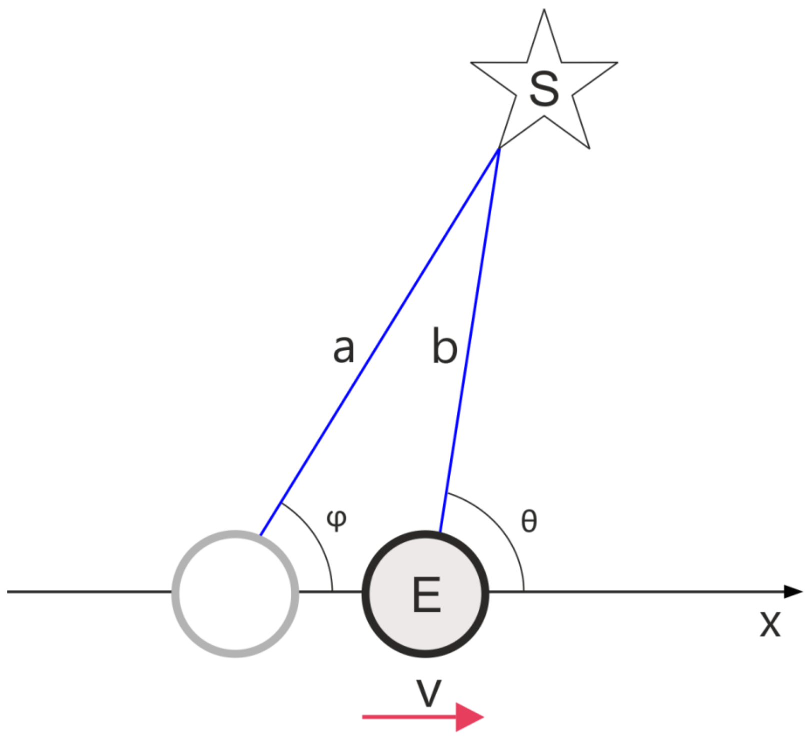

Figure 3 - *The aberration of light coming from stars*

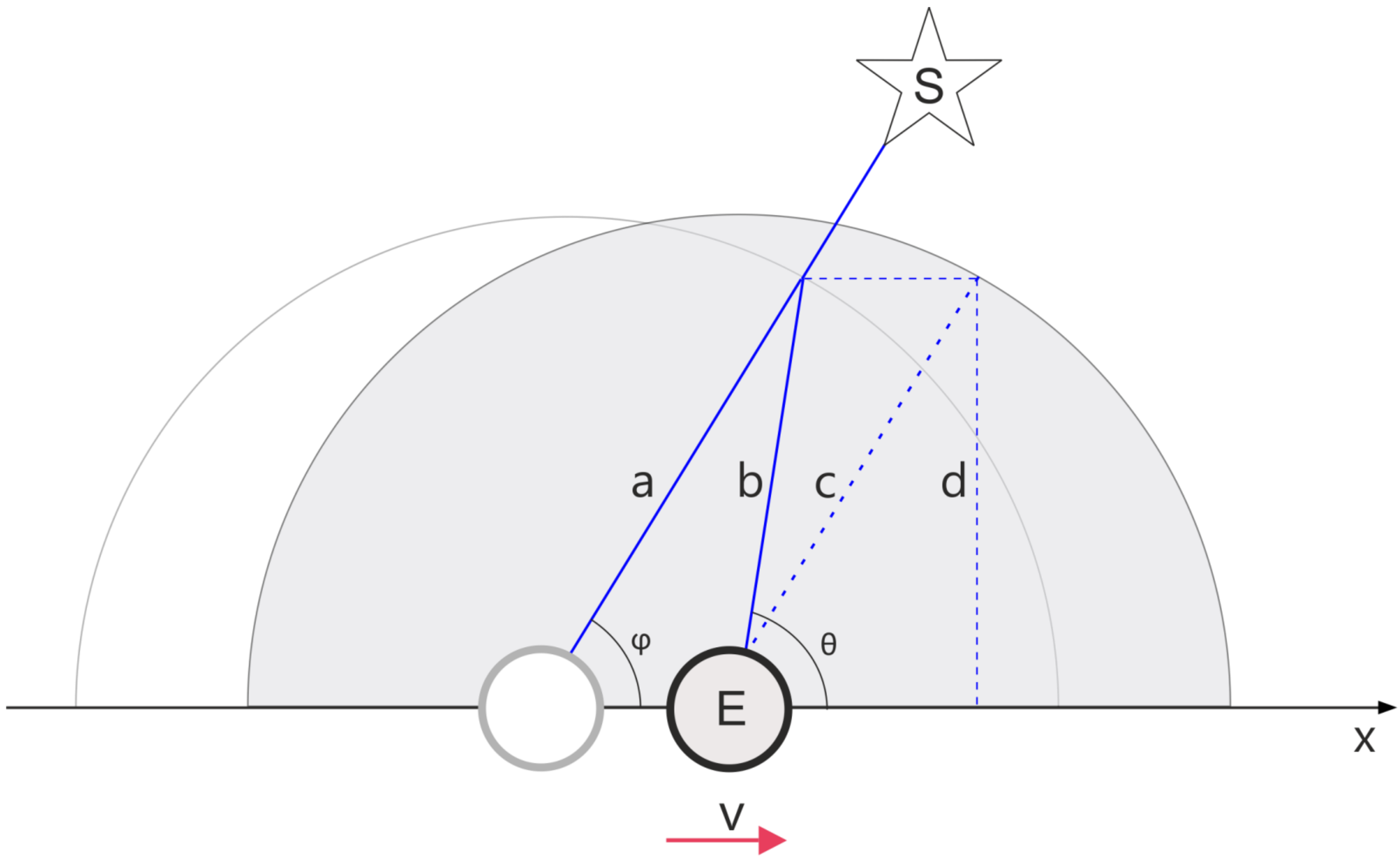

Figure 4 - *The aberration of light in absolute terms*

In relativistic terms, considering that light has the same speed **c** in the observer's frame (i.e. on the path (**b**)), the previous formula becomes (using the relativistic addition of velocities):

$$\tan \varphi = \frac{\sin \theta}{\gamma \left({}^{v}/_{c} + \cos \theta \right)}$$

Where $\gamma = \mathbf{1}/\sqrt{\mathbf{1} - \mathbf{v}^2/\mathbf{c}^2}$. For v << c and $\theta = 90°$, we find that $\boldsymbol{\theta} - \boldsymbol{\varphi} = \mathbf{v}/\mathbf{c}$ in both cases.

In absolute terms, starting from the main principles of TA, we identify at first the Earth and its surrounding space as a spherical region of absolute. At a given moment, the light from star **S** reaches this zone, as shown in Figure 4.

If our planet wouldn't move through space, the light beam would normally follow the path (**a**) toward the Earth-based observer, having the inclination angle $\boldsymbol{\varphi}$ to the horizontal axis. But the planet moves with speed **v** along the horizontal axis and reaches a new position while the beam of light travels at speed **c** toward the observer on the absolute path (**a**). As the planet moves, the whole adjacent region of absolute moves too, and the star will be seen in a different direction, (**c**), which is parallel to (**a**). Light is practically "dragged" by the absolute frame of the Earth, and its apparent trajectory (**b**) will form a greater angle to the horizontal axis, $\boldsymbol{\theta}$.

There are two right triangles formed by the paths (**a,b**), the horizontal axis and the perpendicular direction (**d**); we can write the cotangent of the angles $\boldsymbol{\varphi}$ and $\boldsymbol{\theta}$ and then eliminate the distance **d**, getting to this equation:

$$\cot \varphi = \cot \theta + \frac{v}{c} \frac{1}{\sqrt{1 - v^2/c^2}} = \cot \theta + \gamma \frac{v}{c}$$

The formula above is similar to the relativistic formula, rewritten using cotangents:

$$\cot \varphi = \gamma \left(\cot \theta + \frac{v}{c} \frac{1}{\sin \theta} \right)$$

Taking into account that the average speed of Earth on its solar orbit is only 29.28 km/s, all three cases (considering $\boldsymbol{\theta} = \mathbf{90°}$) lead to the same result, namely a deviation of 20.489 arcseconds.

Remark. This deviation does not depend on the diameter of the absolute sphere.

The analysis made under the TA terms holds for all collateral experiments (the observation of stellar aberration using a telescope immersed in water, for example, in which case the speed of light is lower).

1.3.3. Interpretations

The experiments described above (Chapters 3.1 and 3.2) and their different variants proved to be *inconclusive* in regard to the presumed existence of the ether and to the constancy of the speed of light in any inertial frame. However, they were used to formulate the postulates of special relativity and the final form of the theory was based on them, leading to a wrong approach and a partial understanding of the nature of reality. With all that, TR has a great success in physics, as it does provide accurate results in most cases. Why this paradox? In general, the absolute speed of the inertial frames of reference involved was small and the final results were not significantly influenced. All experiments have been performed on the planet's surface and in the vicinity at relative speeds under 10 km/s.

Normally, we should regard our planet and its surrounding region as an absolute system, which, along with other equivalent systems, moves throughout the Universe and bears the same laws of physics. These distinct or overlapped systems have dynamic configurations, moving and rotating together with the stars and galaxies about the global absolute that is a characteristic of our universe. When photons (or other particles) cross these regions, their motion and their trajectories are changed by the local absolute, being "imprinted" in this way by the respective region. As the relative speeds of these regions are small, the deviations will be also small (compared with the values from Chapter 3.2), but measurable. If a cosmic-level analysis is performed, we must identify first all the absolute systems (stars, planets, galaxies) crossed by the beam of light, their topology, and their speed, and then we may calculate the deviations. If a planetary-level analysis is performed, we must identify first the child IFRs and then find their parameters relative to the local absolute.

If we apply TA to all inertial frames of reference, the analysis becomes uniform and all phenomena have a clear meaning. Moreover, if the time would be absolute, we would observe that all processes and interactions will slow down when the absolute speed increases; this will imply more difficult calculations, but in this way, the nature of reality will be correctly represented.

1.4. Models and calculations

1.4.1. Observers and processes

As reality and its physical laws might depend on the concrete FR, we have to make a clear distinction between the observers of the various processes and movements that take place in nature. Now we can define several types of observers (they may be humans or apparatuses, but this separation will not be made here):

- *Absolute observer*. This observer is at rest in AFR and the time reference he uses is the absolute time - which has the maximum rate in this frame. His observations are *real, uniform, absolute,* and they correctly reflect the laws of physics of this AFR. At the same time, this observer has a virtual character: he can turn into a mobile observer and all the observations he makes in an IFR will have the *apparent* attribute.

- *Local observer*. This observer is at rest in an IFR, being an integral part of that inertial frame; the time reference he uses is the local time (its rate of passage is specific to this frame). His observations, based on his own temporal reference, may depend on the absolute velocity of its frame (both magnitude and direction).

Note 1. The association between time and a certain reference frame is kind of artificial, serving only theoretical purposes. Time is in fact a reflection of some concrete processes that undergo in concrete material objects.

Note 2. The local observer is potentially affected by movement in the same way the observed processes are. If the local physics changes, the internal mechanisms by which he quantifies the observations will also change. We can infer from this a *relative* character of all his observations, an intrinsic limitation they have in the local "universe" of an IFR.

Note 3. The internal clock (reference time) of an observer is based on a process that normally has the maximum possible rate; anyway, the fastest process in that frame has the speed of light in that context.

Uniform processes or bodies in uniform motion can be categorized, depending on their absolute speed, as follows:

- *Luminal processes*, running at the speed of light.

- *Subluminal processes*, running at a speed less than light.

For that the absolute speed of light cannot be exceeded by any particle, field, or body, the behavior of these two types of processes differs when the absolute speed of their IFRs increases. The respective differences are related to the manner in which they are slowing down, and the analysis must be made considering the distinction between the observational and the real nature of these changes.

1.4.2. Parent AFR and child IFR

Let be the absolute frame of reference **XOY**, as shown in Figure 5. At time zero, omnidirectional light is emitted from the origin **O**; at time **t,** the wavefront will have the circular distribution **C** (in a two-dimensional projection). The trajectory of a certain photon emitted from point **O** forms the angle **α** to the horizontal axis; this photon reaches point **A** after the time interval **t**, traveling the distance **ct**.

Now let be the child IFR **X'O'Y'**, which overlaps the parent AFR at time zero (their origins coincide); if it moves along the OX-axis with speed **v**, the wavefront of light will appear different to an absolute observer from this frame (Figure 6). The shape of this wavefront is still circular, but the entire front is shifted to the left by distance **vt**, that exact distance traveled by the IFR in the time interval **t**. That observer will see a shorter distance traveled by the photon to point **A**, and this new trajectory (**d**) forms a different angle, **α'**, to the horizontal axis. From his absolute perspective, our photon has traveled the distance **ct** in **t** seconds; from his local perspective, our photon has traveled a shorter distance in the same interval. Therefore, we might say that the apparent speed of light in an IFR is lower than **c** in the frame's direction of travel.

Note. If we consider that the source of omnidirectional light is in the origin **O'** of the mobile frame **X'O'Y'**, the final distribution of the wavefront at time **t** will be no different from the current one (first postulate of the Theory of the Absolute).

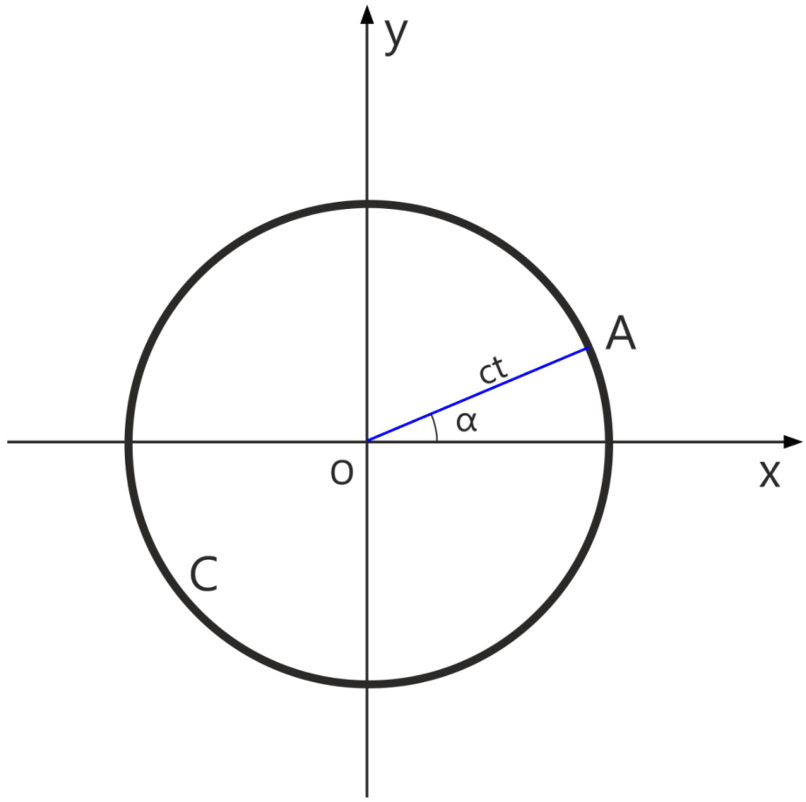

Figure 5 - *The absolute distribution of light*

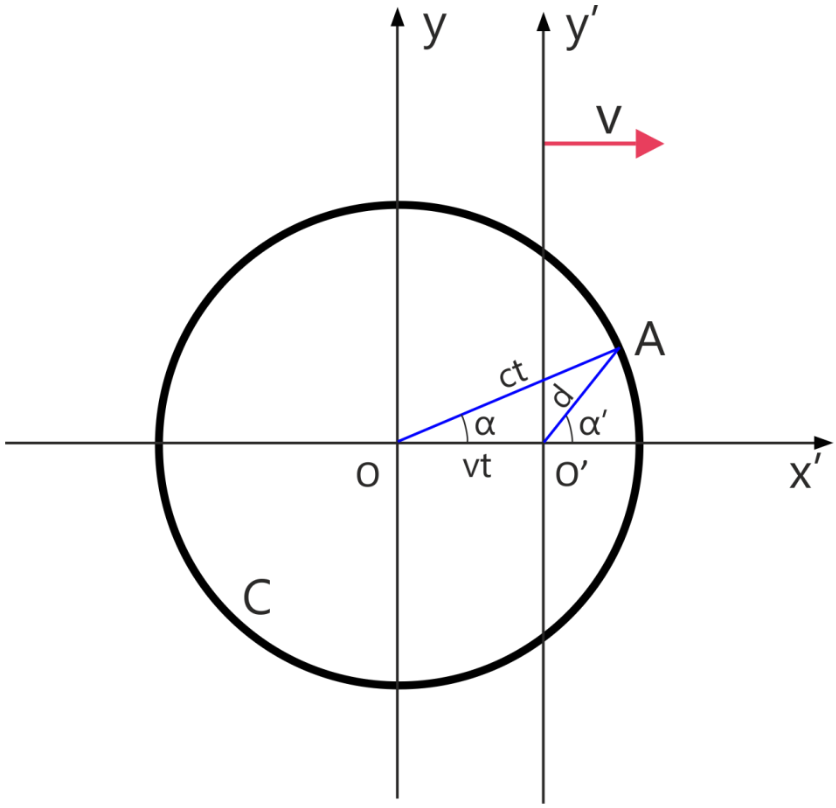

Figure 6 - *The distribution of light in an IFR*

It is easy to observe that the distribution of light in an IFR is no longer uniform, and therefore we can say that light has different speeds in there. A local observer (we can call him a mobile observer), whose time reference has a constant rate, still cannot measure and calculate a constant speed of light (no matter where its source is located).

Be the apparent velocity of light in **X'O'Y'** denoted by **u**; we now can simply write the formulae for the value of this vector and its angle to the horizontal axis:

$$u = \sqrt{c^2 - 2cv\cos\alpha + v^2}$$

$$\sin\alpha' = \frac{c\sin\alpha}{\sqrt{c^2 - 2cv\cos\alpha + v^2}}$$

Here are a few special values of this speed and angles (negative angles are also accepted due to symmetry):

α	**u**	**α'**
0°	c - v	0°
arccos (v/c)	$\sqrt{c^2 - v^2}$	90°
90°	$\sqrt{c^2 + v^2}$	90°+arctan (v/c)
180°	c + v	180°

Table 2

Note 1: Speed **u** is an apparent speed, a relative speed of light in regard to certain IFR. Therefore, its value can exceed the absolute limit **c** (may be up to **2c**). In general, regardless of their concrete FR, two objects may have relative speeds in this range: **0..2c** (when they are seen by an absolute observer).

Note 2: If the local observer (of absolute type) would be able to measure this speed, he would get different values, depending on the orientation: minimum speed in the direction of **v** and maximum in the opposite direction. Therefore, this observer would know at least the direction in which its own IFR moves, i.e. the direction of velocity **v**. Could he find out the exact value of **v**? The answer is yes, and the reason for this hides in Table 2 - the ratio between the maximum and minimum speed does not depend on the rate of local time.

Parenthesis

The single-arm MM interferometer (Figure 2) could be used for this purpose, by analyzing the fringe shift when it is mounted in a certain direction and then perpendicularly to it.

Note 3: Can this local observer synchronize his local clock with a clock ticking in the AFR? But to calibrate it? Theoretically speaking, the answer is yes to each question. Both clocks may start at the same moment, when the origins of the two frames, **O** and **O'**, coincide. For calibration, let us consider that short pulses of light are emitted from point **O** at the time interval $\tau = 1$ (one second). The observer knows this thing, but he perceives a longer pause between pulses, namely the absolute interval $\tau' = c\,\tau\,/(c-v)$. As he knows the value of velocity **v**, the calibration of its "local" second is perfectly possible.

Note 4: This local observer of absolute type will perceive the things around him slightly deformed, all of them being "pulled" back along the direction of velocity **v** (due to the finite speed of light and due to the motion of the IFR). Also, the color of things will change due to the different apparent values of the speed of light.

1.4.3. Time in AFR and IFRs

What is the rate of local time in the above IFR, or the rate of the observer's reference time? And are they local constants, depending only on the absolute speed of the reference frame? TA stated that the rate of time in a parent AFR has a maximum value and all processes are slowing down in any child IFR. Moreover, we have already seen that the apparent speed of light is not uniform in an IFR, it depends on the frame's absolute velocity. If we were to see these things in a relativistic manner, we could establish that the speed of light is constant in any IFR (TR postulate) and, consequently, their local time will have different rates. If we were to see these things in an absolute manner, we have two alternatives:

1. We keep the AFR's rate of time in all child IFRs. All processes and local movements will change with the absolute velocity **v**, and these changes should be described by new equations of motion.

2. We try to set a certain local time in each IFR that its rate does not change the equations of motion. However, Chapter 4.1 shows us how the apparent speed of light depends on the direction in an IFR, and we could infer from it that time - as a reflection of things' velocity - also depends on direction!

Obviously, the second alternative seems more natural, closer to the well-known relativistic style; anyway, is this alternative really possible, and moreover, does it reflect properly the reality? To find the answers to these questions and to choose the best approach, we should now remember the definition of time (Chapters 8 and 12 of [3]); also, we need to know if all types of clocks (especially the light clock and the atomic clock) are measuring correctly the flowing of time and how exactly this special quantity is connected to different observers. In absolute terms, time is a derived physical quantity that is linked to the movement of concrete material bodies. It reflects the speed at which they move, vibrate, oscillate, it shows how the rate of these processes is limited due to the material nature of the structures involved, due to their intrinsic characteristics at quantum and granular levels. The maximum rate of time can only be found in the luminal processes that run in absolute frames (being at rest relative to an AFR). Once an object from this frame starts to move with a certain absolute speed, a part of its internal energy is "reallocated" for this and, consequently, it can no longer move or oscillate at the same speed in its proper (comoving) IFR - therefore, we can assume that its local time slows down. This phenomenon must be used in conjunction with the observational changes that happen in an IFR, which means we have to take into consideration the new apparent speed of things and light.

Let us identify the exact time in an AFR, see how much it slows down in a certain IFR and if this new rate is correctly reflected by the local clocks. According to TA, this slowdown may be quantified by applying TR in IFR relative to AFR - and the constant value that resulted could be seen in the context as an averaged value over all directions. But is this relativistic approach compatible with the normal equations of motion in IFRs?

1.4.3.1. Time measurement

In order to identify the source of absolute time at the quantum level, our analysis must start from the granular time. The quantum time (Chapter 12 of [3]) is in fact a reflection of how the speed of all movements is limited by the fundamental constants at the granular level - in principle, it is about the absolute granular speed ***C***, which limits the speed of all granular structures to **c**. If a particle undergoes a repetitive process in which the absolute speed **c** is reached, it can be used as a good example in our quest to find the rate of quantum time. The period of that process may be considered as a proportional constant, as a base for quantum time - and, implicitly, for the passage of time at a macroscopic level.

For this purpose, let us imagine now a system that consists of two hypothetical particles **A** and **B**, firmly joined together, which are rotating with the speed of light **c** in the plane **YOZ**, as shown in Figure 7. As long as their AFR is an isotropic space, the trajectories of these particles are perfect circles of radius **r**. Consequently, the rotation period **T** is given by this simple formula:

$$\mathrm{T} = \frac{2\pi\,\mathrm{r}}{\mathrm{c}}$$

This system, in the given circumstances, can be characterized as *maximal* if we consider the speed of its internal process. If an external force pushes on the x-axis, the system will accelerate, reaching the speed **v** after a while. The internal process (the rotational motion of particles) will slow down in the system's comoving frame - as shown in Figure 8. As the value of each particle's absolute velocity is still **c** and its direction changes (this vector's plane is no longer YOZ), the tangential speed of both particles will automatically decrease. The new rotation period can be written as:

$$\mathrm{T}' = \frac{2\pi\,\mathrm{r}}{\mathrm{u}} \qquad\qquad \mathrm{T}' = \frac{2\pi\,\mathrm{r}}{\sqrt{\mathrm{c}^2 - \mathrm{v}^2}}$$

and the ratio of the two periods results immediately:

$$\frac{\mathrm{T}'}{\mathrm{T}} = \frac{1}{\sqrt{1 - {\mathrm{v}^2}/{\mathrm{c}^2}}}$$

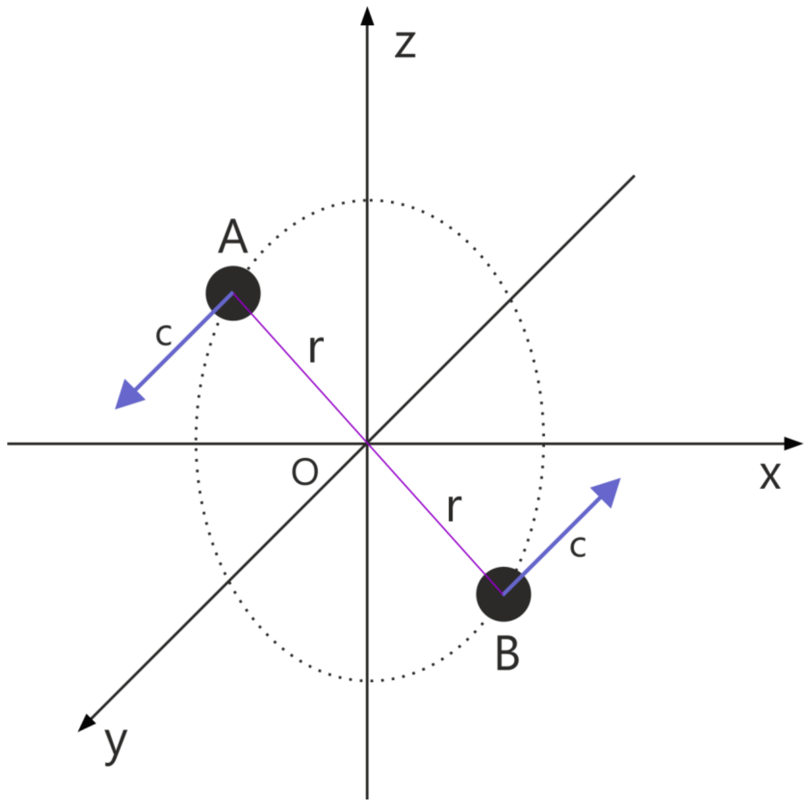

Figure 7 - *A system of two particles in AFR*

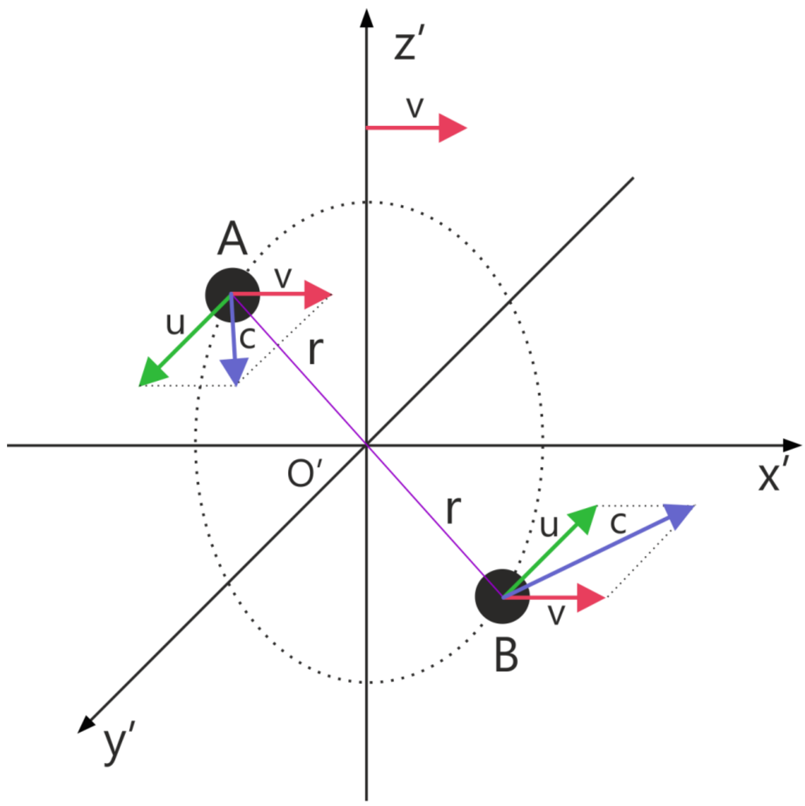

Figure 8 - *A system of two particles in IFR*

We may say that the local time of our IFR, the time shown by a local clock based on this type of mechanism, is given by the well-known formula of the relativistic time dilation applied with regard to AFR. The rate of time is related to the maximum possible speed, but it is also characteristic to a concrete structure or object that has a certain absolute speed. In AFR, we may use the absolute time for a moving object and observe how its internal processes are slowing down with the speed. From the proper frame of reference, a local observer sees in a slow manner those slowed down processes. Therefore, if the rates of these things are identical (and do not depend on direction), our observer would not perceive any change in the speed of those processes or the local physics.

1.4.3.2. The light clock

As shown in Chapter 8 of [3], the light clock can be used to establish a certain period of time, a period that is potentially proportional to the rate of local time in an IFR, based on the duration it takes a beam of light to travel a fixed distance (uni or bidirectionally). Let us consider the light clock **B** that lies inside an AFR (Figure 9) and which will later move along with the IFR **X'O'Y'** (Figure 10); it uses a beam of light emitted by the laser source **L** toward a reflective mirror **M** that is located at the fixed distance **s**. The time it takes for light to reach the mirror, to reflect, and return to the source can be used as a base unit for the local time. As shown above, the relative speed of light in an IFR is apparent and depends on the angle between the beam direction and the absolute direction of travel (even the mean value of speeds on the two opposite directions varies with the angle **α**). However, there is a special range of directions, namely those that are perpendicular to the velocity vector **v**. If the line **s** lies in this plane, the beam of light will travel that distance with an apparent speed of value $\mathbf{u} = \sqrt{\mathbf{c}^2 - \mathbf{v}^2}$, $\mathbf{u} < \mathbf{c}$, within the period $\mathbf{t}'$ of local time. We may therefore write $\mathbf{s} = \mathbf{u}\,\mathbf{t}'$, and we also know that this local time *corresponds* to time **t** which flows in the AFR (where the same distance is traveled at speed **c** and $\mathbf{s} = \mathbf{c}\,\mathbf{t}$). From these equations we can find the relationship between the two periods of time:

$$\mathrm{t}' = \frac{\mathrm{t}}{\sqrt{1 - {\mathrm{v}^2}/{\mathrm{c}^2}}}$$

This formula can also be found by applying TR/TA in these frames, which could imply that the apparent time has slowed down as much as the local time.

Note 1: The light clock shows accurate data only if it is oriented perpendicularly to the velocity vector **v**. Along the parallel direction, for example, the ratio of those time intervals would be different, namely:

$$\mathrm{t}' = \frac{\mathrm{t}}{1 - {\mathrm{v}^2}/{\mathrm{c}^2}}$$

Note 2: The beam of light should form the angle **α = arccos (v/c)** to the horizontal axis in order to reflect and return in the same direction. Similarly, the mirror must be tilted at a certain angle.

Note 3: The apparent wavelength of photons differs from the absolute one due to the transverse Doppler Effect. However, this effect is compensated on reception as the receiver is a part of the mobile frame.

Note 4: Once the speed **v** gets closer to the limit **c**, the movements in a material system tend to take place in a plane perpendicular to the IFR's velocity vector, which means that the measurement of time is pretty accurate.

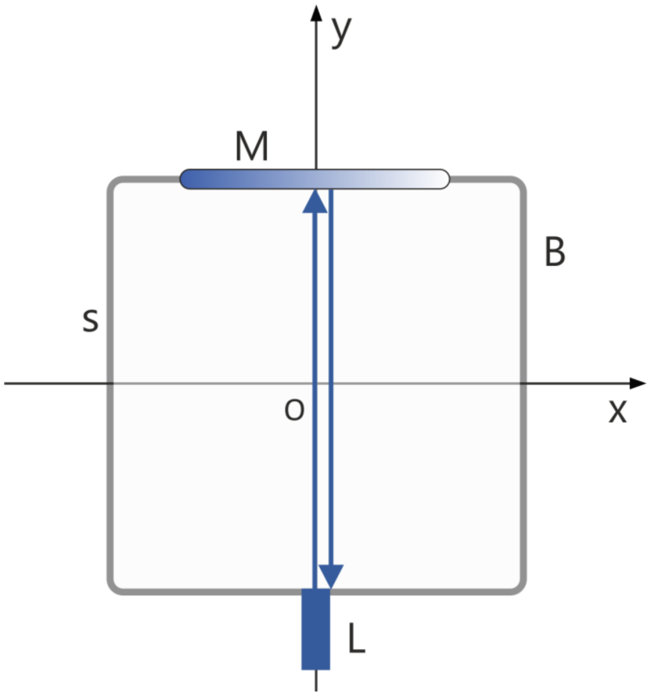

Figure 9 - *The light clock in AFR*

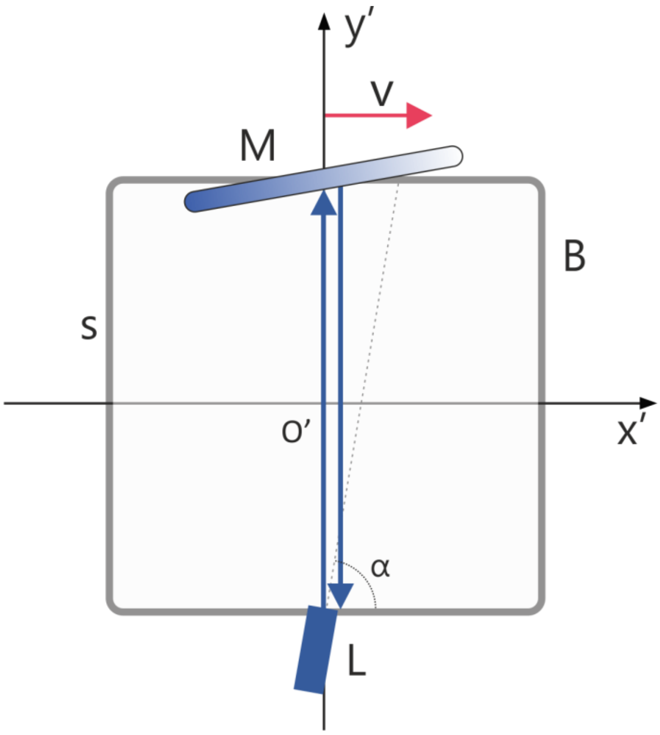

Figure 10 - *The light clock in IFR*

1.4.3.3. The atomic clock

As we already know (Chapter 8 of [3]), the atomic clock uses as a reference the electron transition frequency from certain atoms (Hydrogen, Caesium, Rubidium); this frequency can be in the microwave, optical, or UV region of the electromagnetic spectrum. The second was defined by SI as the duration of 9,192,631,770 oscillations produced by the Caesium-133 atom, which thus becomes the standard in time measurement. Another standard rate may be obtained from the Hydrogen atom (the 21 cm line, given by the spin of its electron), of about 1420 GHz, using masers. The frequency of these oscillations is very stable, but it changes with the absolute speed of the light source. All tests performed to verify the TR's time dilation by the Lorentz factor (Hafele-Keating experiment, for example - 10% precision, and the newer, more accurate ones, about 1.6%) were consistent with the theoretical predictions. We have to mention that the speed of the airplanes was about 500 km/h (140m/s), being much smaller than the speed of light. This means that the electron transitions are becoming slower when the respective atoms also move at a certain absolute speed.

TP has shown that these electron transitions in which photons are emitted have two stages: acceleration (the speed threshold $\mathbf{v_p}$ is passed) until the speed of light **c** is reached, and deceleration (the threshold value is crossed in the opposite direction). However, can this kind of transition happen in any conditions, at any absolute speed **v** of the atoms? Those photons, whose frequency is changed anyway due to the Doppler Effect, can be emitted in any direction? Or there is a certain range of directions that depends on the absolute velocity's direction?

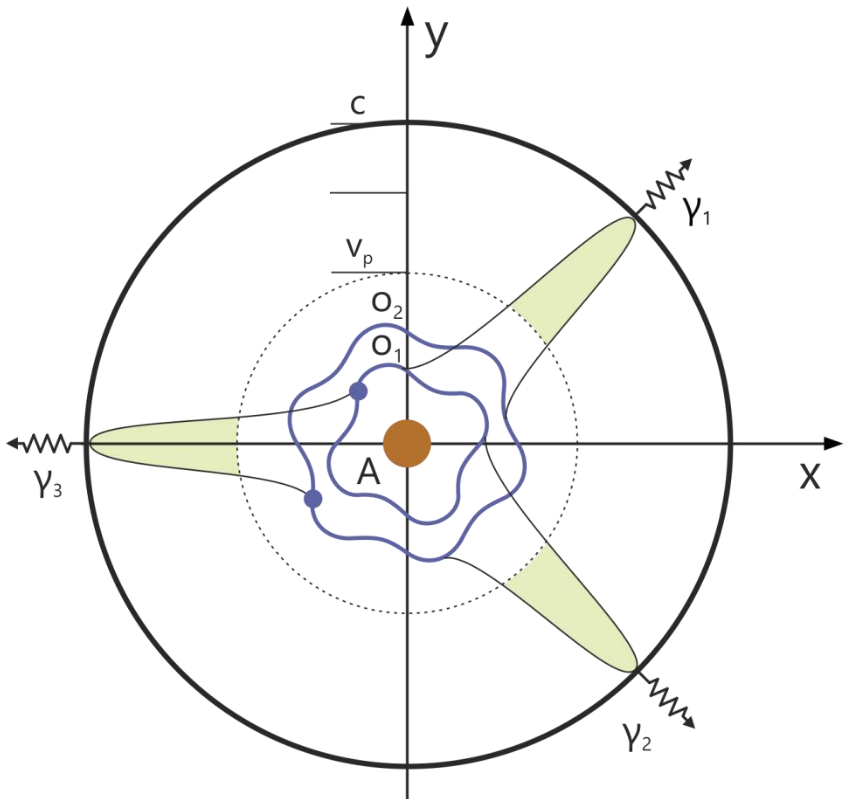

Figure 11 - *The velocity circle for an atom in AFR*

Figure 11 shows a coordinate/velocity circle of all possible speeds in AFR, where the big circle represents the speed limit **c** and the dashed one represents the speed threshold $\mathbf{v_p}$ (from which the emission of photons starts). The atomic electron (blue dot) may occupy one of the two atomic orbitals $\mathbf{o_1}$ or $\mathbf{o_2}$ (atom A is at rest in AFR) and its transition between these levels will generate a photon in any direction (photons $\boldsymbol{\gamma_1}$, $\boldsymbol{\gamma_2}$, and $\boldsymbol{\gamma_3}$, for example). Therefore, we may characterize the emission of photons in AFR as *omnidirectional*.

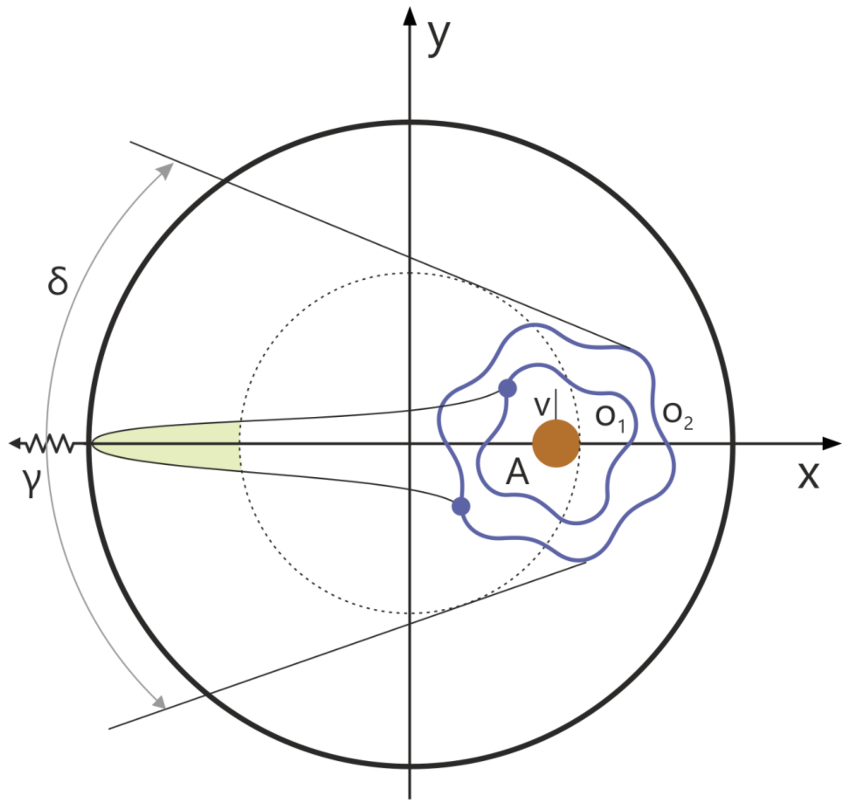

Figure 12 - *The velocity circle for an atom in IFR*

Let us consider now the case of a moving atom (at the absolute speed **v)**, as shown in Figure 12. We easily observe that the complete electron transition can only be made in a limited range of directions, within the angle denoted by **δ** (which is a solid angle in fact due to the implicit symmetry about the Z-axis). Therefore, the emission of photons is no longer omnidirectional and incomplete photons may be generated.

Note 1: A few aspects of the quantum mechanics were not taken into account in our analysis; once the absolute speed increases, we should check if the electric and magnetic fields are undergoing some changes and also consider the increase in mass of electrons and nucleons.

Note 2: In certain materials and objects (those in a fluid state for example), the angle **δ** may considerably increase due to the dispersion of instantaneous absolute speeds (their atoms can move or vibrate with significant speeds).

Note 3: If this phenomenon of directional limitation is real and can be proved experimentally, it will confirm that the TA reflects correctly our reality and, therefore, the state of all objects and the symmetry of quantum physics are changing with the absolute speed.

1.4.4. Interactions in IFRs

Some vector fields, such as the electric or magnetic ones, are caused by charged particles and by their motion. For instance, the electric field is produced by an electrically charged particle and consists of successive layers of electrophotons which are continuously emitted from that particle's surface. And, like all photons, the electrophotons are moving with the absolute speed **c**. Therefore, the electric field is emitted around the particle in all directions with the absolute speed of AFR, and consequently, its speed relative to that particle will no longer be **c** (and this contradicts the TR postulate). How exactly the interactions between charged particles (and the fields which are causing them) are influenced by this thing? Practically, these interactions will not change, the forces exerted on particles are identical. Why these interactions do not change, while the distribution of electric and magnetic fields are certainly varying?

Let us consider two electrically charged particles at rest in AFR, as shown in Figure 13. In my PT model, the electric field is assimilated with a continuous series of omnidirectional electrophotons that are emitted at the absolute speed **c** by the charged particle (the distance between successive layers is denoted by **λ**, a sort of wavelength). Figure 14 shows the same particles, now being at rest in an IFR that has the absolute speed **v**. We may notice the new structure of the fields, the compression along the direction of travel, and the expansion in the opposite direction (this differs from the relativistic compression, which is presumed to be the same in both directions); the wavelengths on the horizontal direction are now $\boldsymbol{\lambda_1} > \boldsymbol{\lambda} > \boldsymbol{\lambda_2}$. Practically, the amplitude of these fields now changes with direction; however, the effect of one field on the other particle is the same, the particle will "sense" the old field intensity from AFR. This phenomenon is similar to the non-relativistic Doppler Effect for light, at source and receiver, and its direct consequence is the same level of interactions between particles - hence the same electric field equations - in IFR and AFR.

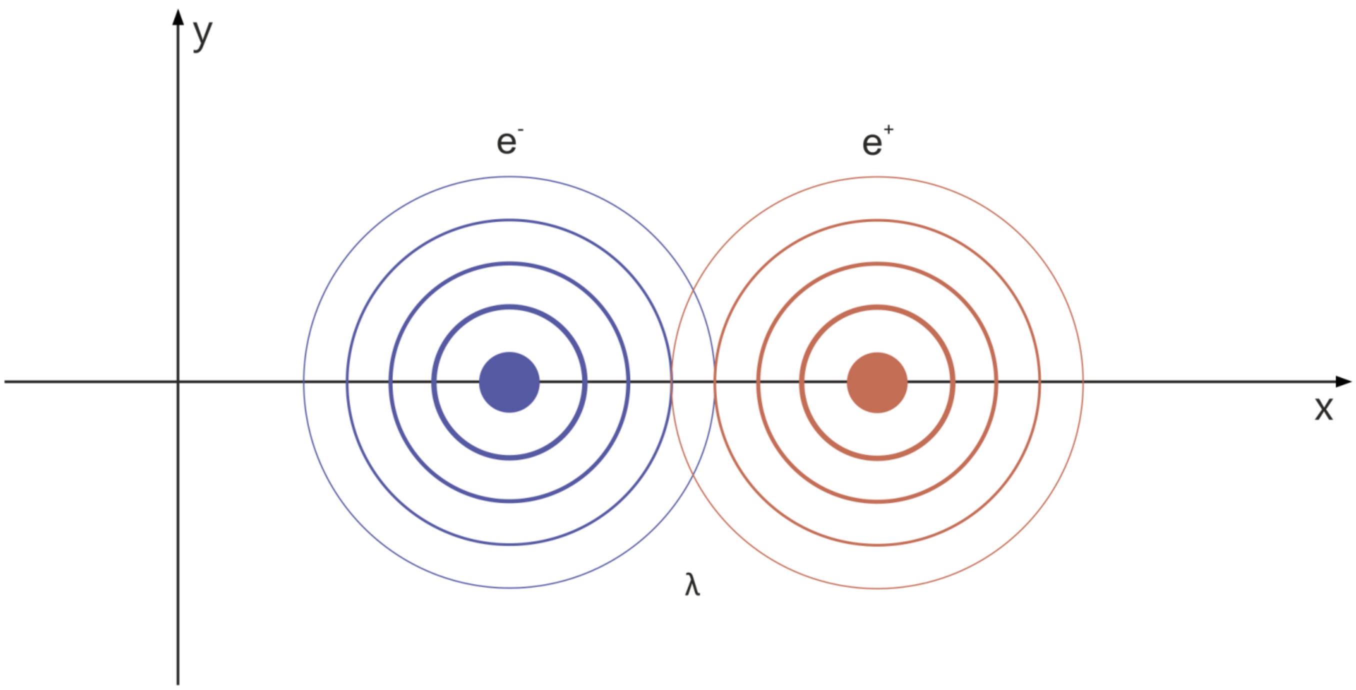

Figure 13 - *Two electrically charged particles in AFR*

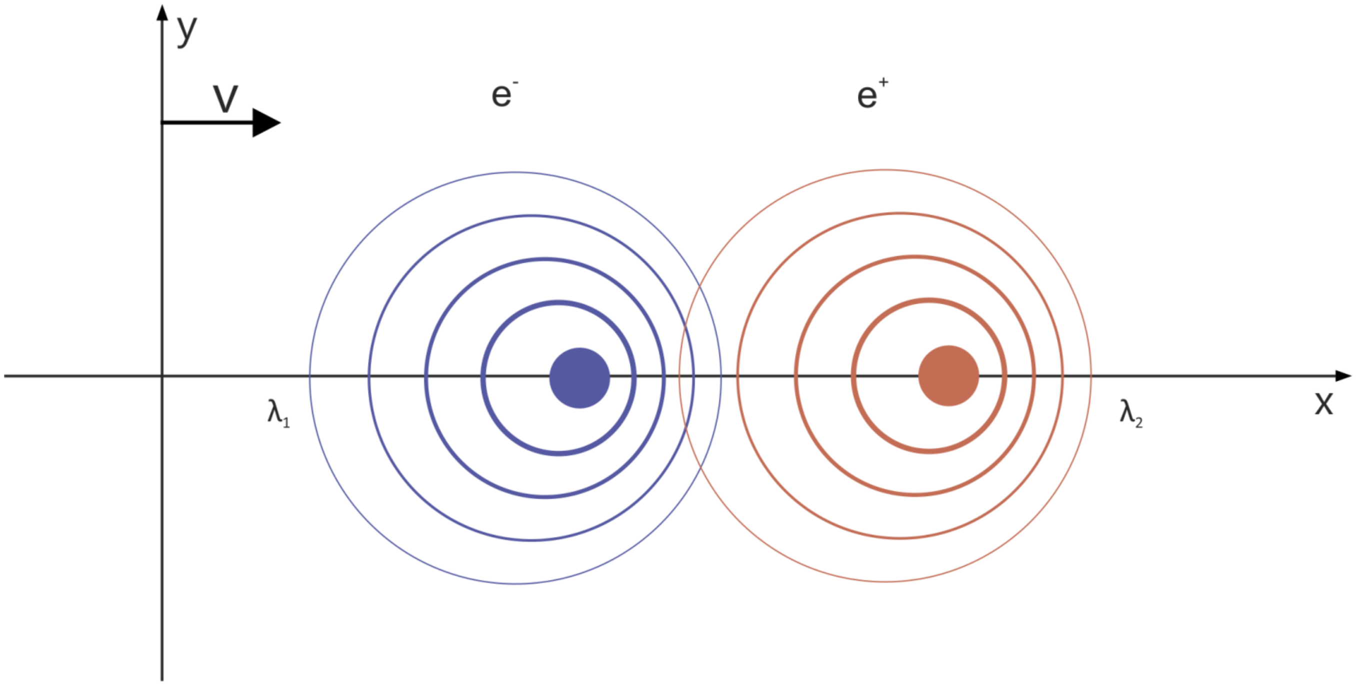

Figure 14 - *Two electrically charged particles in IFR*

1.4.5. The generalized Doppler Effect

Let us take one more look at the atomic clock, that clock in which the photons are undergoing a certain change of wavelength (redshift or blueshift, depending on the direction) when the entire device moves with an absolute speed. As the speed of light is constant, those photons will have a different frequency in AFR, higher or lower. This change in frequency is the manifestation of the non-relativistic Doppler Effect. Moreover, we have to add to this phenomenon the slowdown of all processes in IFR, which is the so-called relativistic component of the change in frequency (determined by a lower rate of time IFR). In the concrete case of the atomic clock, both the light source and the receiver are at rest in the same frame; therefore, when this clock returns to the parent AFR, the time difference it shows will result only from the relativistic component of the change in frequency.

What happened inside the atom that emits photons in IFR, why their frequency (and energy) is lower? We can infer from the previous analysis that:

- The effects of electric and magnetic fields on particles (electrons - nucleus) did not change

- The mass of all particles undergoes a relativistic increase

If Newton's second law of motion is still valid, we may simply say that a constant force applied to higher masses will produce a lower acceleration; this means a longer duration of transition for electrons between the two orbitals, which may explain logically the relativistic decrease in photon's frequency.

A photon takes a certain period of time to be built, and each of its granular layers is emitted in the same direction within an *infinitesimal fraction* of that interval. Over this fraction of time, we can assume that the electron is at rest and the granular layer flies off with the absolute speed **c**; thus, no law or postulate related to the maximum speed was broken during the emission process. The next granular layer is generated when the electron takes a new position, at a distance that depends on its absolute speed. The entire granular structure of a photon (more or less compressed) is built in this way, and its physical length (reflected in wavelength) will depend on the electron's absolute velocity. Globally, the relative speed of photons to the source can exceed the value **c**.

1.4.6. Absolute transformations

We have already seen (Chapter 4.2) that light has an apparent speed below the limit **c** on a broad range of directions in an IFR (the angles of about -90°..+90° to the velocity vector **v**); therefore, certain distances will be traveled by light in a longer period of time. A light clock is able to measure this dilated time (according to TR applied in that IFR) only if it is oriented perpendicularly to the direction of movement. Considering all these things, we may formulate now a few reasonable assumptions, closer to the mechanisms of reality, regarding the transformations between the two coordinate systems (the postulates of TA will be included).

First of all, we need some *initial transformations* to correctly reflect the perception of an absolute observer in both frames, AFR and IFR. Considering the hypothetical situation from Chapter 4.2, the addition of velocities in these frames is shown below (both pictures of Figure 15). The absolute velocity **u** of a body named **A** (left drawing) in AFR is perceived as **u'** in IFR; similarly, the angle **α** of its trajectory in AFR is perceived as **α'** in IFR. In case we talk about photon **B** (right drawing), the velocities will be denoted by **c** and respectively **c'**. The relationships between their values may be deduced from the two right triangles formed by the velocity vectors. To simplify the final formulae, we will use:

$$\varepsilon = v/u\,,\ \ \varepsilon' = v/u'$$

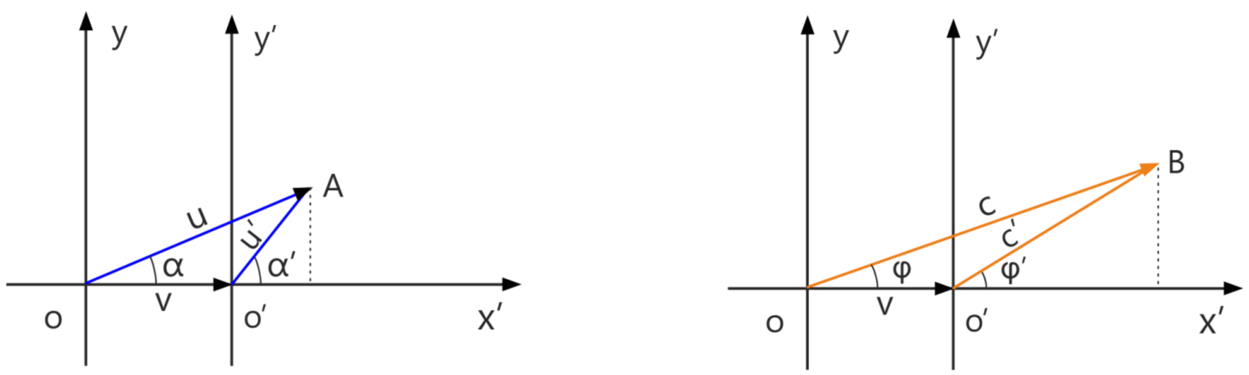

Figure 15 - *The absolute velocities in absolute perception*

AFR	IFR (absolute mode)
$u' = u\sqrt{1 - 2\varepsilon\cos\alpha + \varepsilon^2}$	$u = u'\sqrt{1 + 2\varepsilon'\cos\alpha' + {\varepsilon'}^2}$
$\sin\alpha' = \sin\alpha/\sqrt{1 - 2\varepsilon\cos\alpha + \varepsilon^2}$	$\sin\alpha = \sin\alpha'/\sqrt{1 + 2\varepsilon'\cos\alpha' + {\varepsilon'}^2}$

Table 3

For the photon **B** we will use these equations:

$$\beta = v/c\,,\;\; \beta' = v/c'$$

AFR	IFR (absolute mode)
$c' = c\sqrt{1 - 2\beta\cos\varphi + \beta^2}$	$c = c'\sqrt{1 + 2\beta'\cos\varphi' + {\beta'}^2}$
$\sin\varphi' = \sin\varphi\,/\sqrt{1 - 2\beta\cos\varphi + \beta^2}$	$\sin\varphi = \sin\varphi'/\sqrt{1 + 2\beta'\cos\varphi' + {\beta'}^2}$

Table 4

Let us use one more special notation for photons:

$$\gamma^- = 1/\sqrt{1 - 2\beta\cos\varphi + \beta^2},\;\; \gamma^+ = 1/\sqrt{1 + 2\beta'\cos\varphi' + {\beta'}^2}$$

AFR	IFR (absolute mode)
$c' = c\,/\,\gamma^-$	$c = c'\,/\,\gamma^+$
$\sin\varphi' = \gamma^-\sin\varphi$	$\sin\varphi = \gamma^+\sin\varphi'$

Table 5

We can draw a single conclusion from these formulae: the apparent velocity in an IFR depends (as magnitude and direction) on the absolute speed and direction (and vice versa) in a non-linear manner. This statement is true for any subluminal speed and even for the speed of light.

Now, let us go back to the *local observer*, to its time reference and the general principles of observation. What are the main features of observation, knowing that any measuring equipment would be used for this purpose, it would be equally affected if the IFR's local physics would change? At this moment, we can assume that:

- The observation is neutral, the observer does not interact with the observed system

- Any change in the local physics affects the system and the observer in the same manner
- The time reference of all observers is based on maximal processes (their speed is **c**)
- A single direction can be observed at a time
- Several directions can be simultaneously observed by several independent observers

Let us assume now that the time reference of a local observer is based on a unidirectional light clock (the unit of time is given by the interval in which light travels in one direction); moreover, the clock is oriented along the exact direction of the uniform motion observed in IFR. The apparent speed of light, in any place inside and outside the clock, will have identical values. Therefore, the eventual variation of this speed *cannot be perceived by the observer*, and, from his point of view, light travels at a *constant speed* throughout the IFR. As this speed does not depend on the absolute velocity of the IFR (value and direction), we can infer that its value may be found in a stationary IFR, i.e. *the speed of light has the same value **c** for both types of observers, local and absolute*.

As the local time measurement is based on the apparent speed of light and this speed has proved to be constant, we can infer that the local time and the apparent time are changing in the same way (we have already estimated this, see Chapter 4.3.2).

Furthermore, if we have a maximal process (as of the two-particle system, Chapter 4.3.1) in an IFR, it will be slowed down in the same proportion as the local time slows down; consequently, a local observer will not perceive the change, he will see that process running at the same speed.

These hypotheses lead us to a simple conclusion: "the universe" perceived by the local observer (the one having all the properties above) of an IFR is perfectly similar to the universe of the AFR and the absolute transformations may be formulated considering two things:

- The speed of light has the constant value **c** in both frames
- The local time is given by the apparent time (whose unit is based on the apparent speed of light)

Consequently, my new proposal regarding the *directional local time* is this:

In any child IFR, for any entity in uniform motion, the local time changes in regard to the parent AFR's time in the same proportion as the apparent speed of light on that direction changes in regard to its absolute value.

Now we turn on the *local mode* in IFRs ('') and the local time on a trajectory that has the direction angle $\boldsymbol{\varphi}'$ may be written as a function of the absolute time **t**:

$$t'' = t / \sqrt{1 - 2\beta \cos\varphi + \beta^2} = t\,\gamma^-$$

Due to this new rate of the local time, a local observer from IFR will perceive in a different way the journey of our photon - the same distance will be traveled, but with the "local speed" **c**.

If an object moves with the apparent speed $\mathbf{u}'$ and its trajectory has the same direction angle $\boldsymbol{\varphi}' = \boldsymbol{\alpha}'$, its speed will seem different to a local observer due to the new rate of local time ($\mathbf{t}''$, given by the previous formula). The local observer perceives the speed $\mathbf{u}''$, as follows:

IFR (local mode)
$\mathrm{u}'' = \mathrm{u}' / \sqrt{1 - 2\beta\cos\varphi + \beta^2} = \mathrm{u}\,\dfrac{\sqrt{1-2\varepsilon\cos\alpha+\varepsilon^2}}{\sqrt{1-2\beta\cos\varphi+\beta^2}}$
$\mathrm{u} = \mathrm{u}'\sqrt{1 + 2\varepsilon'\cos\alpha' + \varepsilon'^2} = \mathrm{u}''\,\dfrac{\sqrt{1+2\varepsilon'\cos\alpha'+\varepsilon'^2}}{\sqrt{1+2\beta'\cos\alpha'+\beta'^2}}$

Table 6

We may conclude that local observers will see a movement at the speed of light in the same way as the absolute observer, while the movements at subluminal speeds will be seen in a distorted way - the non-linear changes are depending on the angle between trajectory and the IFR's direction of travel, also on the IFR's absolute speed (Figure 16 shows only the velocity $\mathbf{u}''$ at the new scale of the local time).

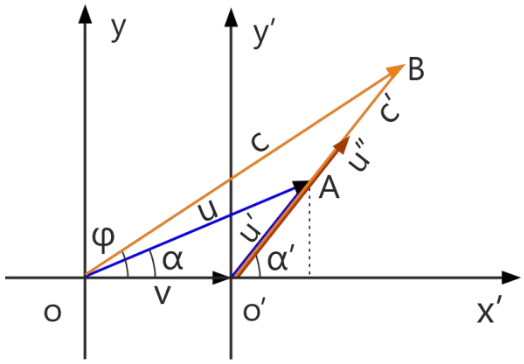

Figure 16 - *Velocity u in IFR*

Note 1: The absolute transformations AFR - IFR are actually the Galilean transformations in which:

- The IFR's absolute speed **v** is limited to the value **c**.
- The local time is directional, see its formula above.
- The Z-axis has not been included due to symmetry; an IFR rotated about the X-axis is equivalent.

Note 2: This variable (directional) time of an IFR can flow faster or slower than the time of the AFR, depending on the direction in which photons are moving in regard to velocity **v** (the relative speeds may be higher than **c** in any FR). For omnidirectional processes running in IFR, we may continue to apply TA (i.e. TR in regard to IFR); for unidirectional processes, the new formula adds more precision and correctly describes how the physical phenomena are seen in fact.

Note 3: The new transformations and the new direction-dependent formula of $\boldsymbol{\gamma}^{-}$ are valid for unidirectional movements and processes. For a material object that is at rest in IFR, the time has an *averaged value* resulting from the proper time of all its particles, atoms, or molecules (depending on their rotations and vibrations in all directions). Consequently, the rate of this concrete time decreases continuously when the speed **v** increases and *tends* to the value given by TR:

$$\gamma^{-} = 1/\sqrt{1-\beta^2}$$

Therefore, we may also apply the general formula, but considering that the movements are taking place in a perpendicular plane - where the apparent angles are $\boldsymbol{\alpha}' = \pm\mathbf{90}°$ (like in the case of a light clock).

Note 4: The apparent speed of light in the world of an IFR is variable, being less or greater than **c** (but no greater than **2c**), and depends on the direction of travel:

$$c' = c/\gamma^{-}$$

Numerically, $\boldsymbol{\gamma}^{-}$ is about 1 (at low speeds, when $\boldsymbol{\beta}$ it is very small) and, if β = 0.99 for example, it varies in the range 0.5 ... 100 when $\boldsymbol{\alpha}$ varies between 180° and 0°. This value reflects in fact the new formula of time dilation.

Note 5: As the apparent speed of light can be zero in an IFR, Maxwell's equations are not longer invariant under the absolute transformations (which is normal, considering the fixed granular structure of photons and of the groups of photons in electromagnetic waves - Chapter 13 of [3] - in their comoving frame).

Note 6: If the local observer would use a bidirectional process as reference (the bidirectional light clock), the local time of its IFR will still be direction-dependent; however, that variation would be smaller.

Note 7: If the local observer would use a relativistic time reference (the TR's dilated time), its IFR would still not become uniform, now in regard to the variable speed of light he would perceive.

1.4.7. The light cone

In relativistic mechanics, an event that occurs in an IFR is described by its geometric position and by an additional coordinate on the time axis. Thus, the three-dimensional description of an **event** may be replaced by a four-dimensional one in a pseudo-Euclidian space (Minkowski space): **(x, y, x, ict)**.

The distance between two such events in spacetime may now be written:

$$\Delta s^2 = \Delta x^2 + \Delta y^2 + \Delta z^2 - c^2\Delta t^2$$

and this new space is characterized by *relativistic invariance* (it does not change under the Lorentz transformations). We may see the light cone in a three-dimensional representation (x,y,ct), as it is depicted in Figure 17. Relativistically speaking, the related events from a certain IFR are located inside this cone, as follows:

- The origin means an event that happens *now*; the events from the upper half of the cone will happen in the future, while those from the lower half occurred in the past.
- A body in uniform motion is represented by a series of events that form a straight line located inside the cone; thus, the vertical axis represents a body at rest, while a line embedded in the cone's surface (inclined at 45°, having a uniform slope) represents a light-speed motion.
- The events located inside the cone are separated from the origin by a distance $\Delta s^2 < 0$; they may be *causally related* to the origin.
- The events located on the cone's surface are separated from the origin by a distance $\Delta s^2 = 0$ (a light signal, for example).
- The events located outside the cone are separated from the origin by a distance $\Delta s^2 > 0$; they *cannot be causally related* to the origin, as nothing can travel faster than light.
- Two space-like separated events can occur simultaneously in a certain IFR, but they may no longer be simultaneous in other frames (the relativity of simultaneity).

These features of the Minkowski spacetime are also valid in an AFR named **A** (as shown in Figure 17), but not in its child IFRs for absolute observers.

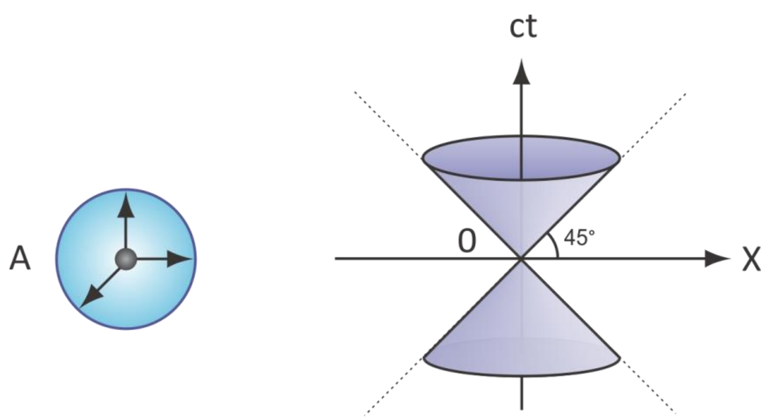

Figure 17 - *The light cone in relativistic perspective*

Let us try to describe the space-time relation in absolute terms. As we have already seen, the apparent speed of light is no longer a constant (of value **c**) in IFRs; therefore, the moving objects will have a different speed limit, and this new maximum of their apparent speed will depend on direction. Time has also a directional variation when we talk about simple movements and processes. The usual spacetime intervals are no longer seen as equal in various IFRs. Consequently, we may infer that this distance remains *invariant* only in equivalent child IFRs.

The light cone (drawn about a uniform time axis) will no longer be the same, it will be skewed in the opposite direction relative to the absolute velocity of the inertial frame denoted by **R** (Figure 18). How this aspect can be interpreted using absolute mechanics?

- First, the side surface is no longer inclined at 45°, as in AFR, because the apparent speed of light will be greater or lower than the limit **c**, depending on direction.

- The events located inside the cone are separated from the origin by a distance $\Delta s^2 < 0$; they may be *causally related* to the origin, as in the case of an AFR.
- The other things are similar to those described in relativistic terms.

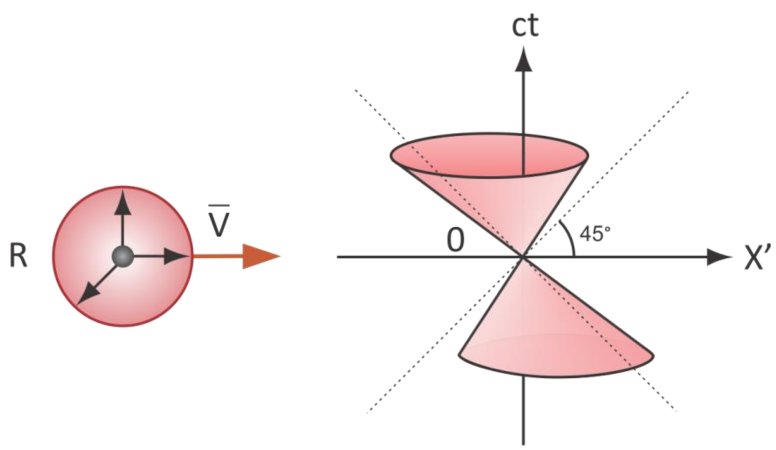

Figure 18 - *The light cone in absolute perspective*

Practically, the time has a rate of passage that cannot be directly assigned to an IFR; as it was mentioned before, its rate is correlated to the absolute speed of a material object. For this reason, we have already made the differentiation:

- Abstract, directional time, useful to describe the simple movements and processes that take place at a constant speed in IFR.
- Averaged, concrete time, which is specific to a material object being at rest in IFR.

The formalism of a unique time used throughout an IFR, valid for any process, does not correspond to reality. As we have stated in the previous chapter, an observer of local type keeps seeing the photons moving at the absolute speed **c**, and this happens due to the change of local time in a directional manner. Thus, the light cone of an IFR returns to its initial symmetrical shape when it is observed by a local observer, but its interior spacetime is no longer uniform for the subluminal processes.

1.5. Conclusion

This article tried to solve one of the most important incompatibilities or inconsistencies found in current physics: on one hand, the absolute space and its special mechanics (see [1] and [2]), and, on the other hand, the special theory of relativity. At first, the results of a few famous experiments have been reinterpreted in this new perspective and some guiding lines have been drawn to help define the absolute regions of the Universe. Then, the parent/child frames have been introduced, along with a proposal for their new spacetime formalism - based on a particular vision on the time concept. In this context, *The special theory of relativity* proved to offer good results in many circumstances, but only if the absolute frame can be identified. The artificial postulates of relativity regarding the isotropic spacetime for subluminal processes do not correspond to the reality of perception. In case we need more precision or a realistic interpretation of the observed physical phenomena, the *Theory of the absolute* must be applied instead (updated according to this article). It has to be noted that the laws of physics are the same in all inertial frames, but the non-linear and the directional change of the reference time used by the local observers modifies and distorts differently the subluminal processes running in the parent frame. Our universe proves to be anisotropic in the perspective of local observers (unlike what TR has postulated for inertial frames); the absolute speed of a system slows down its processes and changes the state of its components unevenly, altering in this way the spacetime uniformity and the laws of physics perceived by a local observer. Simply said, the relative speed of an inertial frame about another frame is not directly responsible for the state of their objects and the distorted perception of the observers; the absolute speed of each object and observer about the parent frame is the quantity that really determines those phenomena.

2. The Dark Universe

2.1. Introduction

The granular hypothesis [1] is the main premise of my new model of the universe – a complete set of principles and explanations that can help decipher the secrets of our universe while showing exactly how it evolved and expanded over time. As the Prime Theory already stated [1], the evolution of the universe and the evolution of space are identical things: space and its characteristics are entirely responsible for the emergence of matter, for all its transformations, as well as for all the interactions exerted by different fields – actually known as "the laws of physics". Inevitably, two very important questions will come up right away:

Q1. Where is space coming from?

Q2. Are the laws of physics universal, valid anywhere in space and time during the evolution of the universe?

The answers to both questions require a clearer definition of the concept of *time*. Is this physical quantity a sort of abstract quantity, unrelated to concrete matter, flowing at a constant speed and in a single direction - from the past to the future? Or is this an internal characteristic of matter, a result of its intrinsic kinetics and its specific constants, which have no meaning if seen separately? All the tests and experiments have proven so far an inextricable link between time and matter; furthermore, the rate at which time passes depends on the speed of matter (of physical bodies) and on its gravitational field (a term that is commonly used is "spacetime warping", but Prime Theory [1] had introduced the expression "uneven distribution of granular fluxes"). Things went even further in Gravity [3], where time – in all its valences and at any dimensional scale – was directly associated with the motion of matter observed from an absolute frame of reference (AFR). And we mean by matter any compact granular formation or structure that is relatively stable – from an elementary particle to the largest celestial bodies.

Answer 1. Basically, the spatial fluid causes and maintains, through its granular fluxes, the stability of any material structure, at any scale. The emergence of this granular fluid effectively coincides with the emergence of space, and several variants of the origin of space have already been introduced in [1] and [3]. This granular fluid will then pass through several stages of self-organization, while the empty space (which is presumed to have a boundary) it occupies is continuously expanded. This leads to a point where all elementary particles are created. After a cooling period, these particles combine and form new structures: the Hydrogen and Helium atoms; moreover, the atoms are immediately emitting their first photons, omnidirectionally, which subsequently decouple from the structured matter and constitute the well-known Cosmic Microwave Background Radiation (CMBR). At this moment, a set of additional laws must be issued to include those complex new structures the elementary particles (atoms and molecules) will build – **The Laws of Physics**. However, the simple laws of granular motion [1] are the fundamental rules that underlie any law of physics, at both micro and macroscopic levels. They are also the basis of the global relativism of the universe, i.e. they ensure the invariance of the laws of physics to the position in the universe, to time and uniform motion, but they also give us the general laws of conservation of energy and momentum; moreover, all these "principles of operation" must be formulated adequately, to work in any epoch of our dynamic and expanding universe!

Answer 2. In addition to the Prime Theory's [1] postulates and laws related to the granular matter, one more principle will be introduced now, the "*Universal Postulate*" (UP); it will ensure that any law applicable to the structured matter will be invariant throughout the universe:

The laws of physics are invariant to the changes in spatial density.

Clarifications:

- the postulate covers a wide range of granular densities, starting from the high level at the time of CMBR emission to today's level, at least, and assumes that all fundamental characteristics of matter and fields do vary simultaneously and linearly. This statement is based on a simple logical inference: as long as the fields and the constituents of matter have a common origin, i.e. the granular fluxes, it seems normal that all fundamental physical quantities change simultaneously and evenly when the intensity of these fluxes changes.
- if the granular density changes uniformly in a region of local absolute, the state of that region will not change. However, if the changes cause some density gradients, the laws of physics and the units of measurement must be adapted accordingly.
- the granular density is proportional to the intensity of local granular fluxes (if they are uniform and omnidirectional).
- the space regions where matter is very dense (massive celestial bodies) feature a significant unevenness of the local fluxes (commonly known as "gravity" or "curvature of space-time"); for these regions, the laws of physics must be adapted accordingly (similar to Einstein's General Relativity approach, but based on the new paradigm).
- These multiple invariances of the physical laws (to position, time, uniform motion, and granular density) complete the global relativism that characterizes our universe and helps us decipher all of its cosmic-scale secrets, being supported by today's very precise astronomical measurements.
- with all this invariance of the laws of physics, the units of measurement cannot remain unchanged in all cases! The physical quantities are keeping their known correlations (force will be mass times acceleration anywhere in the universe), but the units of measurement will practically become variables if seen from an absolute and comparative perspective. Let's take, for example, the speed of light, a physical quantity that has been declared a universal constant; its absolute value, if viewed comparatively, will differ in different places and at different times throughout the universe! Measured with the same device, its value could be $3x10^8$ m/s anywhere within our universe, but its absolute value may differ significantly (and this thing cannot be perceived directly due to the global relativism; also, the changes are relevant only between very distant cosmic zones). Similarly, two identical objects of mass 1kg, one on Earth and one on another planet, could have different absolute masses (the

paradox of generalized relativism deepens when those two masses cannot be compared directly!). Anyway, if we bring the objects together, the masses will become identical – since the matter they are made of is self-adjusting to the local spatial density. In addition, a standard mass of 1kg placed in a rocket traveling at relativistic speeds has a greater absolute mass, but any local measurement cannot detect the difference! A comparative look over some essentially relative measures and the universal laws governing the physical quantities can be taken, however, using several special techniques; for example, we may observe different galaxies and analyze the spectrum of light that comes from them.

All these premises helped me create a complete model for our universe (which will include its genesis and evolution) and formulate coherent explanations for every major event in its history; all these rational explanations and interpretations are based on a minimum set of principles and postulates, addressing many exotic notions and less coherent theories introduced by astrophysics - such as the cosmic inflation [7] and dark matter/energy.

2.2. An alternative to the Big Bang theory

The new distributed model of our universe's birth was described at length in Cap 1.6 of [3]; this model, along with some additional clarifications, presumes the existence of a finite amount of special, primordial matter (called essence) and its irreversible granularization at a given moment called *time zero* [2]. We are talking about a compressed volume of superfluid essence that is enclosed in a kind of external, indefinable environment; the essence is completely separate from this external medium - which may as well be a superfluid material. The granularization of this primordial matter could be explained in several ways, for example by the resonance phenomenon caused by mechanical waves or by a change in the pressure exerted by the external medium. Whatever the cause of these fluctuations, at least a region of perfectly empty space appeared somewhere in its volume at *time zero*; that void, regarded as a region of negative pressure, has triggered a chain reaction-type process of "vaporization" in which the essence *exposed* to the empty spaces turns into granules. The process continued until all the essence became granularized.

Given the super-fluidity of the primordial essence, all detached "drops" already have the smallest possible size or will split very quickly to that size as a result of collisions; whatever the birth process would have been, the granules have gained a maximum absolute speed in the end and the total energy of the system is conserved (potential plus kinetic). When the whole mass of essence is "vaporized" and the granular fluid filled the newly created space, the pressure exerted upon the external membrane reaches a maximum value; consequently, the spatial bubble begins to expand at a very high speed, close to the absolute limit *C*. There is something to be noted, a particularity of my model: the collisions between granules and the external membrane cause the granular reflection process and, consequently, the continuous homogenization of the spatial fluid. These things are similar to the vacuum evaporation of a liquid in a closed chamber. If we assume that the chamber walls are infinitely elastic, the next phase (so-called *cosmic inflation*) will be easily understood: we are dealing with a fixed amount of granular fluid enclosed within a finite empty space that is continuously expanding. The granular fluid is directly affected by expansion, it will undergo a continuous decrease in density (its total number of granules is constant - Fundamental granular postulate #2 [1]). This expansion (two stages) will be analyzed further in greater detail to determine how it leads to a self-structuring process within the granular fluid.

However, why is this model better than the Big Bang theory and the current version of cosmological inflation? And which contradictions does it actually eliminate?

- First, it eliminates the need for that presumed singularity, an infinitesimal point of extreme temperature and extreme concentration of energy (!).

- All these simple assumptions also allow us to develop a new theory for gravitation, in which the gravitational granular fluxes constitute the source and the propagation medium for all the other fields.

- The general relativity and quantum mechanics are now reconciled, they both describe the "working mechanism" of our universe and reveal the common denominator of the laws of physics, namely the *granular mechanics*.

- *Cosmic inflation* is removed from the mechanism that shaped the early universe (anyway, it does not explain how the huge amount of "energy" stored by singularity has evenly spread over higher and higher distances during expansion);

- The hypothetical superluminal speed of the initial expansion may be explained (the radius of the primordial space bubble could increase at any speed below C in my model) if we see these things in absolute terms, from the emergent universe's rest frame (check the granular postulates [1]).

- We have now correctly defined the concept of energy, we now know where the energy comes from and what its form was during this period. The granular motion is completely chaotic, so that the granules move in all possible directions and thus "fill" any new region of empty space in no time. The granular density was really huge at first (it all practically started from one granule next to another), but decreases quite quickly over time. Consequently, the probability of multi-granular collisions also gradually decreases, while the first *directional granular fluxes* [1] are starting to flow. At the same time, granular formations with short lifespans emerge, move chaotically, and then disappear (they were unstable). Subsequently, when the granular density reaches a certain threshold value, the directional fluxes become dominant and "push" some compact granular formations (now with longer lifespans) towards each other. As the density gradients are still high and can curve most granular fluxes, the emergence of many pseudo-stable rotating groups is imminent; this is actually the granular process that has built the first elementary particles, *the quarks.*

- A plausible hypothesis can now be formulated on how the first supermassive black holes have been formed. Let's assume the existence of a large mass of essence (in granular or compact form) somewhere in the early universe. The very intense fluxes that hit on the surface of this embryonic black hole will create the so-called "gravity"; all nearby particles will be pushed by these gravitational forces directly towards the embryo, being incorporated immediately. It is obvious that the mass of this black hole embryo will increase rapidly and, therefore, more granular material and particles will be attracted to it. In my opinion, the accretion of dense granular fluxes (which are curved in the vicinity of black hole embryos, pass their "event horizon" and then are incorporated into their body) is the main mechanism by which their mass grows so quickly in this short period – speaking, obviously, on a cosmic scale of durations (accretion will be balanced later by granular evaporation). The compact internal layers of the BH embryo rotate rapidly, even relativistically in some cases, and this creates a centrifugal force that is continuously balanced by the external granular pressure. Embryos of this kind could reach millions or even billions of solar masses, being evenly distributed throughout the granular fluid (due to the specific intensity of its fluxes); also, their translation speed is very small in regard to the AFR. Anyway, the mass of these types of BHs can be seen in the usual sense - as they all are made up of compacted granular layers. Known today as super massive black holes (SMBH), they play a particularly important role in the evolution of the universe, being in fact those stars around which the future galaxies are to be built (i.e. those cosmic bodies that can produce enough "pull" to ensure the galactic cohesion). The primordial gases are attracted by SMBH, increase in density, and start to rotate while their angular momentum is conserved; over time, the process of accretion and the collapse of these vortexes trigger the ignition – and this is the moment when the very first stars were just born. Now, as the attraction is exerted at a stellar level, the newly formed stars began their revolution around the central BH on orbits where the pull balances out the centrifugal forces. This is the simplified mechanism that shows how a protogalaxy is built, and now it's very easy to observe the decisive role of the central SMBH in powering the whole process.

- As a result of the self-uniformization property of granular fluids, *space* cannot have any curvature, it is flat and does keep itself this way – although we presumed it has an outer boundary of spherical shape. Moreover, we may say that any point is continuously crossed by omnidirectional fluxes of equal intensity, and this makes space *homogeneous* and *isotropic*. The initial unevenness of its density (due to the combination of some initial waves) has led, most likely during this stage, to the emergence of SMBH in those particular, almost equally spaced places. These BHs are stationary stars, no additional forces are exerted on them while space expands and their initial linear momentum, if any, will remain almost unchanged. However, the reciprocal gravitational pull of SMBHs can change their speed over time and cause the formation of certain local groups, clusters, or filaments.

The duration of this initial stage (considered to last until the CMBR was emitted) is estimated by the standard cosmological model of current physics at about 400,000 years; however, given the linear expansion of space presumed in my model, this duration could be significantly longer.

Whatever the actual duration of Stage I would be (see the upper part of Figure 19), its timeline includes these important moments:

- First fluctuations within the primordial mass of essence and the distributed big bang.

- The density of the spatial fluid is decreasing as the volume it occupies increases.

- With this decrease in density, the simultaneous collisions between several granules or granular groups have gradually turned into individual collisions that preserve the linear motion; at this time, the rectilinear fluxes gradually became dominant and thus generated the most important phenomenon in the universe – the *Gravity*.

- Formation of elementary particles and the particle/antiparticle annihilations.
- The possible birth of SMBH embryos right at the end of this stage, when the granular density was still high and many compact structures could easily stick to them.

- The gradual cooling of this medium allowed the free particles to slow down and form the H/He atoms.

- The decoupling of photons from matter and the CMBR emission.

There were a few moments, such as the birth of elementary particles, the birth of black hole embryos, and the particle/antiparticle annihilation (i.e. compact and stable granular structures with mass) when the average granular density of space varied significantly. However, these changes are not visible in the representation of spatial density (the shades of gray from Figure 19). It should also be mentioned that the global entropy, if space is seen as an isolated system, practically decreases at these particular moments (the order has increased, space became more organized). The reason for this paradox (which is only present in the special system named the "early universe") could be found in the strange behavior of the granular fluid: at certain granular densities, individual granules act differently from their groups, and this depends on the size of the group.

Also, we could infer that the homogeneity of the granular fluid, which is preserved during expansion through dispersion, has led to the uniform distribution of elementary particles and, subsequently, of gaseous matter (H and He).

The speed at which space can expand is, obviously, lower than the absolute granular speed, $v \leq C$; although this speed might depend on the granular density (similarly to the pressure of a gas, which depends on density), we will further use the constant value C for this speed, $v = C$.

But why does the granular density of space continue to decrease, as all the fluxes became directional and their structure is assumed to be *fixed*? The explanation – valid for any region of *free* absolute space - is based on two direct implications of expansion:

- As the potential distance traveled by fluxes from one edge of the space bubble to another is continuously increasing, the average time after which they are reflected back and might cross again the considered region increases proportionally to the expansion speed.
- The average distance between all the granules of any flux increases after reflection, also proportionally to the expansion speed. Therefore, a weaker reflected flux that crosses the considered region will lower the local density of space.

2.3. Global and local evolution

Once the primordial "soup" has cooled sufficiently at the end of the first stage, the remained elementary particles (those electrons and protons not annihilated by their antiparticles) were able to form the first hydrogen atoms and thus photons were no longer scattered (H and He are transparent gases). Therefore, the radiation emitted virtually from every point of the early universe (which had a temperature of about 3000K), could propagate in a straight line in all directions. This cosmic radiation is known by the acronym CMBR and its well-defined spectrum (whose point of maximum is in the microwave range and whose uniformity is very high, 1:100000) has a redshift z [8] of about 1100. Since this radiation has the same intensity in every direction, the frame in which its isotropy is the highest can be used as AFR within the local region of absolute, and, after certain corrections, for the entire universe.

Stage II of the global evolution begins just after the CMBR emission; the expansion of space continues, but the newly created structures of matter (from tiny particles up to the stars) are not engaged in this process, as there are no forces exerted on them. The so-called inflation only affects the granular level of space and does not generate any force fields. Present in every place, the expansion process represents only a continuous "dilution" of the granular fluid – as it occupies a space that is continuously increasing in volume – and this may be quantified by the density's scalar field. The "working mechanism" of matter does not change over time (see Chapter 2.1 above), only the ratio of the local absolute "constants" to some reference values is changing – and this may affect the units of measurement. Consequently, the physical quantities may have significantly different measures, but the correlations between them will be the same; anyway, there are real changes, the matter is really changing, but we cannot perceive this locally as the global relativism of the universe prevails. To simplify things, we may declare the current units of the International System as absolute and use them as references in any comparative analyses. All components of our universe are connected and they evolve together; however, there is a certain *locality* manifested within and around each massive component, and this changes the absolute physical properties of its material structures.

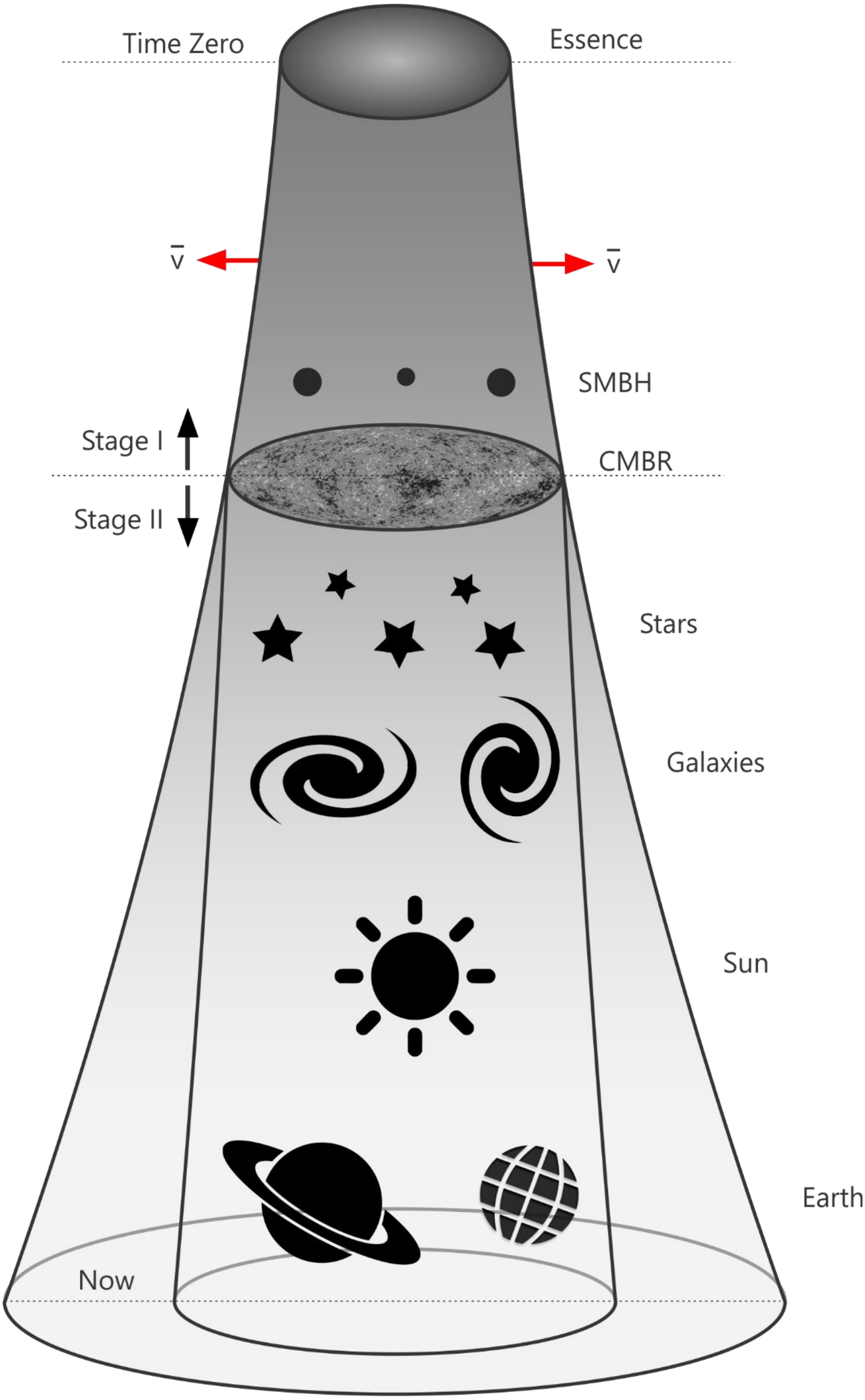
Time Zero
Essence
v̄
v̄
SMBH
Stage I
CMBR
Stage II
Stars
Galaxies
Sun
Earth
Now

Figure 19

2.4. The redshift

Let's consider a hypothetical three-dimensional grid that overlaps the rest frame of our universe (AFR), having the step of one meter on all axes. We also assume that the universe does not rotate and its intrinsic absolute may be perfectly observable from this fixed grid. The Meter is the current unit of measurement for lengths, i.e. the distance traveled by light in a vacuum in 1/299792458 of a second. From now on, the current units of space, time, and speed will have an absolute nature and will be used to compare and explain some of the latest astronomical measurements (light and other radiations coming from distant cosmic objects). Due to the finite speed of photons and particles, we actually immerse ourselves into the past of the universe and observe some cosmic events that have already happened. Anyway, we must add to our analysis the two important assumptions described above, the invariance of the laws of physics over time (UP) and the continuous expansion of space. All of these will be applied on a balloon-like universe whose outer membrane continuously stretches at the speed v, $v \le C$; for simplicity, the radius of this sphere increases *linearly* with that speed v. The volume of space will thus increase with the cube of the radius, while the density of its granular component decreases in the same proportion (uniformly, any inner point being reached at the local speed of light). These density variations do not change the laws of physics (see the UP), but the speed of light will be changed in absolute terms. The formula for this speed is known from [1]:

$$v = C / (1 + \rho \tau C)$$

C - absolute granular speed, a constant

v - current speed of photons

ρ - linear granular density, includes the collision probability

τ - average duration of a granular collision

What happens to the universe's organized matter, i.e. to the ordinary stars, SMBHs, and galaxies that were formed after CMBR? Does the spatial granular fluid have a gradient of density caused by the geometric expansion of space, i.e. a lower value of density in its peripheral regions? My answer is affirmative, there is a small gradient, but it may be ignored if we consider the huge scale of the universe. As this gradient cannot produce significant forces onto the cosmic formations, we will further consider that space is a homogenous and isotropic medium. Unless we take into account their low linear speed and their eventual rotation in the local clusters, galaxies can be regarded as **stationary** in their filaments and thus in our fixed grid (AFR). Basically, the standard model sees the expansion as a continuous *increase* of the intergalactic distances over time, this being resulted from a quantitative analysis of the redshift of light coming from distant galaxies. Some recent observations have indeed shown that the recessional speed v is proportional ($v = H_0 D$) to the proper distance D (distance to that galaxy at the time of emission multiplied by a number, 1+z) by factor $\mathbf{H_0}$ (the Hubble constant, estimated to be 67.4 ± 0.5 km/s/Mpc).

But what does this expansion actually mean, this recession of galaxies from us and implicitly one from another? Does the above mathematical formula imply any real movements or we are dealing only with apparent displacements? And how can we accept that space itself is "stretching", as long as the special "material" it is made of is not defined by the "standard model" of current cosmology? Moreover, does this kind of space expansion manifest selectively, only outside galaxies, or does it happen everywhere?

To answer these questions, let's now consider two galaxies very far apart, denoted A and B (and by B we understand Milky Way and an observer from Earth). The photons emitted from A one billion years after CMBR have crossed the intergalactic space for about 13 billion years and just arrived on Earth, where they are found to be significantly redshifted. How can we explain this in a granular context, using the photon model described in Chapter 13, [3]? How did the space between those stationary galaxies actually increase over time?

Additional assumptions for my new analysis:

1. The total number of granules in the universe is *constant* (stated by Fundamental granular postulate #2, [1])
2. The granular structure of photons is *fixed*; however, it may be changed in regions of very high-density gradients or after some collisions with the matter.
3. Considering the global relativism and the UP conditions, we may infer that any variation of spatial density will not change the laws of physics at the local level. As the most "visible" thing that differs throughout space is the speed of light, we may also assume that other related physical quantities will differ in the same proportion.
4. If we admit this last idea and presume in addition that the local distances are absolute, we can draw an interesting conclusion: the local time flows at a rate that is proportional to the speed at which light travels in that spatial region (a measurement made with the light clock would confirm this conclusion, see the Chapter 8.6 [3]).
5. The Doppler effect caused by the motion of either the light source or the observer will be ignored in the case of these photons, as will the shift caused by the gravitational fields to their spectrum.

During its long journey to Earth, a photon emitted from galaxy A (of frequency $f_A = v_A / \lambda_A$) passes through increasingly older regions of the universe and crosses a more and more diluted space (see Figure 20). The speed of this photon is the only parameter that changes in the process; any spatial density gradient would exist along the path, its effect would be negligible over short, wavelength-size distances and could not cause any significant redshift. Similarly, photons are not redshifted if scattered by particles and transparent cosmic gases. A photon that collides with a cosmic Hydrogen atom, for example, would have the same structure (same λ_A) but a higher local speed, v_H; therefore, the apparent frequency "read" by the atom would also be higher. As assumed above (#4), we may say that the local time flows as fast as the light does, so the Hydrogen atom will read exactly the initial frequency, f_A. The wavelength λ_H of a re-emitted photon will be identical with λ_A, and this phenomenon repeats on any further photon - atom/particle interaction. Therefore, the photon received in galaxy B has the same structure as the photon emitted from galaxy A (same wavelength $\lambda_A = \lambda_H = \lambda_B$), but at a higher speed ($v_A < v_H < v_B$). This normally means a higher frequency ($f_B = v_B / \lambda_A$), but we should consider the source's local time: as it has flown slower in the same proportion, the received frequency will be *equal* in fact to the B's *local* frequency ($f_B = f_{A0}$). Basically, the light that arrived on Earth has the same absolute spectrum as the light emitted from galaxy A, and this means that the photons were already redshifted at the source.

We may calculate the redshift *z* using the following formula:

$$1 + z = f_{real} / f_{received} = f_{real} / f_B$$

in which f_{real} is the actual frequency of light emitted by a nearby galaxy (z = 0, we could check the well-known spectral line of a chemical element, the red line of Hydrogen for example).

Conclusions on the new analysis of redshifted photons:

1. With all their speed difference, photons have the same relative frequency in both galaxies. The redshift of photons coming from distant galaxies is therefore only a reflection of the respective galaxy's specific physical quantities at the time of emission. In fact, the value of this redshift quantifies the difference between our today's universe and a frozen image from its past.
2. As we already assumed above, galaxies are quasi-stationary objects in our absolute grid (which overlaps the CMBR's rest frame); they are not moving away from us, the distance between them does not increase. Over time, with the decrease of spatial density, the speed of light increases, and, consequently, the related physical quantities will also change. As the rate of local time is affected, the *frequencies* of photons emitted by the chemical elements (also by the universe's black body, CMBR) became relative to the local space, as well as their energies.
3. The redshift of light does no longer provide information about the *recessional velocity* of galaxies (or about the so-called expansion of space that would produce a similar Doppler effect). Now, in case we know the rate at which the density of space is linearly decreasing, we may deduce from *z* the exact age of the galaxy A at the time of emission. Obviously, things are more complex and the redshift depends on several variables (the size of galaxy A - which determines its average granular density – or its speed /direction of travel in regard to the CMBR's rest frame). However, the distance to a galaxy can still be calculated from the brightness of light emitted by some of their stars (Type 1a supernovae may be considered cosmic candles) - but this will also depend on the model used to determine the variable speed of light.
4. The universe is expanding, but only in a geometric manner; the volume of space grows bigger and bigger while its granular density decreases evenly. As most galaxies move at very low speeds, we could characterize their part of the universe as *static*. The linear density is a

function of time and can be written as follows (the space bubble is linearly increasing in diameter with the maximum speed 2C in my simple model):

$$\rho(t) = N / (D_0 + 2Ct)$$

D_0 – the diameter of the spatial sphere at CMBR time (t = 0)

N – the virtual number of granules on one axis

C – the absolute granular speed

The distance traveled by photons from galaxy A to B can be expressed as follows (we cannot talk about proper distances now when space is no longer expanding effectively):

$$S = \int_{t1}^{t2} \frac{C\,dt}{1 + \frac{N\tau C}{D_0 + 2Ct}}$$

If K = N C (K is a length-type constant), $D_1 = D_0 + 2Ct_1$ and respectively $D_2 = D_0 + 2Ct_2$ (the diameters of the spatial sphere at two different moments), the integration by parts gives us this solution:

$$S = \frac{1}{2}\,(D_2 - D_1 - k \ln\frac{D_2 + k}{D_1 + k})$$

Remark 1. If space would expand slower, with the new speed *v*, *v* < *C*, the absolute speed *C* must be replaced with *v* only in the formulas for the two diameters, D_1 and D_2.

Remark 2. If we consider t_1 as being the time when CMB was emitted ($t_1 = 0$), the distance traveled by radiation as a function of time can be written:

$$S_{CMBR} = \frac{1}{2}\,(2Ct_2 - k \ln\frac{D_0 + 2Ct_2 + k}{D_0 + k})$$

5. A new standard model should no longer include the gravitational "pull" exerted by matter and the so-called dynamic balance maintained by the current inflationary model's dark things. Space's change in granularity and its increasing volume are the only fundamental phenomena to be considered, and they are now almost independent of the "turbulence" of structured matter; however, the granular density of space and the absolute mass of matter will always

depend on each other and thus the laws of physics will be continuously "adjusted" by the local space (this is the global relativism of our universe). Practically, galaxies do not move away from each other but slowly rotate and translate with hundreds of km/s inside the "sphere" where they were born (projection of that sphere on the time axis is a cylinder, check Figure 19). For instance, our Milky Way galaxy is moving at about 630km/s relative to the cosmic background, while the speed of Andromeda with respect to us is about - 125km/s (both galaxies are approaching one another).

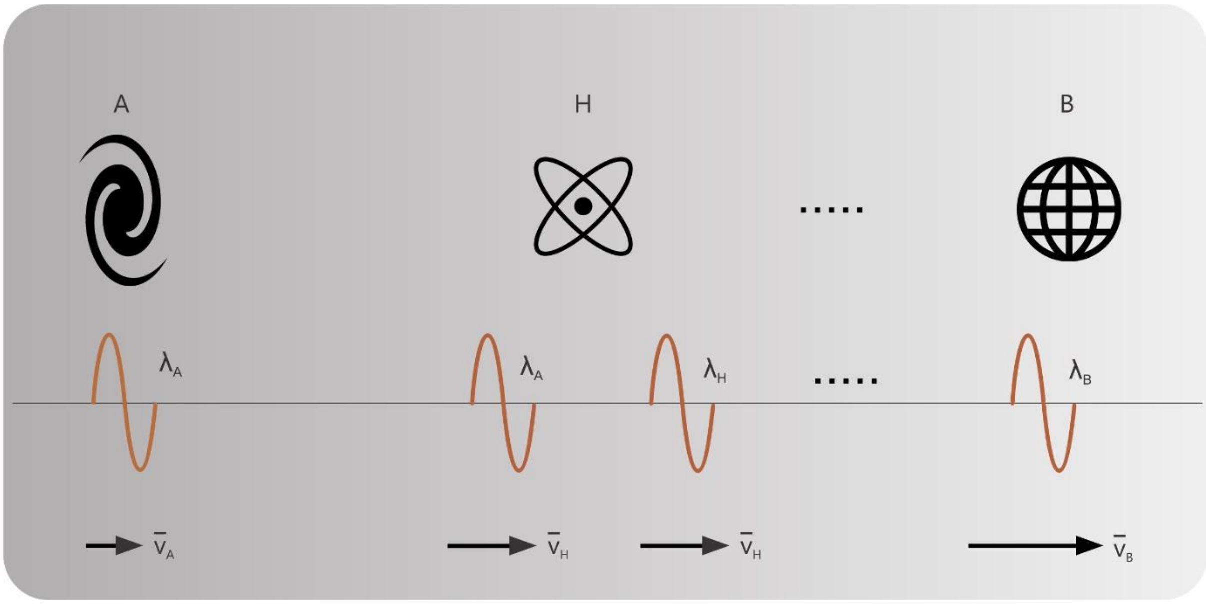

Figure 20

6. The equation involving the Hubble constant has no longer any meaning, it could be replaced by a simple correlation between the age of the galaxy (or the speed of light) and *z*. Analyzing the redshift *z* for several distant galaxies and considering the ages given by the standard cosmological model, we see a relation of proportionality between speed and time, starting 13 billion years ago, from about 38,000 km/s to 300,000 km/s today. A steeper, non-linear increase occurred in the beginning, during the first 800 million years after the CMBR event (when the value of *z* decreases from 1089 to 7).
7. One might say that we used the absoluteness of local distances to demonstrate the global absolute, using a kind of circular logic within the previously assumed relativism of the entire universe. However, since the speed of light and time are related quantities – as the variable granular structure of space limits both the speed of light and the speed of matter (which sets the rate of time) – this choice becomes perfectly reasonable. Of course, it is somewhat paradoxical how space, a fluid that dilutes itself as time passes and whose variable density affects matter, maintains the distance between all cosmic structures and also keeps their sizes at a virtually constant geometric scale.

This model improves the previous interpretation of the redshift (10.2.2, [3]).

2.5. Dark Things

2.5.1. Photons and space

All photons have a fixed shape and travel through space at the local speed of light [1]. In other words, a photon is a particular granular flux that holds its shape and direction of propagation unchanged when crosses a homogenous spatial region. There are, however, regions of space where some parameters of photons (or of any flux) might change:

1. A region with a dominant perpendicular flux (on the tangent to the star's surface)
2. A region that has a certain gradient of granular density (approaching a massive cosmic body, such as a star)
3. A region where the gradient of density forms a certain angle with the path

Case 1: A photon passes through a perpendicular gravitational flux, as shown in Figure 21. If there would be a region of uniform fluxes, the collisions between the photon's constituent granules and those of the homogenous spatial fluid will have no impact on its trajectory. A dominant flux, however, causes a greater number of collisions in a given direction, which in our case would mean a non-zero displacement of the photon trajectory, Δx. This displacement is proportional to the intensity of the flux Φ, the granular speed C, and the collision time τ (TGR would name this the curvature of space-time caused by gravitation):

$$\Delta x = k_2\ \Phi\ \tau\ C \sin \alpha$$

Note 1: Whatever would be the direction of the dominant flux (which can be viewed as a resultant of all local fluxes), the spatial orientation of the photon does not change. The displacement only alters its trajectory (curves it towards the source of gravity) and its speed (a little); furthermore, if this photon exits the gravitational field, i.e. the region of dominant flux, it will resume its initial direction of travel.

Depending on the angle α, that displacement is:

$$\alpha = \pm 90°:\ \ \Delta x = \text{maximum}$$

$$\alpha = 0° \text{ or } 180°:\ \ \Delta x = 0$$

Note 2: Near the event horizon of a black hole, in a region of very intense gravity, photons can be "dragged" inward faster than they can move outward. Depending on position and direction, photons may be absorbed by the BH or they may continue the journey on a different trajectory.

Case 2: If photons cross a region with an extremely high gradient of granular density (a BH of small dimensions), an additional change in their wavelength can be caused by the different speeds of their component granules along the direction of travel.

Case 3: In this case, a change in the granular density of space modifies the speed of light in that region, which automatically leads to a change of all local physical quantities. As photons travel at a lower speed in the denser medium, their trajectory will change; this is perfectly similar to the *refraction of light,* a phenomenon that occurs when light enters a material with a non-unitary refractive index.

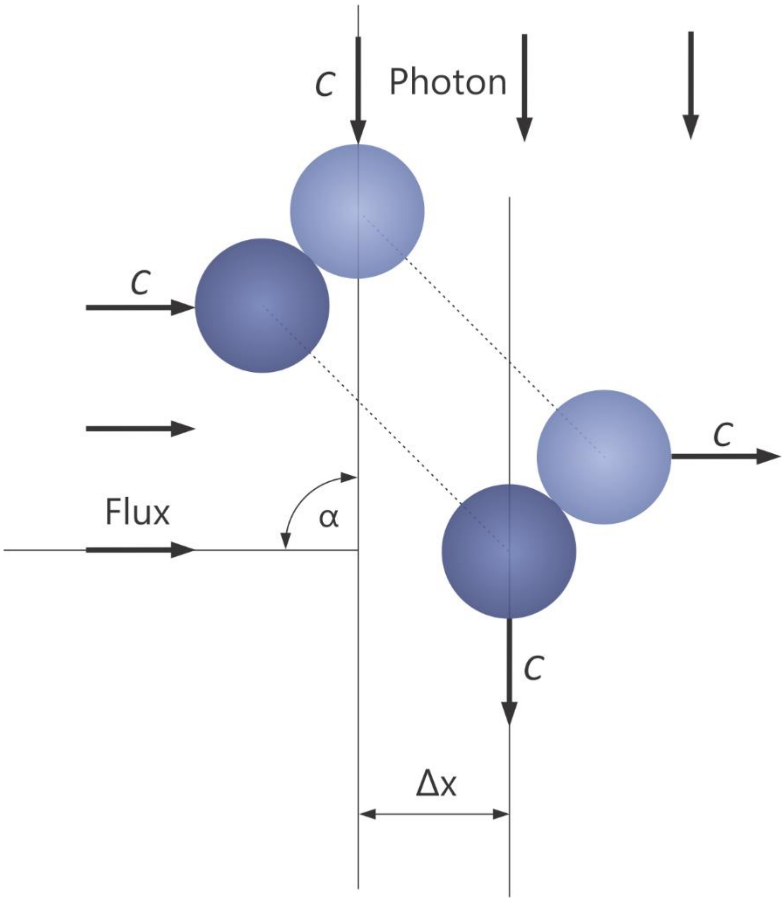

Figure 21

2.5.2. Dark matter

One important problem of modern cosmology is the motion of stars in the peripheral regions of most galaxies, specifically their rotational speeds. Scientists should offer better explanations for their higher speeds and tell us the reason why those stars were not ejected into space. Basically, a greater gravitational force appears to be exerted in that regions than in the rest of a galaxy. Many attempts have been made to develop theories and models – such as a modified Newtonian dynamics (MOND) on large distances or a new type of matter that interacts only gravitationally (Dark Matter) – but the mystery has not yet been unraveled. This latter theory was more successful due to an observational confirmation: the presence of so-called dark matter was indirectly confirmed by the light-bending effect in the galactic zones. However, the detection of a "cold" particle (so is not the neutrinos) that would constitute this matter does not yet have an experimental confirmation.

But how can we explain "dark matter" in the new context of granular mechanics, knowing that the Universal Postulate from Chapter 2.1 also applies inside galaxies? Moreover, any explanation would be given now, it must also apply to the rotation of the large clusters of galaxies (which have the same speed "problem").

To formulate the answer to this question, another observation must be made: regardless of its concrete structure, the matter is in a permanent state of equilibrium with the spatial fluid in which it "floats". Thus, the granular pressure dictates, among other things, the size and mass of all particles, the intensity of all fields, and even the speed of photons. As space is continuously expanding and its density decreases over time, we may say that the net result of granular transfers is now in favor of space, there is a permanent granular migration *from matter to space.* In other words, any cosmic formation (galaxies included) is "emitting" a weak granular flux around – a flux that causes a small increase in density to the adjacent space. Any galaxy will therefore develop a granular "halo" which is slightly denser than the free space. Let's see how dense is this halo and whether its properties are identical to those of dark matter.

As a continuation of the simple logical inference that led to the idea of granular transfers, let's examine now the influence of gravitational fields onto this special region that seems to surround matter anywhere in our universe. In a classical approach, at a certain point located inside or in the vicinity of a spiral galaxy, the gravitational field is a resultant of the fields generated by every star, by the central SMBH, and by the cosmic dust and gases (notice their big delays over the intragalactic distances – from a few light-years up to hundreds of thousands of years). At a lower dimensional level, the fluctuations of these fields create regions of local absolute – overlapped or separated – that surround all cosmic entities and form a "galactic absolute". However, at the lowest level of all - the granular one – we may observe how most of the local fluxes are reflected and scattered *repeatedly* by stars and interstellar gases, being permanently replaced by the external ones. This repetitive process, in which the local fluxes swing back and forth for a while (before they go back into the cosmic void), causes an increase of local granular density and leads to a certain state of *balance*. Therefore, the higher density of local space will significantly slow down the new fluxes that enter the galaxy. This region of higher density actually overlaps that halo described above – which may now be identified with the dark matter – and will permanently surround any type of matter included in a galactic structure (Figure 22). As it was postulated in Chapter 1 (UP), this halo does not change the local laws of physics - only the absolute measures of most physical quantities will differ; anyway, this particular statement can only be proven by comparative methods.

Is this concrete halo helping us explain the various astronomical observations that led to the abstract concept of dark matter?

Explanation 1. The higher density of a halo, which also means increased gravity, bends the trajectory of photons in two ways: if the density changes - by refraction (as in Case 3 described in Chapter 2.4.1), and if the gravitational field is strong - classically (as in Case 1). Thus, by using these galactic-sized telescopes – whose lenses are made of dark matter – we can observe the stars and the cosmic formations hidden far behind galaxies (see Figure 22).

Explanation 2. A spiral galaxy, such as the one depicted in Figure 22, is surrounded by dark matter. It is natural to assume that this halo would be denser in regions with massive stars and denser gases.

Consequently, a density gradient will appear within this granular matter, from the galactic center (high density, dark gray) to all peripheral zones (light gray), along the spiral arms. Over short distances, such as a few light minutes, the difference is negligible; over long distances (light-years), however, the difference becomes significant and can produce visible effects. The formulas of universal attraction and for centrifugal forces, applied to the rotation of peripheral stars about the galactic center, must be somehow changed. As we have shown above (UP), the changes do not modify these two laws, only the measures of some physical quantities will be involved (as their absolute values are depending on the local granular density).

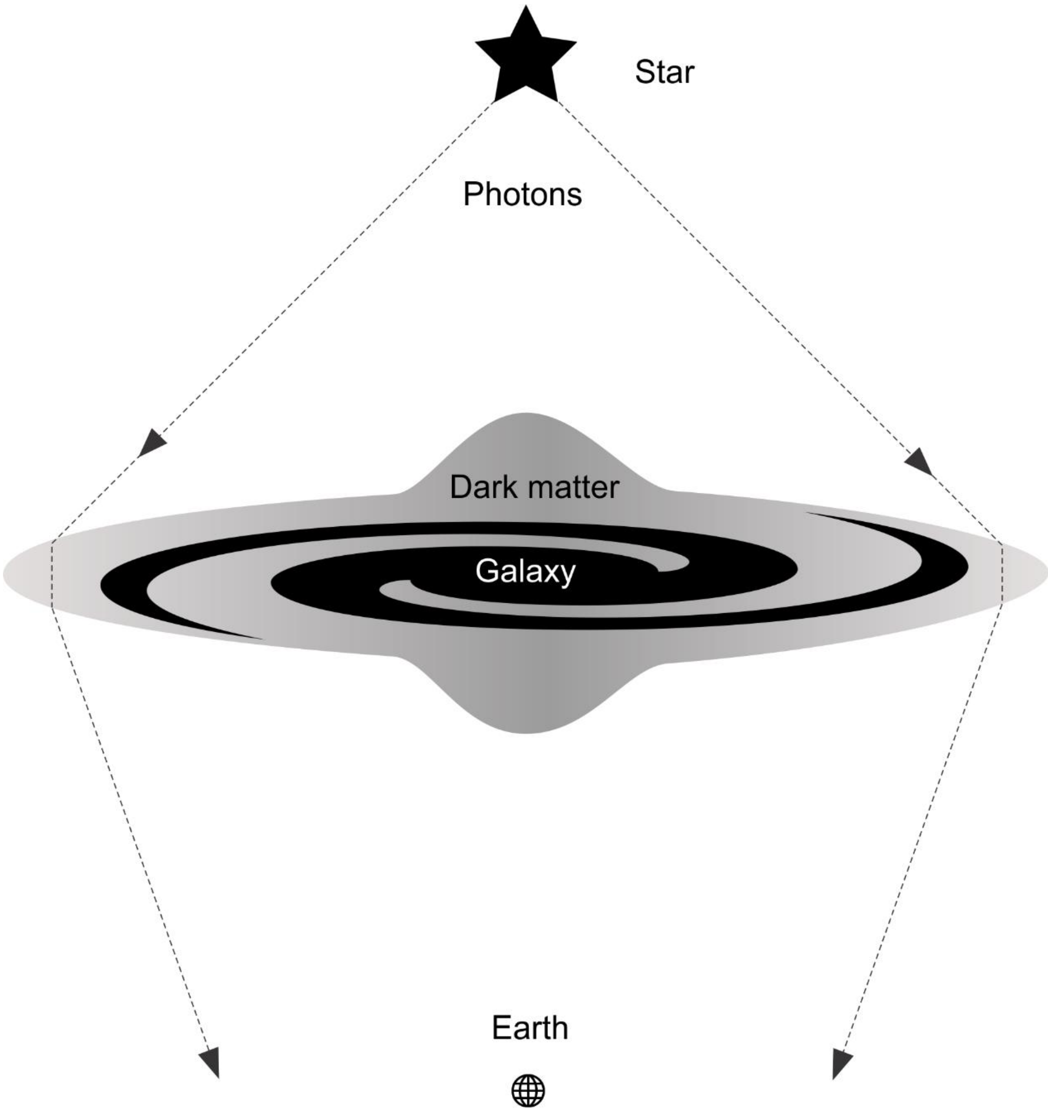

Figure 22

Let be a star (of mass m_0) that rotates at distance *r* about the galactic center (of a hypothetical mass m), in a homogenous region of space. Its rotational speed may be calculated if we equate the force of attraction and the centrifugal one:

$$G\, m_0\, m/r^2 = m_0\, v^2/r$$

$$v = \sqrt{\frac{G\,m}{r}}$$

However, the denser dark matter from the galactic center causes a stronger gravitational field; the actual mass that would produce that field is proportionally bigger, namely M. Therefore, the actual speed of the star will also be higher (v from the following formula):

$$\frac{v_r}{v} = \sqrt{\frac{M}{m}}$$

This ratio is, in turn, proportional to the density ratio between the two galactic regions and shows us that the rotational speed of peripheral stars is inversely proportional to the local density. This dependency is actually more complicated, being affected by many factors: the dispersion and size of the stars, the location of gases and cosmic dust, the retarded gravity, etc. The linearity and magnitude of velocities in a galaxy are thus justified by the changes of physical quantities in the presence of dark matter – whose density ultimately depends on the *distribution of galactic mass*. This phenomenon can have another, strange interpretation, namely that the laws of physics are changing over long distances! And here comes the "success" of some theories and models like MOND [4], which presume the modification of Newtonian mechanics in these particular situations and even give us some applicable mathematical formulas; however, they do not actually take the physical reality into account and the real phenomena hidden behind formulas are not explained.

Explanation 3. The regions dominated by dark matter extend to star clusters and filaments, which are similarly "connected" through this special type of "matter". The rapid rotation of some clusters may be simply justified by the existence of a greater gravitational pull in the presence of dark matter. We may say that matter is organizing itself on a larger scale (cosmic one), creating a dynamic balance in which the groups of galaxies maintain their distancing and tend to remain together in the larger cosmic structures where they belong.

2.5.3. Dark energy

If we consider its expansionist characteristic, the dark energy can be easily identified as space itself – a special granular fluid that had created all the matter and maintained it stable through the action of gravitational fluxes. Since these fluxes are omnidirectional and evenly distributed, our expanding universe must have boundaries (fluxes do return from the edges) and no internal curvature, while its number of granules must be constant (Law 1 of [1]). Moreover, as stated in Chapter 2, its expansion no longer involves the matter and formations that emerged after the CMBR event; in fact, space does not expand at all, it merely "dilutes" – i.e. its granular density decreases while its geometric volume grows (similarly to a balloon made of an elastic material and filled with gas - it will dilate and the internal pressure will decrease). We concluded that the material part is quasi-stationary now and the expansion process affects only the local metric, keeping the laws of physics unchanged. The parallel made between the inflationary model and that raisin cake is no longer valid; in my model, the heated dough still grows - but the raisins are no longer moving along with it, they remain practically in their initial positions.

The redshift of light coming from distant galaxies can now give us an insight into their age, while a model for the density of space (or for the speed of light) would help us find how far they are. The radius of the observable universe would then depend on how big the universe was in the beginning (when the CMBR event occurred) and on how the speed of light has increased. Paradoxically, this quasi-stationary model would allow us to look even deeper into the universe with time – and not the other way around, as in the standard cosmological model.

A few additional ideas:

1. Space is not infinite and yet it is flat. Regardless of its "outer" shape, we cannot assign it a "center" – its perfect homogeneity and our limited observation (due to the speed of light) prevent us from doing so.
2. If space will continue to expand, its granular component will dilute and the intensity of gravitational fluxes may reach a minimum value from which they can no longer hold the cosmic formations and matter stable. Universe, as we know it, will disappear "in silence". About a possible subsequent contraction of space and a new big bang, we cannot speculate at this time.
3. The dark energy dilutes itself, as seen above, and the intensity of granular fluxes decreases globally. This is the real, causal link that exists between dark energy and gravity, and not a hypothetical balance between two different, independent force fields.
4. A cosmic balance is still maintained, and, even if the dark energy does not "oppose" directly to gravity, we cannot say whether the gravity "will win" or not in our universe. This dynamic balance, which is actually between gravity and inertia (as their intensity decreases proportionally), had existed since the first material structures have formed. Moreover, as the mass distribution causes gradients in the surrounding dark matter, this process became stable and the intergalactic coupling is continuously preserved.
5. Photons, neutrinos, and the granular accretion of BH were not considered among the factors that could significantly affect the granular density of space.

2.6. Conclusion

An interesting link between the smallest particles and the largest structures existing in our universe has been identified here. We also saw how granular mechanics transfers its rules to higher dimensional levels, establishes the laws of physics, and how it allows matter to self-organize and create increasingly larger cosmic formations. In addition, more light has been shed on those "dark" things and on how space ensures the stability of all structured matter. Even if space goes through a continuous process of dilution, the cosmic formations are almost motionless and show us a quasi-stationary universe that possesses an internal balance ever since it was born. The speed of light, whose finite value increases as the universe ages, offers us a unique view into the distant past and allows us to witness the creative struggle of matter from the beginning of time.

3. Continuous or Discrete?

Is it necessary for a physical characteristic that is specific to the intrinsic nature of things, such as *continuity*, to be explicitly shown by its associated physical quantity? In other words, could we really say that a certain physical quantity is continuous or discrete? Or have we already assumed that and any unit of measure would be used, the numeric representation of a quantity is always limited and discrete, ignoring in this way the objective reality?

The presumption of a granular consistency for space, which is present in all my previous books and articles, has led me to a complete theory about the birth and evolution of our universe. All of the physical interactions, at any scale, are now explained by the simple rules of granular mechanics, while all the known laws of conservation have now real roots and became causally justified. But how can we characterize the true nature of the fundamental and derived physical quantities, whose measures quantify the interactions and give sense to the laws of physics, are they continuous or discrete? How can we define the border between the two possible assessments? And this border, if exists, is real or it is just a consequence of the observational and measurement limitations?

For example, let's take *time*: is it a continuous quantity or it must be quantized?

Current vision:

Time is a measurable physical quantity, and the *second* is its unit of measurement. Seen at first as a fraction of a day, the definition of the second has been improved later, being now the period in which a fixed number of oscillations produced by the cesium-133 atom takes place. There are a lot of multiples and submultiples for this accurate unit of measurement - from 10^{-24}s (ys – yoctosecond) to 10^{24}s (Ys – yottasecond). But how far can we go with these time intervals? As a mental exercise, would 10^{-100}s make any sense, would it represent something? Intuitively, we should check at the quantum scale and see if, even at the speed of light, we can detect any motion. As this is practically impossible, a quantization at that small level could only be useful in some theoretical models. However, taking into account the dimensional scale of the elementary particles, we can set the minimum duration of time for an observable phenomenon. And does this minimum duration mean the maximum level of quantization possible for a seemingly continuous quantity? Or, at least theoretically, we should go even further, into the subquantum world?

Granular vision:

As a quantity that derives from motion, time must inherit this attribute from the source – i.e. from the motion of objects and particles. Thus, going down to the quantum scale, we could wonder if the motion of a particle is truly continuous, regardless of what the postulates of the Prime Theory [1] have stated. Considering the granular consistency of any particle and the constancy of the granular impulse, this is the only possible answer: the motion is continuous, all the intermediate positions on the respective trajectory are occupied.

What can we say about *space*, if it's seen as a geometric frame, as a scene? Is it a continuous and isotropic medium that does not interact with normal matter? The answer, this time, is not easy. If space is seen as a void, as a passive 3-dimensional frame in which matter can move freely, the answer is yes, space is a continuous medium. But this frame does not exist separately from the granular matter. Therefore, its uniformity and continuity are rather imposed by the granular component. Even if we are talking about a continuous frame, the granularity and all the other properties of the material component will affect all interactions between organized structures. The motion of any particle is continuous and free, but the intensity of its interactions is depending on the elementary impulse and energy [1]. Consequently, the physical quantities related to motion can be continuous, but those related to interactions are discrete up to the elementary quantities mentioned above, at least. As the order of magnitude involved is very small, this discretization is practically virtual and cannot be used in normal impulse and energy calculations.

Moreover, we must take into account the quantum uncertainty for all measurements (considering the Copenhagen interpretation of quantum mechanics). In addition to the observational uncertainty (Observer effect) – as a result of the interaction between the measuring device and a particular system, all quantum objects have an intrinsic uncertainty - as some pair of quantities cannot be quantified with high accuracy. For example, if the position of a particle could be determined with certain precision, its momentum cannot be measured with the same accuracy (Heisenberg's uncertainty principle). The granular consistency imposes to all particles, as Prime Theory [1] already described, a wavy behavior; therefore, some of the motion's pairs of attributes (energy/time, position/momentum) cannot be measured with the same precision (this also applies to quantum systems in general).

What if we, as special observers, would not interfere with the observed systems? In this case, the measurement of any physical quantity could be extremely accurate and, as there are no interactions, the wave functions would not collapse. In fact, the probability given by the wave function has no meaning now, we can determine all the states and variables of a quantum system. Our observations on the quantum realm would therefore help evaluate the continuity of any state parameter.

Quantum mechanics gives us certain limits (the Planck units) for some physical quantities (time, distance, etc.), setting a scale (the Planck scale) beyond which the current models of physics may no longer apply. Are these values representing a level that must be reached by discretization or the current theories of physics are not so coherent?

Table 7 contains all the physical constants used for the Planck units:

Constant	Symbol	Value
Speed of light in a vacuum	c	2.99792458×10^{8} m·s^{-1}
Gravitational constant	G	6.67430×10^{-11} m^{3}·kg^{-1}·s^{-2}
Reduced Planck constant	$\hbar = h/2\pi$	$1.054571817 \times 10^{-34}$ J·s
Coulomb constant	$k_e = 1/4\pi\varepsilon_0$	$8.9875517923 \times 10^{9}$ kg·m^{3}·s^{-4}·A^{-2}
Boltzmann constant	k_B	1.380649×10^{-23} J·K^{-1}

Table 7

Name	Value
Planck length	1.616255×10^{-35} m
Planck mass	2.176435×10^{-8} kg
Planck time	5.391247×10^{-44} s
Planck charge	1.875545956 X 10^{-18} C
Planck temperature	1.416785×10^{32} K

Table 8

Table 8 shows the base Planck units; they resulted from a simple system of equations in which the physical constants are having the dimensionless value 1. In addition to the well-known uncertainty of some constants like G and ε_0, there are other physical constants whose values remain to be analyzed. For example, the speed of light in a vacuum c - which, if seen beyond the inner relativism of our universe, cannot be considered a constant.

Moreover, this obvious inconsistency of the current theories of physics shall be added to their incompleteness. They do not take into consideration the granularity of space, nor its variable density (which is somehow compensated by the inner relativism of our universe, but which must be added to any model we would design).

Even if the Big Bang theory would be generally correct, it is clear now why there are no coherent explanations for the first moments of the universe (at least for the Planck interval)! In addition, the causality, the energy/mass, the laws of physics are all practically compromised in this theory! As this theory of the early universe breaks since the beginning, a rational solution has already been formulated: my distributed model called the First Bang [2], which explains how space became a granular medium and how it expands.

In fact, these Planck units must be regarded with reservation. They do neither determine the level of discretization for those physical quantities nor establish a physical limit beyond which we cannot pass. They only tell us that the current models and equations are not designed to work at the Planck scale. For example, the Planck length has nothing to do with the granularity of space, and we should never mix up these two similar values! Moreover, these Planck units do not validate a so-called invariant scaling of nature, as they are not based on some absolute constants!

Prime Theory series has introduced a set of absolute physical quantities that may justify the attribute *discrete* for their derived quantities (Table 9). If we would express these elementary quantities by using the standard units of measurement, their values would be too large or too small and we could not work normally with them. Anyway, they all are discrete quantities and this thing should be said once again. Moreover, a scalar or vectorial combination of these elementary quantities (more or less useful at granular level) is also discrete and this cannot change any law of physics! These things were only mentioned to better understand the connection between the granular model and the standard model of quantum physics.

Symbol	**Description**
N	The total number of granules
d	Granular diameter
C	Absolute granular speed
p	Elementary granular impulse
e	Elementary granular energy
τ	Duration of a granular collision

Table 9

As *ideal* observers, we could easily find out if a certain physical quantity must bear the attribute of continuous or not, and this might help us decipher all the mechanisms of nature. As *real* observers, though, we are forced to work with uncertain values - that can be considered discrete anyway - when the quantum realm is involved.

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Acronyms and conventions

CMB, CMBR - Cosmic Microwave Background Radiation

Big Bang - Theory on the birth of the universe

AFR - Absolute Frame of Reference

IFR - Inertial Frame of Reference

FR - Frame of Reference

TR - Theory of Relativity

GTR - General Theory of Relativity

TA - Theory of the Absolute

PT - Prime Theory

BH - Black Hole

SMBH - Super Massive Black Hole

MM - Michelson-Morley

SI - International System of units

"abc" - Figurative sense