

Immanuel Kant added to the two ontological knowledge levels, A and B, a third one, C, called by him *propedeutics or preliminary exercise* studying the faculty of reason under the connection with any *a priori* pure knowledge²⁷. Accordingly with these three ontological levels, being conditions are stated, adequately: a) the possibility conditions defining the possible being (a being is possible if and only if it can be thought); b) the reality conditions defining the real being (a being is real if and only if it can be thought non-contradictorily); c) the existence conditions defining an existant being (a being exists if and only if it is perceived). It remains yet a question insinuating more and more, as far as the problems of the ontology the prime are exhausted, namely, *how* it happens that the object is going ever and ever to give itself up in order to be perceived, or, *how* it happens that the subject is able to compel the thing in itself to let itself for being perceived. The Kantian answer, become famous, is “als-ob”, and inaugurates an ontological discourse of a second type about the possibility, reality and necessity conditions of the thing in itself, that presumes an order in itself and an archetypical intellect for whom the nature order and the generic intellect are nothing else than *ectypa*, i.e., mere copies.

Immanuel Kant never believed that the Pure Reason is able to dive into the transcendent, but he considered if there are two pictures of the world, one immanent to the subject and the other transcendent, then must be done something with them in order to unify them, because if two distinct exist, then an infinity²⁸ could. The Kantian unification is the result of the fact that Logos is just arrived Pure Reason, stated and exteriorized with the help of the scholastic doctrine of *suppositio terminorum*: “Here a distinction presents itself in regard to the way in which we may cogitate a presupposition — a distinction which is somewhat subtle, but of a great importance in transcendental philosophy. I may have sufficient grounds to admit something, or the existence of something in a relative point of view (*suppositio relativa*), without being justified in admitting it in an absolute sense (*suppositio absoluta*). This distinction is undoubtedly requisite, in the case of a regulative principle, the necessity of which we recognize, though we are ignorant of the source and cause of that necessity, and which we assume to be based upon some ultimate ground, for the purpose of being able to cogitate the universality of the principle in a more determinate way. For example, I cogitate the existence of a being corresponding to a pure transcendental idea”²⁹.

²⁷ *Ibidem*, p. 246.

²⁸ *Ibidem*, Introduction, 1. On the Difference between Pure and Empirical Knowledge, p. 14.

²⁹ *Ibidem*, Appendix. Of the Ultimate End of the Natural Dialectic of Human Reason, p. 202; Germ, ed., *Abschnitt. Kritik alter spekulative theologie*, S.630–631.

PHYSICS AND EPISTEMOLOGICALLY DIFFERENT WORLDS

GABRIEL VACARIU, MIHAI VACARIU

(University of New South Wales, Sydney, Australia; University of Bucharest)

When the mathematical propositions refer to reality, they are not sure, when they are sure, they do not refer to reality.

Einstein

Abstract. In this paper we will analyze certain famous controversies, paradoxes, and disputes from physics from a more general viewpoint. The reason we do this is that all these fundamental problems from physics have been created under a pseudo-paradigm - the unicorn-world or the existence of one unique ontological world. Obviously, the physicists have produced these disputes by working under this pseudo-paradigm. In section 2, we introduce a summary (4 principles) of the epistemologically different worlds that replace the unicorn-world. In part 3, we will apply this perspective to the great debates that have appeared since new phenomena, fields and waves, could not be explained by Newton's theory. In part 4, we will scrutinize the problem of gravity and Newton vs. Einstein theories, the relationship between the general theory of relativity and quantum mechanics (mainly the problems of infinities produced by the unification of these theories), quantum gravity (the problem of space), black holes, and holographic principle. In part 5, we will try to establish the philosophical foundations for rejecting the (super)string theory from an EDWs perspective.

1. INTRODUCTION

In this paper we will analyze certain famous controversies, paradoxes, and disputes from physics. We investigated them not from a physicist's viewpoint and not even from that of a specialist in philosophy of science but from a much more general one. The reason we do this is that all these fundamental problems from physics have been created under a pseudo-paradigm - the unicorn-world or the existence of one unique ontological world. Obviously, the physicists have produced these disputes by working under this pseudo-paradigm. In section 2, we introduce a summary (4 principles) of the epistemologically different worlds that replace the unicorn-world. (See Vacariu 2005, 2007 and 2008) In part 3, we will apply this perspective to the great debates that have appeared since new phenomena, fields

and waves, could not be explained by Newton's theory. In part 4, we will scrutinize the problem of gravity and Newton vs. Einstein theories, the relationship between the general theory of relativity and quantum mechanics (mainly the problems of infinities produced by the unification of these theories), quantum gravity (the problem of space), black holes, and holographic principle.¹ In part 5, we will try to establish the philosophical foundations for rejecting the (super)string theory² from an EDWs perspective.

2. EPISTEMOLOGICALLY DIFFERENT WORLDS (EDWS)³

The unicorn-world has to be replaced with something that rejects the main characteristic of the world or universe — its unicity. This is the main reason we replace the unicorn-world with epistemologically different worlds (EDWs). We introduce here only 4 principles⁴:

(1) Principle of epistemologically different worlds (EDWs):

Under different conditions of observation, the human subject observes epistemologically different worlds.

(2) The principle of objective reality:

The determining epistemologically different entities and their corresponding constitutive epistemologically different interactions represent the epistemologically different worlds. Each epistemologically different world has the same objective reality.

(3) The principle of complementarity:

As human attention is a serial process, the human subject cannot simultaneously observe EDWs.

(4) The principle of conceptual containment specific:

The set of judgments that describe the phenomena of each epistemological world must follow the rule of conceptual containment that is given by the conditions and limitations within the concepts of the judgments. These conditions and limitations are governed by the different properties of the tools of observation for human beings and in general by the conditions of interactions for any class of ED entities.

Explaining the difference between objective validity and objective reality in Kant's philosophy, Hanna comments on A239/B298-9 and A248/B305, writing that "empty concepts cannot be meaningfully applied by us either to noumenal

¹ Gabriel Vacariu elaborated his theory in philosophy of mind/cognitive science, but it is also applied to quantum mechanics and the relationship between Einstein's general theory of relativity and quantum mechanics. (See Vacariu 2005, 2007, and 2008) Certain essential problems have been created because of the unicorn-world paradigm from physics in the last 100 years. Therefore, we consider that we do not need to analyze all these problems in detail but only from a paradigmatic or even meta-paradigmatic viewpoint. This is the reason that in this paper, we refer only to a few books (Einstein 1992, Kaku 1994, Greene 1999, 2004, and Smolin 2000) and not articles. We leave the specialists from the history and philosophy of physics to analyze these themes in detail from an EDWs perspective.

² We emphasize here that this article is an extension of sections 6.9 and 6.10 of Vacariu (2008).

³ For the EDWS perspective see Vacariu 2005 and 2008.

⁴ We selected only 4 from 6 principles. For the other 2 principles, see Vacariu 2008.

objects or to objects of our sensory intuition, and in that sense they are 'impossible' - that is, impossible to use." (Hanna 2001, p. 90-1) As we will present in this paper, many paradoxes and great controversies appeared in science (and philosophy) when some concepts or principles that have been very successful in a particular theory available for phenomena belonging to a particular EW are extended to other pseudo-theories that usually relate phenomena belonging to EDWs. In this way, those concepts or principles become empty! To avoid such extensions that generate many paradoxes, infinities and other problems under the same umbrella, we introduce Kant-Hanna rule as a supplement to the conceptual containment and complementarity principles:

Any notion/principle initially constructed within a scientific theory that explains very well the phenomena from a particular EW1 and that we use later in another theory that approaching the phenomena from another EW2 is, in general, an empty concept/principle.

This is a general rule but it can be more easily applied to the theories referring to non-living entities for which there are no problems for identifying their status of interaction with other entities. However, it is much difficult to identify such viewpoints of interactions/observations for living entities like cell, molecules, neural patterns of activation, animals, and the human subjectivity. Therefore, we need to transform this rule into another rule for living entities. Any living entity has its own viewpoint of subjectivity. Any non-living entity cannot observe its organizational or epistemological-ontological parts. They exist only at "surface". Any-living entity has certain "implicit" organizational parts that constitute its "personal" identity. The rule can be this one:

Any notion/principle used in theories that refer to organizational or epistemological-ontological parts of an entity is, in general, an empty notion/principle when it is used for explaining the observational/interaction viewpoint of an entity.

We have to recall the principle of subjectivity of human being: The "I" corresponds to the part-counterpart. (See Vacariu 2005, 2008)

3. PARTICLES VS. FIELDS (WAVES)

The 19th century brought about several great disputes on particles and fields (electric and magnetic fields). These problems followed the debate regarding the nature of the light, particles or waves. Using elementary particles from mathematics, Newton embraced an atomistic view about matter: light is composed of particles. Huygens thought that light is a wave; the movement of the waves was possible because of the ether. Many problems appeared in understanding the light

and new phenomena like electric and magnetic fields. At the beginning of 20th Century, Einstein pointed out in different articles that from one side, Newton (light as particles) and Leibniz (Faraday, Maxwell and Hertz) (light as manifestation of a field) represented two scientific theories that use two incompatible *conceptual elements*! Neither theory can explain the notions of the other theory. (Einstein (5), p. 165 or p. 169) Because of the unicorn-world, we can clearly understand this famous scientific controversy. In fact, particles and fields belong to the EDWs and this is the reason for such incompatibility. As we will see below, by using the field theory and the geometry of space and time, Einstein tried to construct a “marble” theory about the world. Opposite to his view, it has been the quantum theory, a theory of “wood” (Kaku 1993). The main problem was the incompatibility between particles and waves (that are produced through the movement of a field). As it is showed in other work (Vacariu 2008), this problem was generated by the mixture of EDWs, the particle-EW and the wave-EW.

Let us summarize the classical steps of the development of quantum mechanics: Young's two-slit experiment.⁵ Schrödinger, the inventor of wave function, believed that it described the electrons.⁶ Born introduced the probability interpretation that became, under de Broglie's duality of wave and particle, the association of the wave with a particle. Following Heisenberg's uncertainty relations, Pauli proposed the wave function as the “probability amplitude” for the positions or momentum of the particle. Zeh supports Pauli's idea that “the appearance of a definite position of an electron during an observation is a *creation* outside the laws of nature”. (Pauli in Zeh, pp. 104–5, Zeh's translation and his italics)⁷ The last steps are Bohm's perspective (both electron and wave exist) and Bell's approach (the global wave function has to be regarded as real). The “entanglement” (according to Schrödinger, “the greatest mystery of quantum theory” — Zeh, p. 106) involves the “superposition” of different quantum states. There are two classical examples of superposition: the spin of a particle can be spin-up and spin-down simultaneously, and the superposition is of wave and

⁵ Feynman used to say that the whole quantum mechanics can be resumed by analysing Young's experiment. Evidently, within the unicorn-world, Young's experiment that combines wave and particles, micro- and macro- EDWs (the particle, the wave, the screen and double-slit apparatus) within the unicorn-world resumes indeed quantum mechanics. About the EDWs perspective applied to this experiment, see Vacariu (2008).

⁶ “What was this quantity, the ‘wave function’, that Schrödinger's equation described? This central puzzle remains a potent and controversial issue to this day... Wave functions could describe combinations of different states, so-called superpositions. For example, an electron could be in a superposition of several different locations.” (Tegmark and Wheeler 2001, p. 71) Or in Greene's words, there is no consensus regarding the nature of probability waves or how a particle “chooses” one of its possible futures; we do not know even if the particle makes any selection from its possible trajectories or participates to all this possible futures states. (Greene 1999, p. 126) (About this topic, see Vacariu 2008, 6.9)

⁷ Heisenberg has similarly claimed that “the particle trajectory is created by our act of observing it”. (Heisenberg in Zeh 2004, p. 105)

corpuscle.⁸ We recall Bohr's principle of complementarity: we cannot observe the wave and the particle using the same measurement apparatus at the same time. Other developments showed that the main idea of the quantum mechanics (Standard Model) is that “*All matter consists of quarks and leptons, which interact by exchanging different types of quanta, described by the Maxwell and Yang-Mills fields.*” (Kaku, p. 124, his italics) Different forces are created through the exchange of different quanta! The Yang-Mills fields are just a generalization of Maxwell's electro-magnetic field. (Kaku 1994, p. 118)⁹

Furthermore, we want to analyze some quantum mechanics notions (from quantum mechanics) from an EDWs perspective. We start with *Heisenberg's principle of uncertainty*, the essence of quantum mechanics (Greene 1999, p. 135) that is “by far the most controversial aspect of the theory, but one that has resisted every challenge in the laboratory for half a century. There is no experimental deviation to this rule.” (Kaku, p. 114) we will inquiry about an essential consequence of this principle: quantum fluctuations at subatomic scale (below Planck's scale). Heisenberg's principle of uncertainty is constructed within the unicorn-world and tells us that we cannot measure the position and the velocity of a particle at the same time. “Uncertainty is built into the wave structure of quantum mechanics and exists whether or not we carry out some clumsy measurement.”¹⁰ (Greene 2004, p. 99) From our viewpoint, this principle is based on the relationship between a wave and a particle and therefore it is constructed on a mixture between two EDWs. For us, the measure of the location of an electron depends on the magnitude of “its” wave function. For instance, if a wave has a uniform succession of peaks and troughs then the particle has a definite velocity. Nevertheless, its position is completely undetermined. The probability (about the probability and a related notion – Feynman's “sum over histories” – see below) of a particle's position is to be anywhere.

From an EDWs perspective, there is a mixture between two EDWs. The particle and the wave are in EDWs and if we want to get some information about the particle, we need to use probability calculus for relating the correspondence between the wave and the particle. From this viewpoint, the EDWs perspective is quite close to Bohm's theory that follows the earlier “pilot wave” interpretation of de Broglie. Within this approach, particles have definite positions and momentum at all times. The particles have continuous trajectories determined by a “velocity

⁸ About the superposition and the EDWs perspective, see Vacariu (2008, 6.9).

⁹ Standard Model with 3 forces: strong, weak and electromagnetic forces. (Kaku, p. 121–4) For strong force there are the quarks (3 colors and 6 flavors) and antiquarks held together by exchange of small packets of energy (gluons). The weak force, there are leptons (electrons, muons, the tau meson and their neutrino partners). The leptons interact by exchanging quanta, the W and Z bosons. The electromagnetic force “includes the theory of Maxwell” (electrons and light) “interacting with other particles.” (Kaku 1994, p. 122)

¹⁰ Embracing a deterministic Universe view, Einstein claims that “I can't believe that God plays dice.” (Tegmark and Wheeler 2001, p. 71).

field” and the initial positions and momentum of the particles are distributed randomly. As limited entities, we can identify the positions of these particles only by using the quantum mechanical probability. (Putnam 2005, p. 622) The superposition of the wave and the particles in the unicorn-world has created this infamous non-locality. (About the nonlocality and entanglement, see Vacariu 2008, 6.9)

From the viewpoint of a particle (its “personal identity”), there is no uncertainty regarding its position and impulse (speed) (or energy and time). Thus, we have to apply Heisenberg’s principle only from our epistemological viewpoint (created by the ontological limits of our conditions of observing the photons) in order to get certain information about the particle. This principle is just an epistemological tool for us even if, from our viewpoint, we can say that epistemology = ontology meaning that Heisenberg’s principle is ontologized. To get information about the micro-EW, we really need to mix the information regarding the wave-EW and the particle-EW. There are no other possibilities for us to get information on the particle because, due to its characteristics, the photon is the smallest particle that can provide information about either the position or speed (not both at the same time) of any particle. Thus, we build our physics as “Science” within the unicorn-world (“there are no experimental deviations to this rule”) but not “reality”, i.e., the EDWs. When applying Kant-Hanna rule, we have to avoid the transformation of an epistemological principle into an ontological one: we cannot extend our viewpoint to the viewpoint of a particle or of a planet (it would mean the hyperontologization of our macro-EW), as for those quantum fluctuations, we cannot apply Heisenberg’s principle to the nature of space and time. By applying this principle to the subatomic scale (below Planck’s scale), the physicists have *postulated* the existence of some *quantum fluctuations* (the non-local correlations - or the relationship between energy and impulse/time - require the fluctuations). Moreover, by avoiding Kant-Hanna rules, some physicists believed that even space and time have these fluctuations at this scale. (Smolin, see below) We have again a kind of hyperontologization of an epistemological principle available only to us as the observers of microparticles. From an EDWs perspective, there is no uncertainty regarding the position or impulse of a particle. Because of our limits, we can equalize epistemology to ontology in really *describing for ever* certain phenomena from the EDWs (macro and micro-EWs) and thus elaborating physics as science, but we cannot (definitively) replace for good the epistemological-ontological status of a particle or planet with our epistemological-ontological status of observers. We have to extend the question “What is it like to be a bat?” to “What is it like to be a particle or a planet?”¹¹ According to the principle of objective reality, the planets, the microparticles and the human beings have the same right regarding their epistemological-ontological conditions of observation/interaction. The entities determine their interactions that

¹¹ If we replace the viewpoint of a planet with our viewpoint, gravity would not exist!

constitute the particles.¹² We emphasize that each set of entities that belongs to a particular EW has a particular status of interactions. We can apply Heisenberg’s principle when we observe a microparticle only from *our* epistemological-ontological viewpoint! At the same time, the conditions of interactions/observations generate our epistemological limits of knowledge and thus we construct our physics as science. Heisenberg’s principle is just an epistemological tool for us and we cannot define the ontological status of microparticles from our viewpoint but only from its viewpoint! We strongly emphasize that we have to avoid the extension of Heisenberg’s principle to the viewpoints of all ED entities (i.e., to hyperontologize it). In other words, we have to apply the conceptual containment and complementarity principles (plus Kant-Hanna’s rule) to stop this “hyperontologization of the unicorn-world”. As we will see below, gravity exists for planets and stars (without the need of the gravitons that would relate EDWs).¹³ Moreover, nobody can offer an ultimate clear definitive argument for sustaining that the field (or the wave) is more “elementary” than the elementary particles.¹⁴

Further, let us introduce the interpretation from our perspective of Feynman’s “*sum over histories*”. (See again Vacariu 2008) In Young’s experiment, when an individual electron (that belongs to EW1) is shot toward a double-slit apparatus, the screen measures the interference of two waves (that belong to another EW2). According to de Broglie, a wave is “associated” to (in fact, it corresponds to) each particle. But the photon cannot be split as it is possible for a wave. Then what produces the interference? Some physicists imagine that the electron “interferes” with itself, i.e., it is a kind of reconstruction of the interference “associated” to the wave. In Greene’s words, we are forced to conclude that each electron, as a particle, has certain characteristics of a wave. (p. 121) In our opinion, it is completely wrong to think that an “electron interferes with itself”! Only in the unicorn-world, somebody is forced to think of this idea. Within the unicorn-world framework, the micro-level (the “ultimate reality”) is indeed a very strange notion for our common sense. For Feynman, the electron can travel through both slits before reaching the screen! Therefore, we have to take

¹² If we apply Einstein’s special theory of relativity, we have to give up to the dependence of each entity on a spatio-temporal background. Each entity has its own spatio-temporal view depending on its speed of movement but this view does not institute a new-EW. The laws are the same certain conditions of observation are different. (See this idea in Greene 1999 many times) Any EW is given by the corresponding entities and their interactions.

¹³ On the same line of thinking, the mind (the “I”) has the same objective reality as the brain. (See Vacariu 2008)

¹⁴ As many other scientists, following Einstein, Penrose accepts the existence of the field (wave) and considers the particles as appearances. (Penrose 2004) The existence of the “I” (that is an EW – see Vacariu 2008), the existence of gravity (as deformation of space-time) and the Standard Model from quantum mechanics support equal rights for the existence of all ED entities belonging to the EDWs.

into account all the possible histories for any individual electron. "Feynman showed that each such history would contribute to the probability that their common outcome would be realized, and if these contributions were correctly added together, the result would agree with the total probability predicted by quantum mechanics." (Greene 2004, p. 180) So, we need to combine all possible histories "in determining the probability that a photon will hit the screen at one particular point or another." (Green 2004, p. 181) The electron passes not only through both slits but also through all possible trajectories from the apparatus that sent it until the screen during the same time! And these possible histories are infinite! Greene specifies that this thing seems to be crazy. (Greene 1999, p. 128) Feynman mentions that quantum mechanics offers an absurd description of nature to our common sense: because this description fits with the experiments, we have to accept nature exactly as it is, i.e., absurd.¹⁵ (Greene, p. 130¹⁶) How this view fits with the classical world? Feynman specifies that for the classical macro-objects, all the trajectories cancel each other except one! We can clearly see here a Ptolemaic epicycle applied only to the micro-EW but not to the macro-EW. Again, only within the unicorn-world, Feynman had correctly introduced this radical notion, the "sum over histories". In reality, the wave from EW2 corresponds to the particle from EW1 and it is exactly this *correspondence* that allows Feynman to introduce his "sum over histories" that are infinite because the wave is infinite! When the apparatus fired the photon, we measured that particle from the EW1 that corresponds to "its" wave from the EW2. The screen measures the interference of the wave in the EW2 that corresponds to the particle from the EW1. Shooting the electron that belongs to the micro-EW with a macroscopic apparatus from the macro-EW, we measure the interference of the wave that belongs to another EW with another apparatus from the macro-EW. We insist that, at every time, a particle has a *corresponding* wave in an EDW!

From the EDWs perspective, we can easily understand another "ontologized" notion introduced by Max Born, the *probability*. The probability of an electron is calculated on the relationship between that particle and the "associated" wave. In the terms of classical quantum mechanics, the wave function describes all the possible states of a particle. Until it is measured, a

¹⁵ Feynman: "I think it is safe to say that no one understands quantum mechanics. Do not keep saying to yourself, if you can possibly avoid it, 'But how can it be like that?' because will go 'down the drain' into a blind alley from which nobody has yet escape. Nobody knows how it can be like that." (Kaku 1993, p. 262 from Heinz Pagels, *The Cosmic Code* (New York: Bantam 1982, p. 113) Greene continues the first sentence writing that even if Feynman said this more than thirty years ago, this framework is still available today! (Greene, p. 105)

¹⁶ From Richard Feynman, *QED: The Strange Theory of Light and Matter* (Princeton: Princeton University Press, 1988)

particle is the sum of *all possible states*. The electron has greater probability to be found where the amplitude of the wave is greater. The wave-characteristic of matter implies that matter itself has to be described at the "fundamental level" under a probabilistic framework. Thus, the "ultimate reality" is under the jurisdiction of probability! Again, when working in the unicorn-world, it is perfectly normal to introduce the probability in explaining the status of a microparticle that corresponds to a wave. As limited entities using limited tools of observation, we need to relate (with the help of the correspondences) two EDWs for acquiring knowledge about the particles. It is completely wrong to ontologize the notion of probability, i.e., to explain the status of a microparticle from our viewpoint!¹⁷

At the end of this section, we want to highlight the huge difference between "association" and "correspondence" regarding the particle and the wave. The notion of association requires the unicorn-world and a causal relationship between the particle and the wave. The "correspondence" excludes any such relationship just because these two entities belong to the EDWs: the wave does not influence the particle, in any way. When we observe/act on a wave in one EW, we act but not observe, at the same time, the particle that corresponds to the observed wave. In a very small part of the wave, there are certain characteristics that are different than in the remaining part of the wave and these characteristics correspond, with great probabilities, to the wave. Within the unicorn-world, we would have had the impression that these characteristics influenced somehow the associated particle. Nevertheless, those characteristics *correspond* to the particle but are not associated to it. Regarding the influence of the wave on the "associated" particle we can make two analogies:

(1) Imagine that a table "influences" one of the microparticles from which is composed

(2) Many people strongly believe that mind influences/produces brain. So, there is a strong causal relationship between these two entities. (Against these ideas see Vacariu 2008.) The same mistake is made with regard to the relationship between the wave and the particle. The entities belong to the EDWs and this explains the impossibility of finding the equations of the "total field" that would explain the particles. Again, this mistake is similar to that of trying to find the "equation" that explains the function of the mind influencing the brain and vice-versa.

¹⁷ Another example of illicit extension of Heisenberg's principle is tunneling barrier or quantum leaps through barriers that "has survived every experimental challenge. In fact, a world without tunneling is now unimaginable." (Kaku 1994, p. 116) "For an electron in a box, there is a finite but small probability that the electron will tunnel its way through the barrier (the wall of the box) and emerge from the box." See for instance, the tunnel diode: electricity cannot penetrate through barriers in the diode, but the wave function of these electrons can do this. (Kaku, p. 117) We think that this is a scientific example that illustrates the existence of EDWs!

4. GRAVITY AND NEWTON VS. EINSTEIN

Newton was aware that his theory did not offer the meaning of gravity. Einstein emphasizes that only by explaining the movement of certain phenomena in an infinite small time (differential laws) could Newton create his theory (Einstein (2), p. 48), and the notion of “material point” became fundamental for the classical mechanics. (Einstein (3), p. 108) Newton used total differential equations to explain the movement of particles. As we saw above, in the 19th Century there was a contradiction regarding the existence of (the) particles and electro-magnetic fields. To explain these fields, Maxwell introduced partial differential equations. The difference between total and partial equations involves two essential notions: discontinuity vs. continuity of matter. (See below) Essentially for an EDWs perspective, for Einstein, gravity means the deformation of space-time. He worked on Riemann’s route of geometrization of “nature” where force = geometry!¹⁸ “To Riemann, the bending or warping of space causes the appearance of a force. Thus forces do not really exist; what is actually happening is that space itself is being bent out of shape.” (Kaku 1994, p. 91) Using Gauss, Lobachevski and Bolyai works, Riemann showed that the distances between all points of a surface of or inside an object determine the quantity of curvature: the greater the disturbances of distances between the points of a flat form, the greater the curvature. (Greene 1999, p. 252) As Greene emphasizes, when we are closer and closer in the understanding of such mathematical abstract points, physics and mathematics become unified. (p. 253) When we try to relate the theory of general relativity and the quantum theory, such infinitesimal points create the infinities. (See below) However, to the general theory of relativity, Riemann’s geometry offers a very good approximation in considering the galaxies as points in relation with the whole universe. (Greene, p. 254) The gravitational force is replaced by curved space and time; only the massive entities (planets and stars) create this curvature. In this way, the particle-messenger that transmits the gravitational force (the graviton) is eliminated!¹⁹ Moreover, the ontological status of any entity/interaction is preserved and there is no hyperontologization procedure, i.e., any entity (like a photon, a planet or a field) exists in a particular EW and it has its own viewpoint of interaction/observation and not our viewpoint! (See Vacariu 2008)

To support of the EDWs perspective is Dyson’s hypothesis of denying the existence of gravitons from the end of his article. The EDWs perspective is supported by Dyson’s hypothesis of denying the existence of gravitons at the end

¹⁸ Unfortunately, physicists from the string theory extend this principle creating the hyperspace. (See 3.3, Kaku 1993 and Greene 1999, 2004) Again, the Kant-Hanna rule is broken!

¹⁹ Wheeler said that mass tells to space how to deform, space tells to mass how to move. (Greene, p. 90) However, many physicists (like Smolin) believe that if the quantum theory is applied to the gravitational waves, then the gravitons have to exist. (Smolin, p. 188)

of his article. (Dyson 2004, p. 88–9) Most of the physicists accept that the gravitational field must be a quantum field with associated gravitons. Dyson remarks that there are no arguments (empirical or theoretical – or even thought-experiments) to support this idea. The detectors can detect only classical gravitational waves produced by massive entities. If we do not even have a thought-experiment to support the quantum gravity, then the gravitational field is a “pure classical field” and gravitons do not exist. This hypothesis promotes us approach. Gravity is produced by massive objects and if we *think* that either a planet is “composed” of microparticles and then we have “microgravity” or there are “gravitons” that produce the gravity. However, these notions of “microgravity” and “gravitons” are empty notions! Gravity exists only in one EW, the world of macro-objects. Without objects, space has no curvature²⁰, but the curvature is produced only by macro-objects.²¹ In Hanna’s words, we can say that even if we can think about graviton and quantum gravity, it is useless to use them! In fact, pseudo-ontological notions are transformed into hyperontological notions. From an EDWs perspective, it is forbidden to use notions from the macro-EW to explain explaining phenomena from the micro-EW. Even if it is very correct in the macro-EW, Einstein’s equation from his general theory of relativity reflects the domination of the unicorn-world:

$$R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = -8\pi/c^2 T_{\mu\nu}$$

where $R_{\mu\nu}$ is the contracted Riemann curvature tensor, $T_{\mu\nu}$ is the energy-momentum tensor that measures the matter-energy content. The equation shows that matter-energy determines the curvature of space-time. Einstein’s himself was not content with all the terms of the equation. He compares his equation to the parts of a building: the left part that describes the curvature of space-time is made of “marble” “because of its beautiful geometric structure” (Kaku 1994, p. 98), the right part is made of “wood” and it describes the matter-energy that is a mixture of atomic particles, atoms, rocks, trees and planets. (Kaku, p. 98) Evidently, from an EDWs perspective, the mistake is the same: the introduction of all ED entities into the same “unicorn-world”. On the same page of one of Einstein’s articles, we can find two things:

²⁰ “Cosmic microwave background observations show that space has almost no curvature.” (Tegmark 2004)

²¹ The relationship between gravity and decoherence is “massiveness”. Dyson suggests that DeWitt (1992) explains the notion of decoherence in quantum cosmology very clearly: “massiveness” and not “complexity” is the key to decoherence. (Dyson 2004, p. 77) Schrödinger’s cat, as a massive object, accomplishes decoherence. From an EDWs perspective, DeWitt needs to introduce the “massiveness” to grasp the difference between micro- and macro-Ews. However, the “massiveness” is represented by macro-objects that belong to an EDW rather than microparticles and we do not have any decoherence. (See Vacariu 2008, 6.9) This massiveness shows us that we have to apply here again Kant-Hanna rule: do not transform essential concepts from successful theories to empty notions!

(a) Einstein considers that the whole mechanics of gravitation is reduced to solving a single system of partial differential equations but his theory is sufficient for the representation of observed phenomena of *celestial* mechanics. (Einstein (3), p. 118) Thus, he limits this general theory to planets and stars.²²

(b) Einstein indicates that the energy-momentum tensor is a “phenomenological representation of matter” that is only an “imperfect substitute for a representation” that would correspond to all known properties. (Einstein (3), p. 118) We have here “matter” in general that includes atoms, trees, stars and so on. Obviously, even Einstein worked within the unicorn-world. Nevertheless, Einstein was convinced that the theory of general relativity does not offer to physics a complete and satisfactory foundation because of two elements:

(1) The total field is composed of two parts non-logically connected: gravitational and electro-magnetic fields. (Einstein (4), p. 141) In the theory of electrical fields the points have a meaning. The lines of the electric field pass through a point. On the contrary, in the general theory of relativity, we can only talk about the relationship between lines of fields. (Smolin, p. 34) This is another reason for which we cannot relate the Maxwell and Einstein’s theories.

H. A. Lorenz tried to unify Newton and Maxwell’s theories combining both types of equations (total with partial differential equations), i.e. the particles and the fields. But he had to admit finite dimensions for a particle, otherwise the associated electromagnetic field would be infinite! He was aware of these limits. (Einstein (3), p. 113, p. 169) The problem is that, in such cases, the theories of the field are full of infinities that appear just because a particle is “surrounded” by a field and the power of the field is greater if the distance to that particle is closer. If the particle is infinitesimal, then the power of the field would be infinite!²³ (Smolin, p. 139) Mathematically, the problem is that partial differential equations for fields cannot include total differential equations that grasp the particles, i.e., they do not have “singularities”. The idea was that a singularity has to represent a particle in a field. Einstein underlined this problem in his articles many times. He spent his last thirty years of life trying to solve this problem through a “total theory of field” (extending Maxwell’s framework) without any singularity. Such a

²² Einstein’s grand strategy was to turn wood into marble, i.e., to give a completely geometric origin to matter, that is his total theory of field would explain the particles through a general field. (Kaku 1994, p. 99)

²³ Pauli, Dirac, Heisenberg, Feynman and others tried to replace the infinitesimal points with “bubbles” or small oscillating particles. However, such theory would contradict at least one of two principles: the conservation of quantum probability (i.e., the physical objects cannot instantaneously disappear) and the impossibility to pass the speed of light. (Greene 1999, p. 176) As we saw above, the notion of probability is just an epistemological tool for us and, more than this, an entity can instantaneously disappear from one EW; we can find just something from another EW that would correspond to that entity. This idea is related to Smolin’s idea (through introducing discontinuous space-time) and Greene’s perspective within the string theory to stop the regression *add infinitum* that produces the infinities. (See below)

complete theory – that combines all fields, including the gravitational one – has to contain certain equations for the total field but the particles have to be solutions without singularities to these equations. (Einstein (5), p. 189)

(2) The general theory of relativity does not explain the atomic structure of the matter. This failure is related to the fact that this theory could not explain quantum phenomena. (Einstein (4), p. 141) As we saw above, since 19th century, the physicists have been aware of the controversy produced by two elementary concepts: the particle and the field.²⁴

After the appearance of the two main theories from physics, the quantum mechanics and the general theory of relativity, the new question is how we can explain one world with two scientific fundamental theories? According to Greene, because of the enormous experimental success of the Standard Model from quantum mechanics in explaining those 3 forces and their related fields, physicists have been looking for a quantum theory of field for gravitational force. Such research would require the acceptance of the existence of graviton. (Greene, p. 144) This is the context that generated essential problems in physics. We have to remember that in quantum mechanics, as in Newton’s theory, we have infinitesimal (mathematical) points. “But whenever physicists tried to perform simple calculations to calculate quantum corrections to Newton’s and Einstein’s law of gravity they found that the result is infinite, which is useless.” (Kaku 1994, p. 138) In fact, the usual renormalization rules do not work for applying them to the theory of quantum gravity. (Kaku, p. 140) When we replace the photon with the graviton, the gravitational force is centered in one single point and the results are infinite. An essential concept to quantum theory is Riemann’s mathematical point (Greene 1999, p. 253), but the string theory (with strings as the smallest entities in the universe) and Smolin’s theory of quantum gravity (with his discontinuity of space) try to avoid the regression *add infinitum* that produces the infinities. In footnote 37, Greene mentions that during the development of the quantum theory of those 3 forces, the results of the calculations were infinite. Later, the physicists introduced the renormalization.²⁵ The infinities from quantum mechanics were eliminated by ‘t

²⁴ Einstein hoped that this “embarrassing dualism” can be eliminated by a “total field theory” that would involve the derivation of material points and the equations of the movement of particles from the field equations. (Einstein (5), p. 169) In special theory of relativity, the physical reality is described through a continuous spatial functions and this is the reason that it is difficult to accept the material points within the calculation of fundamental field theory. (p. 180) We have to remember that the special theory of relativity is an extension of the Maxwell’s partial differential equations that reflects the continuity of space.

²⁵ For describing the interactions between two particles, we applied the perturbation theory. Feynman diagrams describe such interactions showing that a quantum is changed between, for instance, an electron and a neutrino. There were necessary some small corrections (or some loops to Feynman diagrams). In the first period, the calculations of quantum corrections instead of being small were infinite. The physicists introduced renormalization procedure to cancel these infinities. Nevertheless, the Yang-Mills field was too complicated for renormalization. Twenty years after the appearance of Yang-Mills field, ‘t Hooft demonstrated that the infinities of loop graphs (in Feynman diagrams) can be canceled. (Kaku 1994, pp. 119–120)

Hooft, but nobody could eliminate the infinities regarding quantum gravity. It has not been possible to renormalize those infinities that appear when we try to combine the theories of general relativity and quantum mechanics. (See Kaku, pp. 138–9) In this context, the question that arises is why it has been necessary to combine those two essential theories? Even if these two theories can explain different “aspects” of one world, in extreme conditions during Planck’s time, the density and energy of the universe were so great that physicists thought that we had to unify these two theories. From an EDWs perspective, we can say that, in Planck’s time, there was one EW with totally different entities/laws that appeared later in the micro and macro-EWs. So, the unification of those two theories seems to be a mistake! Greene emphasizes that physicists have recently realized that the infinite results are a signal that a theory is used beyond its limits of applicability! (Greene 1999, p. 414) From our viewpoint, the application of a theory beyond its limits of applicability means the application of that theory in an EDW than in which the theory was initially created! Moreover, from an EDWs perspective, we do not have any regression *ad infinitum* (infinite small dimensions) because by changing our conditions of observation we change the EWs. Somebody can ask how many EDWs are. We emphasize that the answer embraces a pragmatic and empirical viewpoint and it excludes a theoretical, abstract (*mathematical*) one: only a few. Vacariu replaced observations with interactions, so the EDWs are given by interactions between ED entities (Vacariu 2005, 2008). This framework shows us great differences between the *mathematical, idealistic* framework (with its infinities) and the EDWs framework! Regarding our observational viewpoint, the divisibility *ad infinitum* of a distance/object (from only a mathematical viewpoint) is replaced with the movement of our observations from one EW to another. The main problem here has been the partition and the difference between organizational and epistemological-ontological thresholds (About these thresholds, see Vacariu 2008). When we divide a particle/distance that belongs to an EW and we pass an epistemological-ontological threshold, we change that EW and our observation offers us information from another EW! Passing an organizational threshold, we get information about the organizational parts of that object/distance that belongs to the same EW1. At one moment in our partition, but only if we pass an epistemological-epistemological threshold, we observe entities and their interactions from another EW2. The entities/distances that exist in the EW1 do not exist in the EW2! Nothing disappears from EW1.

On the same line, we introduce some comments about *quantum gravity* (loop quantum gravity and relational quantum theory). (Smolin 2000) In this theory, the mistake is once again the unification of Einstein’s general theory of relativity with quantum mechanics, i.e., the mixture of two EDWs. Smolin considers that a quantum gravity theory has to combine Einstein’s notions of space and time with the relationship between the observer and the observed system (quantum mechanics). (Smolin, p. 13) From our perspective, we will analyze some ideas from Smolin (2000) that are necessary for applying quantum mechanics to cosmology.

(a) The quantum cosmology has to be a theory of information *changed* among subsystems of the universe (p. 210); the cosmological logic is intrinsically dependent on the observation because each observer observes a part of the world. (p. 42) We know that there are EDWs but there is no exchange of information between them. Nevertheless, we can find some *correspondences* that *relate* data to information from two EDWs.

(b) There are many observers but one world. (Smolin 2000, the title of Cap. 3); there is a kind of pluralistic version of quantum cosmology with only one universe; there are different mathematical descriptions that correspond to what different observers can see. (p. 63) This “cosmological pluralism” has to be replaced with the EDWs (that have different mathematical descriptions). Otherwise, serious contradictions and paradoxes will appear in the unicorn-world.²⁶ According to Smolin, an observer makes a quantum description always referring to a part of the world, even if the observer remains outside of that part. Nobody can see the whole Universe, so each description is incomplete. It is not about parts of the “world” but about EDWs and organizational and epistemological-ontological thresholds.

(c) Space is an aspect of the relations between things/objects (p. 28); the context is an essential notion in the relational quantum theory (Crane, Rovell, Smolin). (p. 62); the property of each part is determined by the relations with the other parts of the world (p. 81) and the universe is a network of relations between processes but not objects. Each entity from a network is the partial result of relations with other entities. (p. 213) We know that each entity is constituted by the interactions with other entities from the same EW. The context is the corresponding EW, or more exactly, the constitutive interactions of that entity with others entities. If Chris Isham considers that the context offers us the definition of “is”²⁷ (Smolin, p. 59), in our approach, this definition involves a double-relationship between entities and interactions: the entities determine the interactions, the interactions constitute the entities. Nothing can exist outside the universe (Smolin, p. 27), i.e., outside (of) the unicorn-world! In Smolin’s universe, only processes exist and no objects. (p. 63) However, with what kind of processes do we replace, for instance, the photons (that have no age after the Big Bang) or the planets that produce their gravity? Maybe with certain wave-processes in which particles are just appearances!

²⁶ Smolin believes that his theory solves the superposition paradox from quantum mechanics. Nevertheless, the superposition paradox (and many other paradoxes from science and philosophy) cannot be solved with the help of “observing different parts of the same world” because of the contradictions that appear within the unicorn-world. Two entities cannot exist at the same space and time. As it is showed in Vacariu 2008, the EDWs resolve much logically this and other paradoxes.

²⁷ The theory of toposes (Butterfield) inserts the dependence of context into mathematics. (Smolin, p. 61)

(d) Regarding black holes, we are interested in the relationship between entropy, information, black holes, atoms, and classical view of the world. Smolin emphasizes something essential for the EDWs: trying to find the significances of temperature and entropy produced the discovery of atoms, the temperature and entropy of radiation produced the discovery of quanta. The analogy tries to find the significance of temperature and entropy of a black hole that leads Smolin to believe in the atomic structure of space and time. (p. 123) In order to avoid the violation of the second law of thermodynamics (the entropy cannot decrease), there has to be an equilibrium between two very different things: the entropy of atoms/photons outside the black hole and the entropy of the black hole itself.²⁸ (p. 124) Thus, we have to relate somehow two very different things. From an EDWs perspective, the entropy (information) from outside a black hole only *corresponds* to the atoms. It seems that the entropy of a black hole has nothing to do with atoms or information. It is a measure of a quantity related to the geometry of space and time, being proportional to the horizontal area of black hole. (Smolin, p. 124) Moreover, quantum gravity needs to explain black holes singularities where the density of matter and the intensity of gravitational field are infinite. There are some speculations according to which the quantum effects will eliminate the singularities: by using techniques of approximation in which the matter that forms the black hole is analyzed from a quantum viewpoint and the geometry of space and time is studied in a classic way.

To solve these problems, we can make an analogy between a simple table and a black hole in an EDWs perspective. Using a tool of observation (our eyes), we observe a table that belongs to the macro-EW. Using a telescope, we can indirectly observe a black hole. Its horizon is a characteristic of a massive entity that belongs to the macro-EW. Using a microscope, we observe the atomic structure that corresponds to a table. From our calculation (Einstein's general theory of relativity applied beyond its limits), we deduce the existence of the singularity of a black hole. We try to apply the quantum gravity because the density of the matter is infinite. The analogy is thus complete. From an EDWs perspective, we do not need to establish any equilibrium between two different entities.²⁹ Such equilibrium would require the unicorn-world framework! Now we can understand much easier the above speculation for the elimination of singularities (i.e., the infinities): the

²⁸ Greene considers that Hawking realized a partial fusion between general theory of relativity and quantum mechanics from which we can find the numeric value of entropy of a black hole, but it did not offer information about the microscopic significance. (1999, p. 255)

²⁹ Greene suggests that Bekenstein was not only right with his analogy between the physical laws of black holes and the laws of thermodynamics. Hawking showed that it is about an *identity* and not only an analogy. Black holes have entropy and temperature. "And gravitational laws of black holes are nothing more than a reinterpretation of the thermodynamics laws within a very exotic gravitational context." (Greene 1999, p. 354) Here it is something like making an identity between brain and mind within the unicorn-world! Against the identity theory from an EDWs perspective, see Vacariu (2005, 2008).

analysis of matter using the quantum theory means that this matter belongs to the micro-EW, while the fact that the geometry of space and time is studied from a classical viewpoint means that these characteristics refer to the macro-EW. Therefore, to solve the puzzle of black holes, we have to mix two EDWs!

In order to avoid Riemann's geometry with its mathematical points that produce the infinities, Smolin introduces the discontinuity of space in his theory of quantum gravity. According to Bekenstein's margin (limit), the entropy (= information) is proportional to the horizontal area that is limited.³⁰ On the contrary, the continuity of space would involve infinite information that contradicts Bekenstein's margin. Thus, the space cannot be continuous. From our perspective, the continuity of space would not involve an infinite amount of information. Bekenstein's margin is available for a macro-entity (the area of a horizon) that belongs to the macro-EW. When analyzing smaller and smaller areas, we do not admit a regression *ad infinitum* (infinite small dimensions) because we change our observations from one EW to another! Therefore, we can re-interpret Bekenstein's margin: any EW has certain limits of information given by the existence of constitutive interactions. The dichotomy on continuum-discontinuum space is replaced by the existence of EDWs. The discrete space-time produced by quantum fluctuations below Planck's scale are just simple Ptolemaic epicycles in the unicorn-world.

The loop quantum gravity theory implies an atomic structure of space (Smolin, p. 125) that avoids the quantum fluctuations. This idea is in contradiction with Smolin's framework. If the relations between objects produce the space, then we have to define the objects and then the space. Why to define the space *a priori*? We have to recall that the fields (waves) and particles belong to the EDWs. In this way, we stop that regress *ad infinitum* that produces the infinities. Smolin enumerates two ways to avoid these infinities: to give up the continuity of space or to accept a kind of dualism (fields and particles, fields and loops, or fields and strings) of nature. (p. 139) Both ways require the existence of EDWs and not aspects or parts of the same universe! Under Einstein's umbrella, Smolin thinks that the field theory has to explain the particles. (p. 139) As we saw above, the field theory is full of infinities and Smolin believes that this is the main reason for which we have to give up the continuity of space.³¹ (p. 139) In this way, we can eliminate the infinities! Introducing Wilson and Polyakov loops, Smolin considers that these loops define the space. The quantum geometry becomes discontinuous. The loop quantum theory of gravity requires a discontinuous quantum geometry. (p. 158) In the unicorn-world, there are certain pseudo-alternatives for eliminating these old and infamous mathematical infinities.

³⁰ Bekenstein's margin is related to Einstein's theory because the margin is a consequence of Einstein's equations. But Jacobson showed that these equations can be deduced from the thermodynamic laws and Bekenstein's margin. (Smolin 2000, p. 208)

³¹ Again Einstein: Heisenberg's principle describes nature through a pure algebraic method that eliminates continuous functions from physics! (Einstein (3), p. 125)

(e) Another notion strongly related to us perspective is the holographic principle. A hologram means the reproduction of a tridimensional visual image onto a bidimensional screen. Working within the unicorn-world, the physicists have invented quite interesting Ptolemaic epicycles for solving different problems/paradoxes of quantum theory. (See Vacariu 2008) One of the last such Ptolemaic epicycle seems to be the holographic principle (initiated by 't Hooft and developed by Susskind – based on the work of Crane, Rovelli, Smolin and Markopoulou – Smolin, p. 210), mentioned by Greene in one of the last footnotes (139) but analyzed in detail by Smolin (Chapter 12, pp. 203–214). Susskind and 't Hooft suggest that all physical events would have an encoded form given by equations defined onto a space with less dimensions. We have to remember that the entropy of a black hole is determined by the area of the surface and not by the volume of the horizon of events. Therefore, the entropy and information of a black hole are encoded into the data of the bidimensional surface area. The horizon of the events of a black hole would act as a hologram containing the whole information on the tridimensional area inside of a black hole. Susskind and 't Hooft generalized this idea to the whole universe.³²

This principle was inspired by Bekenstein's margin: the quantity of information of a physical Object is proportional to the area of that object and not to its volume. (Smolin, p. 206) According to Smolin, this principle has two alternatives: strong and weak. The strong alternative: from an analogy with the relationship between the screen of a computer and an object inside the memory of a computer, we can think that all information we can get regarding that object is from the area of the screen (that is finite) and not from the object itself. Bekenstein's margin tells us that

Information \propto $\frac{1}{4}$ area of the screen

The observer can interact only with the screen but not with the object. However, the information sent by the observer to the screen reaches somehow the object. The pixels of the screen provide us the whole information. The strong principle is this one: the world is constructed such that the description of each physical object is given by the screen of an imaginative computer. From us perspective, the relationship between the object, the screen and the observer is given by the EDWs! For instance, a table *corresponds* to a network of microparticles and the surface of that table is the screen for that network.

The weak alternative is more interesting to us perspective: the world is not made of objects but of Screens. Such screens represent the world! The only things that exist are such representations through which "a set of events from the history of the universe receives information about the other parts of the world." (Smolin,

³² Some physicists consider that the string theory incorporates this principle. More than this, they believe that the holographic principle can lead to the 3rd revolution of the superstring theory! (Greene 1999, p. 428, footnote 139)

p. 212) In such world, there are only processes. The area of a screen is just the capacity of that area to transmit information. Therefore, space is nothing more than different channels of communication that allow information to pass from one observer to another. Geometry is a measure of the capacities of these screens to transmit information. By measuring the flux of information in the universe, the observers get the geometrical quantities (like the areas of surfaces). (p. 213) In this way, the world is a network of holograms, each containing encoded information about other holograms. The world is a network of relationships that involve nothing else than information. "Each element from the network is nothing else than a partial result of the relationship among the other elements." The history of the universe is nothing but a flow of information.³³ (p. 213)

We saw at point (d) that some paradoxes regarding the black holes have appeared just because of the mixture of two EDWs. Even if the holographic principle is quite close to EDWs perspective, we can find here the same mistakes. We can get information about one EW analyzing the very approximate correspondence between entities/processes from another EW. Moreover, the "world" is not a network of holograms; the hyperworld is the sum of EDWs, but we have to remember that the hyperworld is an abstract notion. The EDWs exist without any relations or communications between them. Changing the conditions of observation, only human beings can find certain correspondences among entities and their interactions from the EDWs. The "universe" is not a "flux of information" but only these EDWs that exist without us getting information about them!

5. THE (SUPER)STRING THEORY

The main idea from the string theory is that the fundamental elements that constitute any microparticle in the Standard Model are some 10-dimensional strings (or 11-dimensional, according to Witten's work at the middle of the '90s). Different modes of oscillations of fundamental strings produce different masses/power of forces. The string theory unifies all those forces, including the gravitational force.

I make a brief presentation of the main steps: in 1919, Kaluza sent Einstein an article regarding the theory of fifth dimensions that unifies the theory of gravity with Maxwell's equations for electro-magnetic fields³⁴. Later (in 1926), Klein improved this theory but the theory failed because "The fifth dimension was curled

³³ At the end of Chapter 12, Smolin emphasizes that this principle is a new and very controversial one. Even if this principle is a consequence of Einstein's general theory and quantum mechanics, it is possible the relationship to be vice-versa! (Smolin 2000, p. 205)

³⁴ Even if Einstein was very surprised by Kaluza's approach of proposing the Riemann metric in five dimensions for unifying the theory of gravity with light (Maxwell's equations), but later, he rejected Kaluza-Klein's approach considering that contains more arbitrary elements than the original theory. (Einstein (3), p. 118) and (Kaku 1994, pp. 99–105)

up into a tiny circle the size of the Planck length was not testable.” (Kaku 1994, p. 107) In the ‘60s, the theory re-started with Veneziano and later Susskind, Schwarz, Scherk and others. (Greene 1999, pp. 1554–9 and Kaku 1994) Between 1984 and 1986 the “first revolution” took place in string theory with Green and Schwarz who showed that the quantum conflicts from the string theory can be eliminated. (Greene 1999, p. 156–7) The second revolution took place in 1995 and it was made by the famous Edward Witten who made some suggestions about M theory unifying all five particular string theories.³⁵

To me, the amazing thing is that such incredible theory in physics, the superstring theory, without any empirical results or even support, has dominated physics in the academic environment of USA for so many years (20–25 years)! We do not make any history about this theory, but we will analyze some essential notions that have no empirical support.

The most important notion of this theory is the 10 or 11 spatio-temporal framework. Coming from a mathematical combination of Einstein’s theory of general relativity and quantum mechanics, the string theory is totally abstract.³⁶ As we saw above, there have been different reasons for combining these two incompatible pillars of physics, one referring to big entities (planets, stars) and the other to micro-entities (photons, electrons, etc.). One is about the extreme conditions of the “universe” during Plank’s time. Moreover, in the unicorn-world, it is understandable that the planets and the electrons are in the same universe at the same time. In the unicorn-world, the trajectory of a photon is curved by the gravity produced by different planets/stars. Thus, to explain its trajectory, we need the general theory of relativity. Nevertheless, the electron interacts not only with the other microparticles but also with planets and tables, so we need the quantum mechanics. As we saw, from our viewpoint, micro and macro-entities belong to EDWs, so it is forbidden to combine these two theories. We have to remember the essential thing that the viewpoint of a microparticle/planet is different than our viewpoint (the electron interacts with a sum of microparticles that correspond to a planet (or a table) and all such viewpoints have the same objective reality regarding each EW. Even today we can see the photons that we free to travel into the universe, 300,000 years after the Big Bang: the temperature decreased a few thousand grades, the first neutral atoms appeared and the photons could move freely within that “universe” that became transparent (this idea is proved by the cosmic background radiation). After one billion years, the first planets, stars and galaxies and their gravity appeared. We recall that gravity is produced only by the massive objects like planets/stars. So why do we need to insert the gravity when (in)

³⁵ The majority of the physicists from the string theory consider Witten as the most brilliant living physicist. He was compared even with Einstein.

³⁶ Against the string theory, see Woit 2004 and 2006 or a book written by Smolin in 2006. (We had no access to the last book.)

explaining the first EW – a micro-EW - without any planet/star?³⁷ Here we have again a break of Kant-Hanna rule. We do not know any of those characteristics of that special-EW where the temperature and density were so high, and we cannot deduce them by comparing that EW with the micro or macro-EWs!

As we saw above, because of Heisenberg’s principle, the physicists consider that below the Planck’s scale (ultramicroscope space), there is a kind of “quantum foam”, i.e. those quantum fluctuations (Wheeler) that represent the notorious incompatibility between the principles of the main theories: the geometrical space without curvature available for great distances (the general theory of relativity) and the uncertainty principle (quantum mechanics).³⁸ We analyzed above the issue on the relationship between Riemann’s geometry and the mathematical points and gravity (the infinities). The string theory eliminates this problem: the strings are the smallest entities that exist in the universe and so, from a pragmatic reason at least, we can conclude that the quantum fluctuations at ultraquantum level do not exist! (Greene, pp. 174-5) The mathematical formalism with infinitesimal points from Riemann’s framework that explained the curvature of space is avoided through the limitations imposed by the dimensions of strings. Thus, “the Riemannian geometry” of infinitesimal particles based on the distance between points is modified at ultramicroscope scale by the string theory.”³⁹ (Greene 1999, p. 253)

The interactions between two microparticles are replaced by the interactions between two strings. To avoid those infinities produced by the gravitational force and gravitons, the strings create a flat area of interactions, so we have no kind of fluctuations at ultraquantum level. (Greene 1999, p. 182–4) As we emphasized before, we can avoid some of such infinities with the existence of EDWs.

Such methods of creating odd abstract (mathematical) theories with applications to an extravagant landscape of “reality” contain some illicit extension of the relationships between mathematics and the world. In general, in these cases, the Kant-Hanna’s rule is avoided. (See also the motto of this article) In Chapter 2, Kaku wrote the incredible story about Riemann’s life, his metric tensor for n-dimensions space, his idea of the equivalence between geometry and force and about a geometrical unification of all forces. Trying to unify all the forces from that

³⁷ Again the same pseudo-problem: within the unicorn-world, the physics can think that until we do not understand how the space is flat at the macro-scale as a result of quantum interactions, we will not be able to understand what the graviton is and its relationship with classical space and time. (Smolin 2000, p. 221)

³⁸ Even if the physicists have been aware that these theories are available only for different entities and distances, nobody have thought about the existence of EDWs so many decades! We have to be aware that the microparticles cannot interact with/observe massive entities or cannot observe great distances and the planets cannot interact with/observe small entities or observe microscopic distances!

³⁹ Greene wrote something like this: the string theory re-write the laws of geometry for short distances so that what seemed to be a cosmic collapse in the past can be seen now as a cosmic *jump*! (1999, p. 259) From our view point, it is about our observational jump from one EW to another.

time, Riemann believed that electricity, magnetism and gravity “are caused by the crumpling of our three-dimensional universe in the unseen fourth dimensions”. (Kaku 1994, p. 36) He was convinced that the laws of nature are simple when expressed in higher-dimensional space.⁴⁰ (Kaku, p. 37) Einstein applied successfully the same principle in the elaboration of his special theory (creating the framework with four dimensions), but we believe that the extension of this principle to a higher dimension for explaining all four forces is totally illicit! We saw above that trying to unify those three forces from micro-EW with gravity (that belongs to macro-EW) is a mistake. Moreover, we have to take into account that Riemann (and Einstein) could not unify gravity with electricity and magnetism. The extension of Riemann’s principle to more than what Einstein did is really a myth (the string theory)!⁴¹ We believe that the same wrong paradigm of thinking is applied for creating other notions from physics (the string theory) like supersymmetry and superparticles, supergravity and the interpretation of black holes.⁴² With a mythical belief (believe) in mathematical power, some people with (a) strong imagination have (has) created many myths since the Ancient period. There are other people (mainly from physics) who reject the string theory but only for (from) pragmatic reasons, mainly because that there are no empirical results/confirmations of (for) this theory or even worse, there are no possibilities for such confirmation in the future.⁴³ With EDWs paradigm, within a

⁴⁰ Kaku wrote about a discussion that took place in Romania in 1953 between Peter Freund (borned in Romania) and his professor, George Vranceanu, regarding more dimensions as an answer to the question “Why should light and gravity be so disparate?”. (Kaku 1994, pp. 104–5) As Riemann, Freund was convinced that the laws of nature are more simple in higher dimensions.

⁴¹ The title of Chapter 2 from Kaku’s book is “Mathematicians and Myth”!

⁴² For string theory it has been the same problem for understanding black holes: the incompatibility between big objects (the area of a black hole) and small objects (“its” singularity) that reflects the incompatibility between Einstein’s general theory and the quantum mechanics. Greene (with Morrison and Strominger) discovered a direct relationship between black holes and elementary particles. They showed that a new type of vibration of the strings with mass zero that appears due to a special transaction with “broken space” of a Calabi-Yau form of space is “*a microscopic description of a particle with mass zero in which the black hole has been transformed.*” (Greene 1999, p. 348) They introduce an analogy regarding the phase transition (due to the variations of temperature) between the water-ice and black hole-microparticles. Greene is convinced that the topological forms of supplementary dimensions of Calabi-Yau determine some physical structures to appear as black holes (the first phase of Calabi form) or as elementary particles (the second phase). (Greene, p. 349) There are thousands of Calabi-Yau forms and nobody has any idea which of these forms fit with the equations from the string theory. (Greene, p. 238) We can speculate this situation saying that the transition from one EW to another presupposes a “broken space” of Calabi-Yau that is the imaginative space of the hyperverses! Greene is even wrong in saying that the black holes and elementary particles are two sides of the same coin. (p. 349) We have here again the theory of identity (philosophy of mind) within the unicorn-world.

⁴³ The strings have usually Planck extension but the those with much more energy can be much bigger. With its energy, Big Bang could produced astronomical strings! Witten thinks that nothing can be a better proof than to see a string with a telescope! (Witten in an interview from 1998 in Greene 1999, p. 245).

hyperontological framework, we offer the philosophical foundations for rejecting the string theory. Moreover, this theory was created using nothing else but certain illicit extensions of some concepts/principles from particularly successful scientific theories to a “no man’s land”. The abstract notion of hyperverses from EDWs perspective is transformed in a “universe” with 10-dimensions into one, among thousands, pure mathematically form of Calabi-Yau!

7. CONCLUSION

This article (together with Vacariu 2008 and 2005) represents the philosophical framework for the rejection of the unicorn-world paradigm that has created so many and essential controversies and paradoxes in science and philosophy during the history of human thinking. In physics, the worst think is the compulsive research for the unification of all four ED forces!

The problems from physics that we analyzed in this article are not accidental. They have followed a long line of disputes between two branches of thinkers. One part has embraced Plato’s philosophy of eternal Ideas constructed within a mathematical framework. (Plato himself worked within the Pythagoras mathematical frame.) Usually, the people that work in the string theory think in these terms: from a mathematical viewpoint, the “world” has to be perfectly, beautifully and mathematically constructed. The universe has to be like a perfect music or to have a cosmological musical structure!⁴⁴ We enumerate just a few elements from this branch: Pythagoras, Plato, realism (Middle Age), Kepler, Riemann, Einstein with his total theory of everything, and the proponents of the string theory. Nevertheless, even working within the unicorn-world, Einstein was right saying that “God does not play dice” and his sentence quoted as the motto of this article reflects the relationship between mathematics and “reality”: “when the mathematical propositions refer to reality, they are not sure and when they are sure, they do not refer to reality.”⁴⁵ (Einstein (1), p. 37)

The other part is under Aristotle’s umbrella. Earth and life have nothing to do with “perfection”. We can find here the nominalism, Copernicus, Darwin, Freud, Gödel, many physicists from quantum theory and those against the string theory. Related to these disputes, within the first part, is the idea of unifying everything in the universe. In a correct way, Newton related sky and stones on the earth, Maxwell related electricity to magnetism, Einstein related space and time, acceleration to gravity, and Glasgow, Salam, and Weinberg unified strong and weak micro-forces. But the extension of such unification is obsessive in physics where we have the obsession of unifying various entities – Grand Unification

⁴⁴ The title of Greene’s one part of his book is “The cosmological symphony”!

⁴⁵ We can add here that mathematical infinities from physical theories do not refer to “reality”! As we saw, they show us the limits of those physical theories, i.e., the limits of EDWs.

Theory (GUT) or unifying everything, Theory of Everything (TOE). (Against these unifications, see Maudlin 1996) However, we have some physicists who oppose this myth of unification like Anderson and Morrison (see 6.10 from Vacariu 2008) or those against the string theory like Woit and Smolin. The EDWs perspective is against the unification of all those four forces! Following Einstein's words (see the motto), this article (and Vacariu 2008) is against this *idealization* of "nature". Nature or reality does not even exist! Then why are we trying to unify all those forces? This route of unification is a Platonic myth and if we want a successful direction in science then we have to give up this notion, the "world" and its "unity". The unicorn-world is probably the most powerful pseudo-notion in our thinking that has dominated the human thinking since the Ancient period. In order to prevent all the above mentioned infinities, we have to return to Aristotle's slogan: stop somewhere to avoid the regression *add infinitum*! The EDWs perspective is a breaking point for such regressions *add infinitum* and it offers the new "reality" against a mythical and mystical way of thinking that involves a double mistakes: the unicorn-world and its "idealization" (mathematization).

REFERENCES

- Anderson, P. W., 1972, "More is different", *American Association for the Advancement of Science* 177, pp. 393–396.
- Dyson, J. Freeman, 2004, "Thought-experiments in honor of John Archibald Wheeler", in D. John Barrow, C. W., Paul Davies, L. Charles Harper, 2004, *Science and Ultimate Reality: Quantum Theory, Cosmology and Complexity*, Cambridge University Press.
- Einstein, Albert, 1992, *Cum vad eu lumea*, Editura Humanitas: articles (in Romanian) selected by M. Flonta and I. Parvu from *Mein Weltbild*, Querido Verlag, Amsterdam, 1934 and *Out of My Later Years*, Philosophical Library New York, 1950:
- (1) Geometrie și experiență, pp. 37–45 (Geometry and experience, 1921).
 - (2) Mecanica lui Newton și influența ei asupra evoluției fizicii teoretice, pp. 46–53 (Newton's mechanics and its influence on the evolution of theoretical physics).
 - (3) Fizica și realitatea, pp. 98–133 (Physics and reality, Franklin Institute Journal, vol. 221, 1936).
 - (4) Fundamentele fizicii teoretice, pp. 134–147 (The fundamentals of theoretical physics, Science vol. 91, 1940, pp. 487–492).
 - (5) Note autobiografice, pp. 154–199 (Autobiographical notes in Einstein, Albert: *Philosopher-Scientist*, Open Court, la Salle, Illinois, 1949).
- Friedman, M., 2001, *Dynamics of Reasoning*, CSLI Publications, Stanford, California.
- Greene, Brian, 1999, *The Elegant Universe*, Vintage Books (In Romanian: 2008, *Universul elegant: supercorzi, dimensiuni ascunse și căutarea teoriei ultime*, Editura Humanitas).
- Greene, Brian, 2004, *The Fabric of Cosmos; Space, Time and the Texture of Reality*, Vintage Books, New York.
- Hanna, Robert, 2001, *Kant and the Foundations of Analytic Philosophy*, Clarendon Press: Oxford University Press.
- Kaiser, D., 1992, "More roots of complementarity: Kantian aspects and influences", *Stud. Hist. Phil. Sci.*, vol. 23, No. 2, pp. 213–239.
- Kaku, Michio, 1994, *A Scientific Odyssey Through Parallel Universes, Time Warps, and the 10th Dimension*, Oxford University Press.

- Kant, Immanuel, *The Critique of Pure Reason*. Trans. N. K. Smith, New York, Modern Library, 1958.
- Maudlin, Tim, 1996, "On the unification of physics", *The Journal of Philosophy* 93, no. pp. 129–144.
- Morison, Margaret, 2006, "Emergence, reduction, and theoretical principle: rethinking fundamentalism", *Philosophy of Science* 73, pp. 876–887.
- Penrose, Roger, 2004, *The Road to Reality. A complete Guide to the Laws of the Universe*, Jonathan Cape London.
- Putnam, H., 2005, "A philosopher looks at quantum mechanics (again)", *British Journal of Philosophy of Science* 56, pp. 615–634.
- Smolin, Lee, 2000, *Three Roads to Quantum Gravity*, The Orion Publishing Group Ltd. (In Romanian, 2006, *Spatiu, timp, univers*, Editura Humanitas).
- Tegmark, Max, 2004, "Parallel universes", in D. John Barrow, C. W. Paul Davies, L. Charles Harper: 2004, *Science and Ultimate Reality: Quantum Theory, Cosmology and Complexity*, Cambridge University Press.
- Tegmark, Max and Wheeler, John Archibald, February 2001, "100 years of quantum mysteries", *Scientific American*.
- Vacariu, Gabriel, 2008, *Epistemologically Different Worlds*, (in English) University of Bucharest Press (and at <http://www.ub-filosofie.ro/gvacariu>).
- Vacariu, Gabriel, 2007, "Kant, philosophy in the last 100 years and an epistemologically different worlds perspective", *Revue Roumaine de Philosophie*, vol. 51.
- Vacariu, Gabriel, 2005, "Mind, brain and epistemologically different worlds", in *Synthese Review*, vol. 143, no. 3.
- Woit, Peter, 2006, *Not Even Wrong - The Failure of String Theory and the Continuing Challenge to Unify the Laws of Physics*, Jonathan Cape, London.
- Woit, Peter, 2007, "The problem with physics", *Cosmos* 16, pp. 48–56.
- Zeh, H. Dieter, 2004, "The wave function: it or bit?", in D. John Barrow, C. W. Paul Davies, L. Charles Harper, 2004, *Science and Ultimate Reality: Quantum Theory, Cosmology and Complexity*, Cambridge University Press.