Red and Blue

Mysteries hidden in the colors of our universe

Laurenţiu Mihăescu, May 15, 2023

“We are a way for the universe to know itself.” - Carl Sagan

1. About the Universe

What exactly do we know about the Universe at this point? How have all the measurements, increasingly complex and precise, helped us imagine the best possible model of the evolution of our universe? Can this model tell us how the universe came into being and how it will one day die, or whether it is finite or not, or flat, or unique?

It is obvious that all our observations are subject to certain limitations, and the most important of these is the *finite* speed of light. All photons travel at this finite speed (about 300,000 km/s), as do any electromagnetic or gravitational wave that reaches our measuring devices. Thus, if we are looking into the deep reaches of the cosmos, what we actually see is the past, that is, an image of things at a certain point in their history. For instance, if we observe the nearest star, Proxima Centauri (located at about 4 light-years from Earth), we will actually see its 4-year-old image. If we look at the nearest galaxy, Andromeda, its image will be 2.5 million years old. The *James Webb* Space Telescope has just captured the incredible images of the most ancient galaxies in the known universe, which appeared to be roughly 13.5 billion years old; and there are two important clarifications we have to make at this point:

A) This observation was made in the infrared spectrum; according to the conventional interpretation, the light coming from these distant galaxies shows a large increase in wavelength - up to the infrared part of the spectrum - as a result of the expansion of the universe.
B) The same expansion also affects the distance to these galaxies; the real (proper) distance would no longer be just 13 billion light-years, but over 32 billion light-years.

Therefore, the standard cosmological model assumes a continuous expansion of space, supported and validated by the proportionality between the speed at which galaxies move away from us and the distance to them (Hubble's Law). It's the Theory of General Relativity applied to the entire universe which, along with this assumption, has outlined the model that is almost unanimously accepted by the scientific community these days. As you've found that all galaxies are moving away from each other, it's pretty reasonable to assume that, at an early point, all matter was condensed in an infinitesimally small singularity - as specified by the Big Bang theory. Similarly, it is also reasonable to assume that space itself was created by the expansion process in which the energy of that singularity expanded rapidly and evenly - as the inflationary cosmology specifies. This standard model (Lambda - CDM) gives us an estimate for the age of the universe of about 13.7 billion years and a diameter for the observable universe of about 93 billion light-years. The following series of findings supports the model:

- Existence of the cosmic microwave background (CMBR)
- Distribution of galaxies in the universe
- The abundance of Hydrogen, Helium and Lithium in the early universe
- The spectrum of light coming from distant galaxies and supernovae, as proof for the universe's expansion
- The homogeneity and isotropy of the large-scale universe

while the invisible dark matter and energy were added to justify the peculiar motion of stars in galaxies and the expansion of space.

The above findings and observations seem quite objective and their interpretations are as reasonable as possible. However, the fourth observation can have a different *interpretation*, and we will go into details about this subject next. Also, the standard model has many more minuses, and therefore it can be easily challenged; as it was already mentioned [4, Chapter 2], there are two important things that do not seem right: the emergence of that primordial singularity and the ultra-fast spatial inflation that followed that moment. And this is mostly due to the lack of explanations, as modern astrophysics did not give us yet satisfactory definitions for space, matter and energy, based on a concept that would have to include a minimum number of coherent elements and assumptions. All my previous models [2, Chapter 2], which were built trying to eliminate these inconsistencies, are also perfectible, and my goal here is to improve them as much as possible.

It is obvious that the scientific knowledge has limitations, of both macroscopic and quantum level kinds, but the speculations and postulates we add in order to replace the missing scientific data must have a minimal connection with the surrounding reality and must provide the simplest possible explanations - as they tend to be true in most cases!

Moreover, the standard model gives us a dynamic universe, but it does not specify whether the universe is finite or not, or what is its exact curvature (flat, closed or open). It is supposed to continuously expand, faster and faster, but we didn't find out why and into what. And it's the space between galaxies the part that actually 'stretches', but the cause is not exactly known - as the so-called *dark energy* still remains an insurmountable mystery. Also, we don't know how photons become 'longer' while crossing the space, and why! And what lies beyond the boundary of space, in case it is finite, or what space is expanding into, in case it is infinite?

2. Hubble Constant

The value of this so-called constant has been determined by using several procedures, but a reasonably accurate result has not yet been obtained; the various measurements have given a wide range of values around H_0 = 70 km/s/Mpc. Several methods and apparatus have been used, increasingly complex, even the gravitational waves (LIGO) from the collision of neutron stars were analyzed. The expansion of space is, however, time-dependent, and the Lambda CDM model shows how the Hubble parameter depends on variable *z* - the redshift of light [9]:

$$H(z) = H_0 * \mathrm{sqrt}(\Omega_m(1+z)^3 + \Omega_\Lambda + \Omega_k(1+z)^2)$$

where $z = (\lambda_{obs} - \lambda_{rest})/ \lambda_{rest}$, λ_{obs} is the observed wavelength, λ_{rest} is the normal one and Ω_x are various cosmic curvatures.

We can underline here, in parenthesis, that the James Webb telescope has recently detected a few ancient galaxies (GLASS-z13 for example) having redshift values (*z*) of 13 or even higher, which means they date back less than 300 million years after Big Bang - if we consider the standard cosmology framework.

There are basically two categories of methods involved in this assessment: *the distance ladder* and *the early relic* [8]. The first group of methods is based on particular cosmic bodies (for example, Supernovae type Ia or Cepheide variables - the well-known standard candles). As we know their luminosity, the distance to them may be accurately gauged by comparison with their apparent brightness. We can do these things for distant and nearby stars, in different galaxies, and thus know both the distance to them and the redshift of their light. In this way we can build a cosmic distance ladder that would theoretically show us how the universe has expanded over time. The other methods use an image of the early universe, such as the CMBR map, and the imprint of those initial temperature fluctuations is then compared with the current distribution of galactic structures in the universe. Unfortunately, the two types of methods give different results, the values of H_0 being 73-74 and respectively 67-68, in km/s/Mpc. The current standard model has considered the latter value, as this would imply a flat universe (deSitter universe) that contains 5% normal matter, 27% dark matter and 68% dark energy.

3. Granular paradigm

As mentioned above, my intention here is to reinterpret the data gathered during the 'war' for the exact value of the Hubble constant and to rationally analyze the results, hoping to go much further and even shape a new model for our universe. However, in order to achieve this goal in a fair and coherent way, we should start by defining a few things, adding some new hypotheses and specifying the reason for doing so.

At first, it is easy to observe how the postulate that states the *constant speed* of light in a vacuum (and of all electromagnetic waves, gravitational waves, information) was taken from Einstein's relativity theory [6], included in the standard model of cosmology and 'forcibly' imposed to all regions and epochs of our observable universe.

From now on, all things will be evaluated within *the granular paradigm* (see [1],[2],[3]) and therefore by space we will understand a special medium that consists of two components:

a) A three-dimensional geometric frame, continuous, linear, perfectly empty and of infinite size. This is a 'given' of the universe, a special 'place' where matter of any kind can move freely in any direction. Although it has no intrinsic properties, the geometric space can no longer be created or destroyed, and neither can contract, expand or distort in any way.
b) A granular fluid, also a 'given' of the universe; it could have emerged together with the empty space, most likely in a compact form. As it was already postulated [1, Chapter 3], it now consists of an infinite number of identical granules that can move through space in all directions at a constant (superluminal) speed. The number of granules remains constant over time, but their density may differ in certain regions of space. A space region that does not contain structured matter, seen at a large enough scale relative to the granular size, is uniformly filled with granular fluid and thus may be considered homogeneous and isotropic. Moreover, the spatial granules [1, Chapter 4] are the only component of

the fundamental particles of matter and also the physical support for all known fields. Their directional fluxes [3, Chapter 2.4] are the basis of *gravity*, the most important field of all: it allowed structured matter to form, self-organize, and remain stable at any level.

As the cosmic objects are distributed all over the universe, astronomers can easily identify some relatively stable, distant markings and thus evaluate the distances and velocities of many nearby stars. Moreover, with no celestial bodies being at absolute rest, they can use the omnidirectional movement of the granular fluid (as support for all waves) to establish a quasi-fixed reference frame for measurements. The special characteristics of this fluid [3, Chapter 2.3] are solely responsible for the laws of physics and dictate the *maximum speed* for matter and fields within the regions of absolute space [3, Chapter 11.4 - where we have shown how the normal matter causes fluctuations to all gravitational fluxes and thus generates regions of absolute around any cosmic body]. Specifically, as the remanent cosmic radiation CMBR is omnidirectional and uniform, it can be used as a global absolute reference frame to any speed or distance measurement made in our isotropic universe. The term *space* will further include the two components we previously described (*a* and *b*), unless is specified otherwise, and will have the meaning of structural foundation for the entire universe.

4. Gravity and the laws of physics

An additional hypothesis, which is about the granular density in the early universe, must be formulated now. At the beginning, when a uniform distribution of granules could already be presumed, the level of density must have been in a certain range - as a result of the strong *correlation* between the infinite volume of space and the infinite number of granules. Obviously, that level should have been maintained for a while; during this period, the granules were not very close, nor very far apart, so they could self-organize into emerging structures. It is a kind of granular *Goldilocks* hypothesis that we must include in any scenario of the birth of our universe (see the distributed model [3, Chapter 1.6]).

Since the elementary particles are granular entities of maximum density, it is perfectly rational to assume that the average granular density of free space has decreased significantly when they all came into existence [3, Chapter 3.3]. Moreover, the strong force - a force that holds quarks together inside protons and neutrons - is also a high-density granular concentration. As the formation of some bigger, compact cosmic objects - from regular stars to black holes - is predictable, it is normal to expect more changes in the average density of free space over time.

But when did these major variations occur? Is there a general trend of the evolution? And how do the different values of density affect the laws of physics (at all dimensional levels) and fundamental physical quantities?

Regardless of the concrete way these granules emerged and got their fundamental properties (shape, kinetic energy, elasticity, etc.), they went through a period of high density, at the same time and almost everywhere in space. The high-density fluid they formed has completely filled the space at some point, homogenized itself and soon began a structuring process. Structuring means to create countless embryos of elementary particles - electrons/positrons, quarks/antiquarks - which slowly become stable and start moving through space. If a certain region would be crossed only by two opposite flows of granules, the granular fluid will shortly become chaotic and therefore homogeneous - as the collisions between various groups of granules will scatter them in all possible directions. A few seconds later, when the granular density significantly decreases after the rapid emergence of elementary particles, collisions become less frequent and now involve only two granules at a time. This is the exact moment when the pressure exerted by the granular fluid on any compact structure turns into *gravity*. Broadly speaking, by gravity we mean that omnidirectional pressure exerted by the granular fluxes on all compact material structures. The progressive linearization of gravitational fluxes will take a longer time, maybe until the CMBR event - when elementary particles stopped popping in and out of existence and the lower temperature allowed the formation of the first stable atoms of H and He.

To summarize, the first significant decrease of granular density occurred when matter concentrates into structures and the granular fluid gets homogenized. Moreover, all *granular fluxes became directional*, giving birth to gravity as we know it. As its characteristics got stable then, we can simply set the *origin* of gravity in this period; from every 'point' of space, streams of granules start to flow in all directions and the less dense fluid allowed their *rectilinear* propagation at a maximum speed. Some of these fluxes were deflected by the wide clouds of atoms, but most of them continued to 'flow' and initiate another concentration of matter, on a much larger scale.

This new process led to the formation of massive cosmic bodies - *the stars* - and triggered the fusion reactions in their cores. Since the time when first stars have appeared, gravity can be regarded as a stable field that has well-defined values anywhere and at any moment. We can no longer speak of reflections on the 'edges' of a finite universe; omnidirectional fluxes are flowing everywhere, making a continuous and causal 'connection' of any spatial region with the neighboring ones through gravity (at the highest possible speed in that medium). Homogenization of space began when the first gravitational fluxes emerged; this process happens everywhere in our universe and will continue for an indefinitely long time, no matter the change of granular density.

Does the intensity of these fluxes depend on local density? What about their speed? Does the presence of a cosmic body modify this density? There are other phenomena that could cause changes in density, and to what extent?

After initiation, a flux travels through space without being affected by the local granular density; what varies, however, is the propagation speed, which will thus increase over time with the decrease in density. The density changes a little around big cosmic bodies or galaxies, but the significant variation there is the uniform distribution of fluxes - which is consistent with the actual interpretation of gravity, the so-called distortion of spacetime (GTR, [7]). Moreover, an additional granularization of the respective spatial fluid will be indirectly caused by matter through its quantum-scale induced fluctuations (see [3, Chapter 11.4]); in consequence, this new layer of space is that medium which now dictates the absolute speed of light.

Among the main causes that lower the global density of free space over time, besides the creation of primordial particles, are the following ones:

- The fusion reactions inside the stars, which produces heavier and heavier elements, with more nucleons.
- The huge number of neutrinos born in the same fusion reactions (they are particles with granular mass)
- The huge number of photons released during stellar fusion reactions (which are also granular concentrations)
- Granular accretion, a process that occurs at the surface of any black hole (see [3, Chapter 2.4.5]); this is the *major cause* of the decrease in density over long periods
- The large number of SMBHs formed in the early universe, when the spatial fluid was extremely dense

There are a few more details needed to make my previous model of gravity [3, Chapter 2] complete. It was an old assumption of mine regarding the gravitational fluxes that are reaching Earth now, telling that they are coming from afar, from an infinitely distant region. But it is stated above that all of them originate in fact from the early universe, at the time - we may call it G_0 - when all elementary particles have finished forming. If we would consider an absolute measure for space and a variable speed for fluxes, the absolute distance would be R_0 and T_0 years would have passed since then. Although some fluxes were blocked by the interposed cosmic bodies, we can say that most of the Earth's actual gravity was generated on the surface of a sphere whose radius is R_0 (see Figure 1, for a solid angle Ω). This reasoning can be easily extended to any cosmic object and to any time in its past or future. At a future time T_1, all those fluxes will originate from a bigger, concentric sphere of radius R_1. As the respective surface area is larger now, what can we say about the overall intensity of the flux? It will proportionally increase, but we cannot realize this due to the gravity-invariance of the laws of physics?

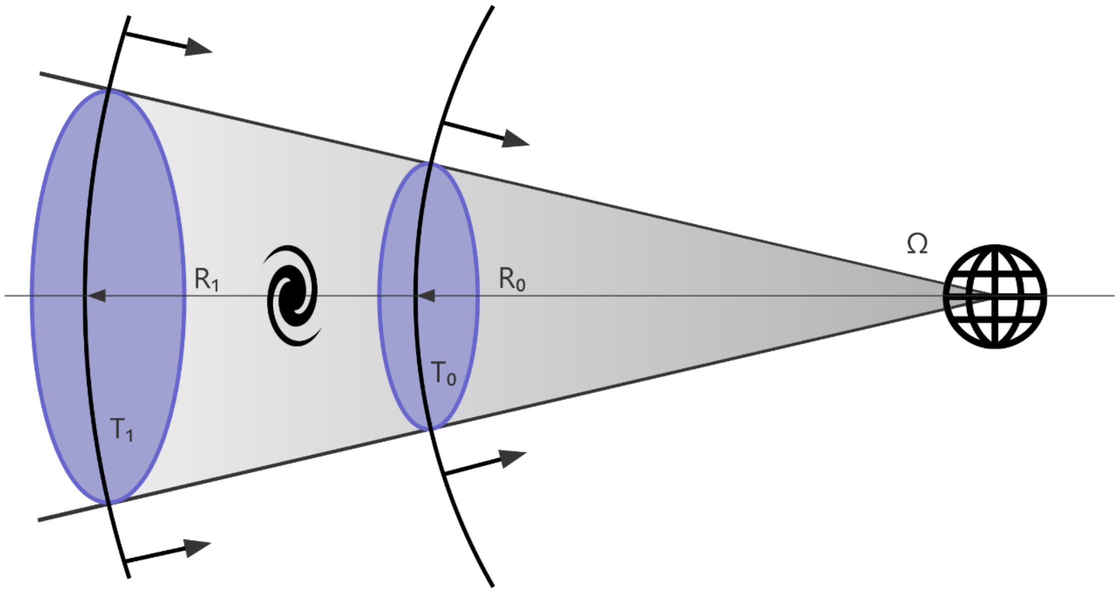

Figure 1

The concept of a global *relativism* present in our universe was already formulated in *Gravity* [3, Chapter 12], and it presumes a certain 'elasticity', a resistance of the laws of physics to the changes in spatial density; the laws are practically invariant (some physical quantities may have different measures though) in a wide range of densities - in which the structured matter, elementary particles, and the fields that bind them remain stable. This could similarly apply to the intensity of the fluxes, but the value of the gravitational constant seems to be identical in all astronomical observations. We can give a simple explanation for this phenomenon: the intensity of fluxes decreases with the square of the distance, while the area of the radiant sphere increases with the square of the distance; consequently, the two quantities will continuously balance each other out and thus the magnitude of gravity remain (theoretically) constant over time.

This new model of gravity leads to a relatively static, stable, homogeneous, and isotropic universe, on whatever large scale. The granular density around stars and galaxies will still vary and the nearby regions will be crossed by nonuniform fluxes (as the hypothetical dark matter would cause), but the global physics of the universe remains unchanged.

Space (neither the intergalactic, nor the intragalactic one) does not expand; it is the continuous diminution of its granular density that changes the matter and the way light propagates (as the hypothetical dark energy would cause). Stability of the cosmic structures, in this new perspective, is still provided by the well-known balance between inertia and attraction, but the rules of this 'Newtonian' game are established in fact at granular level.

5. Redshift

As it was already mentioned before, different epochs of the universe assume different global granular densities of space and thus the existence of an age-specific 'physics' is validated; also, any cosmic object or formation significantly modifies the local physics, and this is currently related to those ‘dark forms’ of energy and matter. Therefore, as the way we compare and interpret the astronomical data becomes extremely important, we should treat the results of measurements unitarily and start to normalize and adapt them first to a unique 'physics'.

Concretely, let’s consider now the astronomical measurements made to determine the so-called Hubble constant and the efforts to integrate it into the standard cosmological model as 'the expansion rate' of the universe.

Standard interpretation

Put it simply, the Hubble constant has been introduced as a proportionality between the recession speed of remote cosmic objects and their distance:

$$V = H_0 D$$

D - proper distance - is the distance between the object that emits light and observer, which increases with time because space is expanding.

V - recessional velocity - is the speed at which the object is moving away from the observer, deducted from parameter *z* (the redshift of its spectrum of radiation) with this formula: V = c z.

The distance to certain types of stars (Supernovae Type Ia and Cepheids) can be easily determined by measuring their apparent brightness or their variation in brightness; this apparent value is then compared with the actual brightness of a nearby star for which we know the distance. After some corrections (for stellar dust, light spectrum, time dilation, etc.) were applied, the *luminosity distance* obtained in this way can be considered very precise (3% accuracy).

Also, the recession rate can be quite precisely deduced from the parameter *z*, which is if fact the shift of the frequency of light. According to current models, the expansion of space produces the same changes in wavelength as a relativistic Doppler shift applied to the light emitted by objects that move away from the observer. Obviously, there are certain corrections that must be made (for the rotational speed of stars, gravitational fields, etc.), but the end result has a pretty good accuracy.

A graphical representation of the redshifts for different stars shows how the Hubble parameter depends on *z* (so on time), and this suggests we can no longer call this parameter a constant. The Hubble tension, as a discrepancy that exists between the results of different types of measurements, is another thing that could substantially alter our level of thrust in standard cosmology.

Here is a table that shows the dependence of *z* on distance and time [10]:

z	Time the light has been traveling	Distance to the object now
0.0000715	1 million years	1 million light-years
0.10	1.286 billion years	1.349 billion light-years
0.25	2.916 billion years	3.260 billion light-years
0.5	5.019 billion years	5.936 billion light-years
1	7.731 billion years	10.147 billion light-years
2	10.324 billion years	15.424 billion light-years
3	11.476 billion years	18.594 billion light-years
4	12.094 billion years	20.745 billion light-years
5	12.469 billion years	22.322 billion light-years
6	12.716 billion years	23.542 billion light-years
7	12.888 billion years	24.521 billion light-years
8	13.014 billion years	25.329 billion light-years
9	13.110 billion years	26.011 billion light-years
10	13.184 billion years	26.596 billion light-years
1092	13.8 billion years	46 billion light-years

Table 1

Granular interpretation

We can not question how the values for *distance* were calculated and the various methods that were employed; however, we can interpret the result as an absolute measure of the distance travelled by photons. If that star, its galaxy and the observer would be fixed, this distance can be seen as absolute if the units of measurement would derive from the actual speed of light (which is similar to the notion of 'comoving distance', but it would not imply the expansion of space). During their journey from that distant star, photons have crossed regions of less and less granular density, and therefore their absolute speed has continuously increased (the formula is $v = C / (1 + \rho \tau C)$, see Article [4, Chapter 4]). We must assume, in this context, that the change in density does not affect the way light decreases in intensity with distance. Consequently, a new interpretation must be given to the proportionality between this distance and the 'recession velocity', as the geometric space is no longer expanding with time and the galaxies are no longer moving away from each other!

What could be the new interpretation of parameter *z*, the spectral redshift of distant galaxies (their velocity inside the clusters, the Doppler effect, and gravitational influence are not taken into consideration)? As we already know [4], photons are fixed granular structures that move at a constant speed and this speed depends on local granular density. Moreover, their shape and length *do not change* [4, Chapter 4] if the spatial density decreases, only their absolute speed becomes greater. Based on these premises, the 'expansion of space' can no longer be the cause of these redshifts and we have to look elsewhere for an explanation. The answer is easy to find if we bring back the nice idea of universe’s age-specific physics - a unchanged set of rules, but different constants and measures. For example, the interactions of matter obeyed the exact same rules in the early universe as today. Knowing that the light was travelling slower back then, we could suspect a less 'energetic' universe in the past; however, this thing is not true as time was flowing slower then in the same ratio. In atoms, electrons were confined to orbitals as well, emitting or absorbing photons in the same way they do now. But since the granular speed was lower (due to a higher collision frequency), it is reasonable to assume that photons emitted in a particular transition were different. During the jump between those energy levels, the maximum speed reached by electrons is significantly lower then the current speed of light, and this means a proportionally lower energy stored in each photon (greater wavelengths).

This gave me a new idea, to use the parameter *z* as an indicator of the changes in local physics, of how the speed of light increases with time. *In this context, the redshift becomes just a measure of time, a hint for the age that cosmic formation had when light was emitted!*

Consequently, the Hubble's law is nothing else than a well-known correlation between the distance to certain cosmic formations and the amount of time it takes light to travel that distance! As we look deeper and deeper into the universe, into a more distant past, we can see the images of some of the earliest cosmic formations. That proportionality between distance and time manifests now in a static universe; considering the previous expression for granular velocity and the universal time, the new formula for distance can be written as:

$$D = \int_0^T v\, dt$$

where v depends on granular density, which is a function of time [4]:

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

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
Figure 2 shows the time T (billions of years) a photon takes to travel the distance D (billions of light-years).

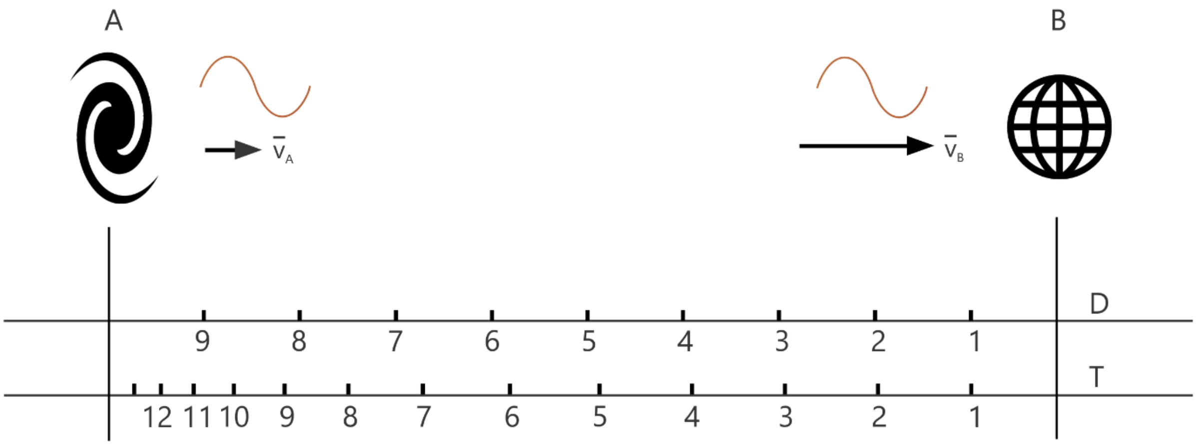

Figure 2

As the granular density of space decreases with time, the matter, fields, absolute speed, and local time are all affected. However, the energy carried by a photon that travels through space is constant because its frequency does not change during the journey (its speed is continuously correlated with the rate of local time). At the cosmic scale, the total amount of granular energy is also constant; what changes with time is its distribution, as the mass/energy tends to accumulate in supermassive cosmic objects. As it was already mentioned, the laws of physics are the same all the time, but the data gathered from different epochs must be compared correctly, considering which physical quantities are in fact correlated (see The Universal Postulate, [4, Chapter 1]). This density-based perspective allow us to explain everything we see in the early universe, from the larger mass of the first cosmic objects up to the smaller size of their formations. Since space does not actually expand, all cosmic structures will roughly maintain their actual positions over time; moreover, their particular movements can be easily explained within this framework (dark matter is no longer needed).

The redshift *z* could therefore be regarded as a fractional change in speed, and we could use for it a formula like this:

$$z = \Delta v/v,\ z = (c-v)/v \ \text{ or } \ v = c/(z+1).$$

Table 1, in which the flight time of photons is numerically equal to the distance they traveled in light-years, allows us to observe the almost linear dependence of the speed of light (km/s) on time (billions of years) - as depicted in Figure 3. If we consider z = 10, the proper distance is about 13.2 billion light-years and the estimated value for the speed of light at that time would be v = 27,272km/s (see Figure 3). This low value made me think of the actual time light has spent on its way to Earth, which in fact was much greater than 13.2 billion years - even twice as much! And we cannot ignore the variable rate at which time has passed during various epochs; years, as *uniform measures* for time, must have the same duration in order to be counted correctly at this scale! In this new perspective, the age of the universe should be recalculated and thus significantly increased, while the standard model of the universe should be adapted accordingly and linearized. Obviously, we could adjust the distances instead and use an absolute time, but the previous approach seems more appropriate to me.

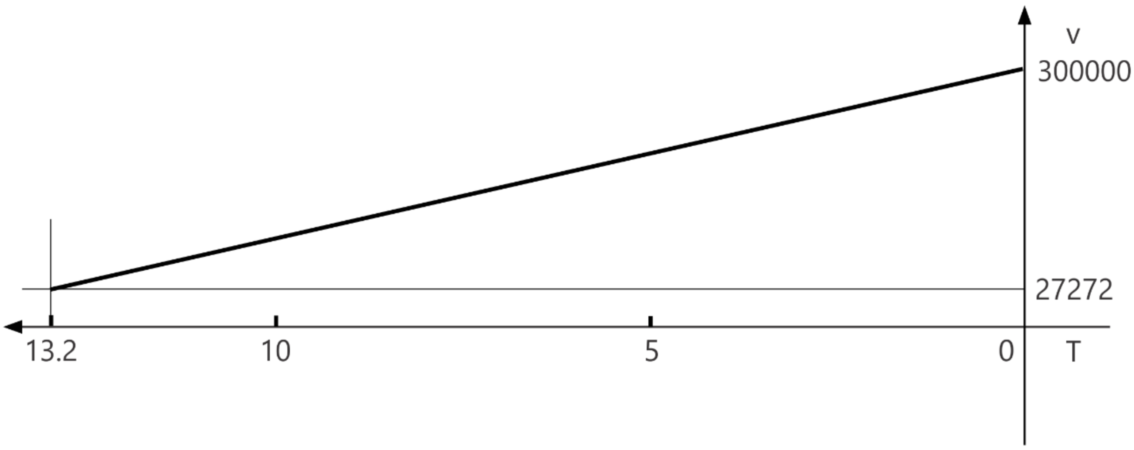

Figure 3

6. Blueshift

If we could peer into the future of the universe as easy as we did into its past, we should see a *blueshift* in the light coming from distant galaxies; the farther away they would be in time and space, the greater the spectral displacement would be. Within the granular paradigm, this phenomenon can be simply explained: in the future, a lower granular density of space makes the light propagate faster than today. But what about the intensity of granular fluxes, can we estimate how the magnitude of gravity will be changing over the next billions of years?

As the granular density will continuously diminish, the mass of all particles and of the structures they formed will also diminish, as will the strength of all known fields; consequently, it is to be assumed that the cosmic objects will increase in size and, at a certain point, gravity will start to decrease in intensity. The granular fluxes, as a force that 'presses' on all cosmic bodies and makes them 'attract' each other, will come from increasingly higher distances. Thus, in a very distant future, their intensity will significantly drop due to the interposition of more and more cosmic structures in their path; besides this gravitational 'opacification', their progressive divergence should also count as a reduction factor (they are discrete flows of granules). Moreover, the gravitational field will no longer be uniform, significant fluctuations could appear over time.

What impact will this have on stars and galaxies? Any compact structure or cosmic formation will lose some of its mass, dissipating around that 'surplus'. But this granular matter does not remain in the spatial fluid (see the Granular postulate [1, Chapter 3.1]), it will be gradually absorbed into the body of the nearby, small or big black holes. The bigger a BH becomes, the lower is the granular pressure required to maintain its stability (their rotation slows down over time with the mass growth). BHs are thus the cosmic bodies that will hold stable for the longest time in the future - up to a point when they too begin to disintegrate. Seen at granular level only, the concentration of matter (which contradicts a presumed increase of granular entropy [1]) seems to be a *reversible* process.

7. The end of the universe

Space - as a system built of normal and granular matter - cannot reach a point of equilibrium while its gravitational fluxes are still decreasing. Therefore, a turning point can be expected in the distant future of our universe, a moment when the building process stops and disintegration begins. If the process reverses, space will end up having a huge granular density. And a new question arises: Are we talking about a short, BB-like event or about a long and quiet process?

Given the slow rate at which fluxes are diminishing and the various amounts of granular matter accumulated inside SMBHs, the direction will rather be reversed slowly, over thousands of years; considering the big size of the 'expanded' BHs and their wide range of mass, we can easily anticipate that the moments of reversal will be quite different. With all the lack of synchronism, each of these BHs will eventually send in radial directions huge quantities of matter, forming 'bubbles' of granular fluid in the surrounding space. These bubbles are expanding very fast, as the granular matter flows with speed *C*, and will soon overlap each other; this process (a distributed BB [5, Chapter 6]) is quite similar to the acoustic oscillations described by current theories. Therefore, the intense fluxes coming from neighboring BHs will collide and, as their initial directions are different, they will quickly form a homogeneous, superdense fluid that fills completely the interstellar space. The superluminal speed at which the granular matter spreads out through space may actually be the only major similarity that exists between my model and inflationary cosmology.

This superdense fluid allows the spontaneous formation of elementary particles and then some primordial clouds of H and He will shortly appear. Moreover, the decrease in density allowed fluxes to propagate linearly and so the intrinsic gravity started its heavy work, to concentrate matter and build cosmic structures.

8. The beginning of the universe

There is a perfect resemblance between this scenario and the sequence of events mentioned in Chapter 4, as both describe the series of initial transformations that granular matter went through in order to fulfill its destiny: to create matter and use it to eventually build great cosmic formations. These were actually some special moments, a baby universe being born from the 'ashes' of the previous one.

In addition to countless elementary particles, the granular fluid may have been built at that time another high-density structures, the *primordial black holes.* Whether they grew on the skeleton of some incompletely dissolved SMBHs or many 'chunks' of granular matter have collapsed gravitationally, these primordial bodies will be the key elements in building and maintaining those great cosmic structures - the galaxies. Moreover, they will consume more and more granular matter from the new universe, changing its physics and settling its fate (see Chapter 7). Interestingly, all the galaxies, clusters, and superclusters of the old universe may thus be inherited (as final position and relative motion) by the new universe, in which the young galaxies will form in roughly the same regions of space (see Figure 4).

A simple conclusion can be drawn at this point: the birth and death of a universe are cyclical processes that are only determined by the spatial fluid and its special properties. The granular form of essence carries all the secrets a good builder must know in order to reach the 'cosmic' perfection. Among the 'masterworks' of this smart builder we must mention here the chemical elements, the motion and transformation of matter, and the interactions mediated by fields. Above all his creations, however, is *life* - the most complex combination of these simple elements, and *humans* - the most intelligent living beings, the ultimate way 'mother nature' tries to understand itself (paraphrasing the Carl Sagan’s quote).

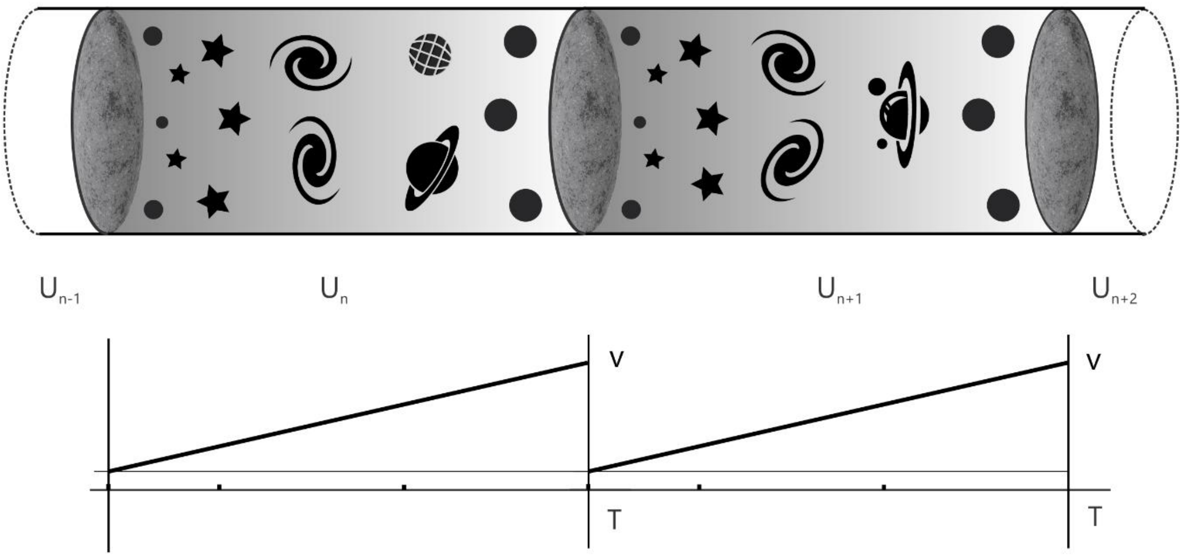

Figure 4

9. The infinite loop

Gravitational fluxes are impulse-bearing agents responsible for the movement, stability, and evolution of any material structure that exists in our mechanical universe. These fluxes, although they travel at a finite speed, are crossing all over the space and make all cosmic regions, however far apart, equivalent. Indirectly, they cause the quasi-simultaneity of the great events throughout the universe. If their intensity decreases, the change will be global, the same at any point in space. As these streams of infinitesimally small granules were emitted in all directions from virtually every point, it is normal to see a smooth, uniform medium at any level we look; thus, the free space cannot contain a flux-free zone, or adjacent regions with different intensities. On the other hand, the number of granules in an infinite universe is also infinite. However, the granular infinity is unique; we can describe it, in a Cantorian perspective, as an *absolute infinite*, being *the biggest infinite* of our material world.

The granular energy is conserved in our mechanical universe; consequently, a similar law on conservation can immediately be formulated for the total energy of its structured matter. And this law is valid in any universe, at any moment, it practically transcends time, space and any form of matter. Due to its intrinsic properties, the spacial fluid makes of any universe a builder, a creator of stars and stellar structures. Matter starts to concentrate, evolve, and transform, but after a while returns to its chaotic granular form - in a periodic process that repeats indefinitely, everywhere in space. The infinite size of our universe can be quite frightening for many of us, but its endless cyclical repetition is a staggering idea that far exceeds the grasping capacity of our mind. The existence of these infinities, however, has a good side: it eliminates our need for clarity and for answers to some fundamental questions. Humans are biologically programmed to better understand things that have a beginning and an end; also, internal and external clocks allow them to accurately perceive the passage of time. The problem of an infinite time - both to the past and to the future - forces us to elucidate some mysteries in an unconventional way, by formulating simple postulates instead of theories. We could therefore see our universe as a *supreme given*, a datum that has always been and will always be there, and which no longer needs a creator to justify its existence. Consequently, this sort of metaphysical explanation would eliminate the cosmic-scale causality; big questions like 'How did the universe come to exist?', 'What is the universe made of?' and many similar ones will no longer make any sense! And thus we would be permanently freed from searching answers in an area that is almost inaccessible to human logic and reason...

P.S. If the universe were not infinite, it would still be much larger than its observable part, and we can practically assimilate it to an infinite one. In this case, the mystery of what lies beyond its edges and of its possible expansion would still persist. Whatever the real situation may be, things do not change fundamentally for our universe and therefore the hypothesis of an infinite cycle of rebirth cannot be definitively ruled out.

10. References

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11. Acronyms and Conventions

CMB, CMBR - Cosmic Microwave Background Radiation

BB, 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

'**abc**' - Figurative text

JWST - James Webb Space Telescope