



HAL
open science

HYPOTHESIS: How Defining Nature of Time Might Explain Some of Actual Physics Enigmas

P Letizia

► **To cite this version:**

P Letizia. HYPOTHESIS: How Defining Nature of Time Might Explain Some of Actual Physics Enigmas. 2017.
<hal-01424099>

HAL Id: hal-01424099

<https://hal.science/hal-01424099v1>

Preprint submitted on 3 Jan 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons CC BY-NC-SA 4.0 - Attribution - Non-commercial use - ShareAlike - International License

HYPOTHESIS: How Defining Nature of Time Might Explain Some of Actual Physics Enigmas

P. Letizia

Abstract

Nowadays it seems that understanding the Nature of Time is not more a priority. It seems commonly admitted that Time can not be clearly nor objectively defined. I do not agree with this vision. I am among those who think that Time has an objective reality in Physics. If it has a reality, then it must be understood. My first ambition with this paper was to submit for study a proposition concerning the Nature of Time. However, once defined I understood that this proposition embeds an underlying logic. While I was following the route of that logic I realized that this vision about the Nature of Time might; change our vision of Space; unlock our comprehension of Dark Energy; clarify our comprehension of Gravity; modify our beliefs about the future of our Universe; have a potential impact on Quantum Physics as well as on many other topics in Physics. I therefore submit for study a wider scope than the one initially intended. For sake of clarity I will present in this paper each proposition as concise and synoptic as possible. I will be able to develop further each concept if needed.

Keywords

Time — Motor of time — Nature of time — Time arrow — Space — Nature of Space — Nature of the Universe — Red shift — Hubble — Accelerated expansion of the Universe — Black Energy — Dark Energy — Black Matter — Dark Matter — General relativity — Special relativity — Gravity — Speed of light — Vacuum — Big Bang — Quantum physics — Paradigm shift — Space time — Spacetime — Change — Movement

Contents		Impact on Quantum Physics	7
Introduction	2	Conclusion	7
Time	2		
Defining the Nature of Time . . . . .	.2		
The Motor of Time . . . . .	.4		
Definition of Time in Physics . . . . .	.4		
Space	4		
A New Concept of Space . . . . .	.4		
Definition of Space . . . . .	.5		
The Concept of Energy-Space . . . . .	.5		
The Cycle of Energy-Space . . . . .	.5		
Dark Energy - The Accelerated Expansion of the Universe	5		
Dark Matter	5		
Hypothesis 1: Dark Matter does not exist . . . . .	.5		
Hypothesis 2: Dark Matter: A High-Energy-Space . . . . .	.6		
Gravity	6		
On the Nature of Gravity . . . . .	.6		
Explaining Why All Objects Fall at the Same Speed . . . . .	.6		
Interaction Between Matter and Energy-Space . . . . .	.6		
The Different Expansion Phases of the Universe	7		

Introduction

Among the scientific community, it is commonly admitted that there is no real nor convincing definition for Time in Physics. When a definition of Time is proposed it always includes the notion of Time itself. The online Cambridge Dictionary gives the following definition for the word "time": "The part of existence that is measured in minutes, days, years, etc., or this process considered as a whole". Another example with the on-line Collins dictionary differentiates a) the common notion of "time" from b) the Time in Physics:

a) *"The continuous passage of existence in which events pass from a state of potentiality in the future, through the present, to a state of finality in the past"*

b) *"A quantity measuring duration, usually with reference to a periodic process such as the rotation of the earth or the vibration of electromagnetic radiation emitted from certain atoms. In classical mechanics, time is absolute in the sense that the time of an event is independent of the observer. According to the theory of relativity it depends on the observer's frame of reference. Time is considered as a fourth coordinate required, along with three spatial coordinates, to specify an event"*.

All those definitions focus on metrics. Let's consider now Albert Einstein approach of the Time. Here are some quotes directly extracted from his Theory of Special Relativity;

"... all our judgments in which time plays a part are always judgments of simultaneous events"

and following a bit further: *"It might appear possible to overcome all the difficulties attending the definition of "time" by substituting "the position of the small hand of my watch" for "time." And in fact, such a definition is satisfactory when we are concerned with defining a time exclusively for the place where the watch is located; but it is no longer satisfactory when we have to connect in time series of events occurring at different places, or—what comes to the same thing—to evaluate the times of events occurring at places remote from the watch."* Those two quotes are extracted from the chapter called "Definition of Simultaneity". Albert Einstein focuses on the relation between "times" in different referential. He is interested in its characteristics. However, he never refers to the "Nature" of "time". Today, in 2016, more than 100 years after Albert Einstein's theory, the Nature of Time is still undefined. The general opinion is that its Nature will never be discovered. Some scientists argue that the Time doesn't exist. My conviction is that the notion of Time has a reality in Physics. This implies that Time can be defined. However, a clean-up in our approach of the Time from the scientific point of view is necessary. Time needs to be disconnected from all subjective consideration. I will present here my suggestion about the Nature of Time. Then I will pursue with presenting all the possible ensuing implications.

Time

How can we solve this commonly accepted statement: "There is no definition of Time"? Or more exactly: "There is no definition of Time that doesn't already include the notion of Time itself". Contrarily to the majority of the other scientific domains the "time" is not the only prerogative of the scientific community, but has always been one of the most commonly discussed subject in day-to-day life. It is essential to make some clean-up in our beliefs and clearly differentiate the "time" that we commonly discuss from the Time in Physics. The way we conceive the "time" impacts our understanding in both domains. We use the notion of "time" to express for example:

- A duration: *During the 3 hours' time it takes to go from Paris to Geneva by train I can read my book.*
- A marker: *At what time do we meet for dinner? 8.30pm.*
- An evolution: *"The times they are a-changing"; my kids are grown, and my hair turned white.*
- A reference compared to our actuality: *The "time" that expresses moments before now is called "past", the "time" that expresses actual moments is called "present", the "time" that is still to come is called "future"*.

The list of situations where we identify different notions with the word "time" (money, death, boredom, speed, distance etc.) is almost endless. It may not seem, but surprisingly we have already made some progress at this point. We have stated that our experience of the "time" regroups too many notions to allow a clear definition. This highlights the fact that we misuse this word to express concepts that have nothing in common. And here is our second step done: Time in Physics differs from the "times" we refer to in our day-to-day life. Yet, the necessary effort has not been made in the past to clearly differentiate the Nature of Time from the Physics point of view. As this pre-work on the Nature has never been done, Physicists and scientists in general (and in fact all of us), have appropriated the only aspect of the "time" that can be manipulated, i.e. its measurable proprieties. This has greatly contributed in misleading our understanding of the Time by mixing the proprieties of a concept with the concept itself (this disposition to name the "whole" by "a part" is called synecdoche). The way the Time is approached in Physics consists mainly in the ability to manipulate it with mathematical formulas or to express it with temporal markers (minutes, years, ...). Subsequently, before we try to define the Time we need to reveal its Nature.

Defining the Nature of Time

Let's make a pause here and list all what we have already stated concerning the Time from the Physics point of view. This will help to prepare the field to convey the proper definition. List of assertions about Time in Physics:

- Time in Physics is very different from what we call the "time" in day-to-day life
- Time in Physics must not be conceived through our

human experience

- Our perception of the “time” is by nature subjectivist
- As Time from a Physics point of view needs objectivity, Soft Sciences references (such as Philosophy references) are excluded in this paper.
- Time in Physics cannot be a mix of concept such as a duration, an evolution, a marker, a ranking, the result of distance/speed all at the same time
- Time in Physics is one and only one unique reality

As a result it is necessary to define the unique concept that the word “Time” expresses from the Physics point of view as it will reveal its Nature. What is then this “unique” concept? This is certainly the most difficult part to develop as some may think that the explanation might have more to do with intuition than with rationale. Let’s then define a methodology to help the development of the logical thinking. The proposition is to reveal the concatenation of the logical thoughts. What seems the most logical is that this unique concept cannot be “something” totally new. We would not be able to refer to it as being the Time otherwise. The “unique concept” we are looking for is something known. We need to list the most common concepts linked to the notion of “time” and then proceed by elimination. We already had the opportunity to mention those concepts earlier, but let’s enumerate them again with the following precision: as we are looking for an objective concept, are excluded those who have clearly nothing to do with Time in Physics. For example, the subjective “time” is not something that we want to enumerate here as it is this idea of the “time” that seems to be very long to us when we are bored, or that seems to “fly very fast” when we enjoy what we are doing. All the other same kind of concepts, too numerous to be mentioned, that are clearly foreign to the Time in Physics are excluded. List of the most common concepts around the notion of Time in Physics

- Duration
- Change
- Temporal marker
- Past-Present-Future

The evident concept that can be excluded right away as being related to the objectiveness of the Time in Physics is the one that defines the “time” as a marker. The action that consists in isolating a “date” or an event and locating it on a time-scale that has been determined beforehand is clearly a notion that would not survive to man and woman extinction. For example, Monday 26th December 2016 does not have any objective reality. Thus it cannot be an objective Physical phenomenon.

The other concepts that needs to be eliminated are the notion of Past-Present-Future. The reason is that those notions need consciousness to exist. Let me repeat that the concept that we are looking for exists independently of human experience, including consciousness. Some people may argue that 1 billion years ago, our Universe was not the same as what it is “today” and that in 1 billion years down the road it will be different, This would prove that Past-Present-Future exists

independently of man’s consciousness. However this is not accurate. If we exclude consciousness, Past-Present-Future does not mean anything as consciousness is needed to establish a relation between those notions.

Remains the notions of duration and change. Those are a bit more difficult to evaluate as they are the most obvious notions that come with the idea of “time”. The Special Relativity focuses exclusively on the notion of duration. When change is evoked it is only as a consequence ensued to two different reference points. It is then easy to consider that Time is mainly the concept of duration. But this is not wrong. Duration for Time is one of its proprieties not its Nature. The Nature of a phenomenon is what generates that phenomenon. Duration is not the origin of the Time it is a consequence. From the Physics point of view, the Time is that phenomenon that reveals the evolution, the modification, the transformation of all systems in the Universe (including life). All those words are synonyms to express the idea of “change”. The origin of Time in Physics, its primarily Nature, is this only and unique notion: change.

Outcome: the unique concept that we need to focus on to define the Time in Physics is the notion of “change”. Change is a phenomenon that is totally decorrelated from consciousness. This is not a revolutionary discovery. Many thinkers and in fact most people agree with this assertion about Time. However, the premise here is that the Nature of Time is defined by one and only one concept. All the other notions that we commonly refer to when we evoke the “time” or that are evoked in other fields such as Philosophy for example, need to be firmly declined as not being rigorous from the point of view of Physics. Now that we are clear with what we are looking for, let’s start thinking to an objective definition of Time.

You might have already heard, among other assertions that “Time is that thing that makes the change happen.” As this specific assertion focuses on the idea of change the intention is good. However, the approach that consists in granting a power of action to the Time is intellectually wrong. It is wrong because it confuses the denomination of an effect by looping the explanation of that effect to its denomination. This sentence might be difficult to digest. Here is an illustration via an example: when we say that “the revolution of the Earth around the Sun represents one year”, we are not saying that the word “revolution” is what makes the Earth move. It is just the noun that names the complete movement of our planet around its Star. It is the same for the Time. Time “does” nothing. It is the noun that names the idea of change. The goal should now be clear for everyone: we need to find the definition of the Time considering the latter as the expression of the change that affects all systems in the Universe. To say it differently, what we need to understand to be able to deliver an objective definition of Time in Physics is what the “motor” of the change is?

The Motor of Time

The true quest starts now. The journey accomplished since here consisted in cleaning-up our mind. The purpose, as explained, was to conceive the Time from an objective perspective. Let's make a new pause and resume where we stand at this point of our reflection:

- Our understanding of Time must be totally disconnected from our human experience
- Time designs one unique concept
- Time is not able to "do" anything. Time is the noun that verifies the action
- Time in Physics is the universal expression of the change
- The definition of Time needs to reveal what is this motor of change

What then is the motor of Time?

There is "something" that creates this flow called Time. Let's speak about this "something" as its "motor". We have already determined that this motor doesn't find its origin through our perception. It is imperative to exclude all kind of personal experiences, such as consciousness, or social sciences. This seems to be a "leitmotiv" as it must be the 4th or 5th time that I repeat it. However, disconnecting the notion of "time" from our human experience is the very main idea that I want to make clear, so it is worth to repeat it. Without counting the fact that some of you may have jumped directly to this chapter... The motor of Time refers to a physical phenomenon. What is then this physical phenomenon that "generates" Time? Always? Without ever stopping? One could argue that the motor of Time is the expansion of the Universe. Even if the notion of Change is present, it doesn't result directly from the expansion of the Universe. There is a more fundamental cause to Change. A cause that is more specific. We need to look for the motor of Time among universal Physics proprieties. So, what is the Physical phenomenon that is general and that generates change? I do see only one that matches all those requisites: Energy. Energy is the only basic phenomenon that generates change. All other phenomena that include Change are consequences of Energy.

Definition of Time in Physics

Time in Physics is a direct attribute of Energy

This definition of Time has several implications.

SPACE

Before Albert Einstein, Space was considered as a 3 axis geometrical object. Then Albert Einstein has added in his theory of the General Relativity a fourth dimension, Time. He introduced the notion of Space-Time, in other words a geometrical object with 4 dimensions. Some other hypothesis attribute to the geometrical object Space even more dimensions (the String Theory for example). The Space being a geometrical object is not to deny. But I would like to demonstrate that geometry for the Space is here again a propriety, not the primary Nature. To achieve this goal we need to rethink the

Nature of Space basing our thoughts on the new definition of Time. Let's begin by an example; Man has been able to walk on the Moon by propelling a rocket from the Earth to its satellite. Beyond the technical prowess, this proves that there is a Time-continuum in Space. If Time was absent in Space, the rockets, the artificial satellites and all the celestial objects couldn't travel. Time-continuum needs to be considered as a Universal truth wherever motion is possible, otherwise we would face a paradox: If Time-continuum does not exist in some areas of the Universe this means that part of the Universe would be missing within the Universe. Note that Albert Einstein has enunciated the Spacetime-continuum. The idea presented here is the same, but focusing only on the Time (we will see why further). If we agree with the definition of Time presented earlier: "Time, from the physics point of view, is a direct attribute of Energy" then we need to conclude that Time-continuum is in fact an attribute of "Energy-continuum"

A New Concept of Space

As mentioned above, Time being present everywhere in the Universe implies that Energy is equally present everywhere in the Universe. In fact, Time must be present "absolutely everywhere" otherwise we couldn't understand Universe as an homogeneous System. A System cannot include a no-Time situation. Thus Energy is necessarily absolutely everywhere as well, "so much everywhere" that there is not a single space plot without Energy. As Space cannot be conceived in absence of Time, I propose to adopt a paradigm shift in our conception of Space: I propose that Space is Energy. I am not saying that there is a form of Energy in Space. I am saying that the Space itself is a specific Energy. The logic resumed and very simplified being: Time is an attribute of Energy + Space cannot be conceived in absence of Time = Space is Energy. What are the consequences of this proposition? The first questions that this proposition arises is: where does this Energy comes from and what kind of Energy is it? The Space (from now on we will admit that speaking of the Space and speaking about the "minimum level of Energy that constitutes the Space" are equivalent concepts) has 2 origins. The first one is the original generation arising from the Big Bang according to the actual theory of the creation of the Universe. The second origin of the Space is more "recent". Did we ever thought at what is happening to all the enormous amount of Energy released by the Universe activity? For example, what happens to the Energy released by a star exploding in a Supernova? Does this Energy just disappear in the "emptiness" of the Universe? I do not think so. I do think that the intensity of the Energy lowers down and reaches the lowest possible level that Energy can have, namely the Space. This means that in our Universe the Energy cannot vanish. There is a minimum threshold for Energy. Accordingly to the present definition of Space this can be raised as the following 2 intricate universal rules:

- 1) True emptiness cannot exist in our Universe as Space is a form of Energy.
- 2) Energy cannot vanish. There is a minimum Energy thresh-

old that corresponds to our conception of Space.

Definition of Space

The updated definition of Space (arising from the definition of Time presented earlier) is:

Space corresponds to the very minimum level of intensity that Energy can have.

This new vision of Space has several impacts. In the following chapters I will present potential impacts on different Physics topics.

The Concept of Energy-Space

From now on we will name the new concept of Space, Energy-Space each time that the notion of Energy will play a role when Space is mentioned.

The Cycle of Energy-Space

Following the logic of Space being Energy we can assume that Energy-Space can be generated as well as absorbed.

We will develop both ideas in the following topics.

Dark Energy - The Accelerated Expansion of the Universe

This vision of Space (space being a form of Energy) could give an explanation for Dark Energy. Hubble (as well as Friedman and Lemaitre) discovered in the first half of the XX century that our Universe is in an expansion phase. Then almost 100 years later, Saul Perlmutter, Brian P. Schmidt, Adam G. Riess discovered while observing distant Supernovae that this expansion of the Universe was accelerating. This discovery has been a big shock as all the Astro-Physicists thought before those observations that the expansion of the Universe was decelerating due to the action of Gravitation on the celestial objects. The accelerating expansion of the Universe then is a mystery because of this logic: How the expansion of the Universe can accelerate despite the action of Gravity? The hypothesis raised is that there is a mystery Energy that inflates the Universe. As this Energy is unknown it has been called, Dark Energy". With the new vision of Energy-Space we might have an explanation. Energy-Space would be the "Dark Energy" that we are looking for. More exactly the different Activities of the Universe would generate Energy-Space. By Universe Activities we design all the events in the Universe that release energy, like Supernovae for example (however all the Universe Activities are not necessary generating Energy-Space). "Dark Energy" would be the generation of Energy-Space by some activities in the Universe. Let's illustrate it by the following hypothetical illustration: When we look at two different Galaxies from the Earth, the observations proved that the most remote Galaxy is pulling away faster than the closer one. The explanation would be that each Galaxy generate their own Energy-Space. This would mean that the most remote Galaxy would pull away faster from the Earth due to its own Energy-Space generated + the Energy-Space generated by the closer one. On the other hand

the closer Galaxy is pulling away only due to its own Energy-Space generation. Thus the most remote Galaxy is pulling away faster due to the bigger amount of Energy-Space generated. This can happen only because the distances are so huge between the 3 systems (Earth, close Galaxy, distant Galaxy), that even if the Energy-Space expands at the speed of light, the Energy-Space generated by the most remote Galaxy will need thousands of years at the minimum to cover the distance. This is the reason why we can observe the most remote Galaxy pulling away faster. If the Galaxies were closer and that the Energy-Space of each of them could cover the distances between the 3 systems almost instantly, then we would see both Galaxies pulling away at the same speed. This would mean that we are wrong in looking for an "anti-gravitational" force. The accelerated expansion of the Space here would not be the result of a force that inflates the Universe, but the result of new additional Space created from the Energy coming from the Universe activity. The forces implicated are then much lower than the one needed to compensate the total mass of the whole Universe. This would also explain the 10^{120} ratio difference between the density of the supposed anti-gravitational force compared to the density of the Energy observed for the expansion of the Universe. "Dark Energy" is not 10^{120} bigger as it is not a repulsive Energy. It is the addition of very tiny Energy.

Expansion of the Universe Might Not Be Even

A consequence of the hypothesis of Energy-Space generated by Universe activities would be that the Expansion would not be even in the whole Universe. We can assume that the amount of Energy-Space generated by a "small" Galaxy for example and the one generated by a big Galaxy would not be the same. The amount of Energy-Space generated should be proportional to the size of the System generating it. Thus if we compare two different pairs of Galaxies, each pair having sensible different sizes, the observation should reveal a difference in the measure of the acceleration of the Expansion of the Universe.

Dark Matter

According to the assumptions made about Dark Energy, some hypothesis might be advanced for Dark Matter

Hypothesis 1: Dark Matter does not exist

If we consider, as proposed in the previous sections, that some activities in the Universe can generate their own Energy-Space, then we might consider that the "gravitational" force explaining that one Galaxy is hold together despite its high turning speed would be the generation of Energy-Space by this Galaxy. The act itself consisting in generating Energy-Space would compensate the tendency The Galaxy has to fly apart.

Hypothesis 2: Dark Matter: A High-Energy-Space

Another option would be that Dark Matter is in fact a specific condition of Energy-Space, where the intensity of the Energy of the Space is higher than in the rest of the Universe. This could be due to the fact that Energy-Space that has been "just" generated (where "just" needs to be determined as it could be some years or some billions of years...) by Galaxies has an higher intensity. Energy-Space would be then more shrunk/compressed. This shrunk Energy-Space would be the action that maintains the Galaxies together. A mix of the 2 hypothesis is also a possible solution. As a side note, if we observe gravitational lenses effects it would be due to the fact that Energy-Space is distorted in both hypothesis. Light being obliged to follow the distortion of the Energy-Space will result in the gravitational lens effects.

Gravity

In his Theory of the General Relativity, Albert Einstein revealed that Gravity is not a force but the curvature of Space-Time. This vision of "curved" Space-Time describes very well the impact on the movement of celestial objects for example. However this representation of "curved" Space-Time might not be the most appropriate. If we consider that Space is Energy, we might have another complementary approach of Gravity. We know that gravity occurs as soon as matter is present in Space, and that its action is proportional to the amount of Matter. What we call Gravity might be the interaction of the Energy-Space with the Matter. The assumption here would be that Matter consumes Energy. Matter then needs to compensate this consumption of Energy by absorbing Energy-Space. This means that Gravity should not be considered as the attraction between two bodies in Space. Gravity exists even when there is only one body isolated in Space. Gravity is the absorption of Energy-Space by Matter. But this cannot be observed for the moment. When we see two Celestial Bodies in Space that seem to attract each other, in fact each body is absorbing the immediate Energy-Space around it. As a result Energy-Space decreases between them. Another consequence being that if one body is much bigger than the second body, for example the Earth compared to an apple, then the amount of Space absorbed by the Earth is much higher compared to the one of the apple. If the apple is in the Gravity field of the Earth, then the apple "falls" on the Earth. The assumption here is that the apple is not really falling, it is still in the Energy-Space, but as the Energy-Space is being absorbed by the Earth, the apple is following the same route of the Energy-Space. **Gravity might not be the universal law of Attraction but the law of the interaction between Matter and Energy-Space where Matter absorbs the Energy-Space. Dark Energy would be to some extent the counterpart of Gravity as it is the law of Energy-Space released by Universe activities.**

On the Nature of Gravity

What would be the hypothesis explaining that Matter absorbs Space continuously as explained above? The hypothesis

would be that Matter needs Space or more precisely, that Matter needs the Energy that Space is. The Matter absorbs the Energy-Space because it needs this Energy to compensate the Energy that the Matter consumes. Otherwise where would come from the Energy of the Electrons for example? How could we explain that the Energy doesn't vanish? If we do not admit that Matter consumes Energy and needs to replace it then we would need to accept the fact that Matter would produce its own Energy and this would be even more difficult to admit. **The hypothesis that Matter needs Energy-Space implicates that Energy-Space decreases around the Matter. This explains the effect that we call Gravity.**

Are Objects with Different Masses Really Falling at The Same Speed?

The reason why 2 bodies with different masses fall at the same speed, for example an apple and a tree, if they are dropped from the same height (and if we omit air resistance on Earth) is because those bodies are "falling" with the Energy-Space towards the center of the Earth. They are not falling independently. This because the Earth is absorbing the Energy-Space where the apple and the tree are located. However, we need to take into consideration that the apple and the tree are also absorbing the Energy-Space. But their respective effect is marginal. However if we take 2 different bodies with a huge difference between their masses, then we should be able to observe a difference with their respective "gravitational" effect. According to what we just say, the one with a huge mass should absorb much more Energy-Space. The result would be that the amount of Energy-Space between the massive object and the Earth would decrease faster than the amount than the less massive one. This means that the massive object would fall faster. But at the same time the object with the smaller mass would not "fall" toward the center of the Earth, but its trajectory would be diverted toward the massive object. This could be observed only if the object are dropped from a sufficient height from the ground (and that the massive object is really significantly way more massive).

Interaction between Matter and Energy-Space

The representation that we commonly have about a planet surrounded by Space would be wrong according to the new concept of Gravity presented here. The Matter is not surrounded by Space, but is part of the Energy-Space. The Energy-Space is interacting at sub-atomic level. Energy-Space is not only "around" but also "inside" the Matter. We could even imagine that in fact Energy-Space is a component of the Matter, as Protons or Electrons for example. The only difference is that the component Energy-Space might not be a discrete component but a continuous one.

The Different Expansion Phases of the Universe

The reason why the Universe is in expansion is either completely or partly due to the constant amount of additional Energy-Space provided by the Universe activity. The other potential reason explaining the expansion of the Universe being the remaining Energy of the Big Bang. However the slow-down that the Expansion faced 3 billion years after the Big Bang would tend to prove that the only factor of the actual expansion is the Energy-Space generation by the Universe activities. We can imagine that the Acceleration of the Expansion of the Universe would decrease if Energy-Space generation (aka Dark Energy) would decrease under a certain threshold that would not be able to compensate anymore the action of the remaining "gravity", i.e the action of the Matter absorbing Energy-Space in its proximity. Even if with the notion of quantum vacuum we already had that notion about the Space not being empty, by declaring that Space is a form of Energy conception of emptiness needs to be completely revised. The notion of Emptiness would then be banned from our Universe. If it is the case the Universe will then enter in a new phase: the shrinking phase.

Impact on Quantum Physics

Following the proposition that Space is the lowest possible Energy (that we can call Energy-Space), we have supposed in the previous chapter that Energy-Space plays a role on atomic and sub-atomic level. This means playing a role in Quantum Physics. One example could be the role played by the Energy-Space in the entangled particles where those two particles are linked by the Energy-Space. If Energy-Space is a reality, the impact on Quantum Physics would be much wider. The assertion that atoms are made of more than 99 per cent of emptiness needs to be reinterpreted and the potential consequences evaluated.

Conclusion

In trying to define the Nature of Time we have raised additional hypothesis that might explain some of actual enigmas in Physics. Very few references to classical Theories have been made, as the intention was to follow another logic and see if this Paradigm Shift could allow to reach the same conclusions and offer some additional insights. For example the proposition that Space might be Energy (that is the 2nd core idea of this paper after Time being an attribute of Energy) not only corroborates Albert Einstein theory of General Relativity saying that Matter affects Space(-Time), but also add some perspective explaining how Matter and (Energy-)Space interact. Space-Time explains "how" Matter affects Space, Energy-Space change a bit the explanation on "how" Matter affects Space by explaining "why". Even if the hypothesis are presented in a very synthetic form, even if there is no demonstration nor prove, even if it's difficult to admit that Space

could be Energy, I hope that this paper will raise some interest, bring further discussions and possibly generate researches.

References

- [1] Rai 1 - Piero Angela. *Superquark sull'Universo 11 giugno 2015 Documentario*. 2015. URL: <https://www.youtube.com/watch?v=5CxqGZh3rkU>.
- [2] BBC. *BBC Documentary — The Mystery of the Universe Documentary*. 2016. URL: <https://www.youtube.com/watch?v=tM-4VqCNkSs>.
- [3] Julien Bobroff. *Voir la quantique?* 2014. URL: <https://www.youtube.com/watch?v=j6h6fUKnRAY&t=3206s>.
- [4] Albert Einstein. *RELATIVITY The Special and the General Theory*. 1916.
- [5] Euronews - Englert. *Le prix Nobel de Physique, Dieu et l'énergie noire*. 2013. URL: <https://www.youtube.com/watch?v=mxFq2pVAXmU>.
- [6] National Geographic. *National Geographic DARK MATTER and ENERGY*. 2014. URL: <https://www.youtube.com/watch?v=8fo3TnxUp50>.
- [7] Ted Talk - Catherine Heymans. *The dark side of the universe — Catherine Heymans — TEDxUniversityofEdinburgh*. 2014. URL: <https://www.youtube.com/watch?v=Yr0eW6PbmOs>.
- [8] Etienne Klein. *Étienne Klein Que savons-nous du temps ?* 2013. URL: <https://www.youtube.com/watch?v=NDYIdBMLQR0&index=1&list=PL3sZNaHrelvpNAF7n7xoo-pm4xasQ3BFy>.
- [9] Jean-Pierre Luminet. *Trous noirs et énergie sombre, par Jean-Pierre Luminet*. 2014. URL: <https://www.youtube.com/watch?v=uFacEfJ-MGA>.