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Chapter

Rethinking “Dark Matter” within the Epistemologically Different World (EDW) Perspective

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*The really hard problems are great because we know they'll require a crazy new idea.
(Mike Turner in Panek 2011, p. 195)*

Abstract

In the first part of the article, we show how the notion of the “universe”/“world” should be replaced with the newly postulated concept of “epistemologically different worlds” (EDWs). Consequently, we try to demonstrate that notions like “dark matter” and “dark energy” do not have a proper ontological basis: due to the correspondences between two EDWs, the macro-epistemological world (EW) (the EW of macro-entities like planets and tables) and the mega-EW or the macro-macro-EW (the EW of certain entities and processes that do not exist for the ED entities that belong to the macro-EW). Thus, we have to rethink the notions like “dark matter” and “dark energy” within the EDW perspective. We make an analogy with quantum mechanics: the “entanglement” is a process that belongs to the wave-EW, but not to the micro-EW (where those two microparticles are placed). The same principle works for explaining dark matter and dark energy: it is about entities and processes that belong to the “mega-EW,” but not to the macro-EW. The EDW perspective (2002, 2005, 2007, 2008) presupposes a new framework within which some general issues in physics should be addressed: (1) the dark matter, dark energy, and some other related issues from cosmology, (2) the main problems of quantum mechanics, (3) the relationship between Einstein’s general relativity and quantum mechanics, and so on.

Keywords: universe, dark matter, epistemologically different worlds, correspondence, clusters of galaxies, cosmic filaments, “standard” Lambda-CDM model of cosmology

1. The epistemologically different worlds (EDWs): principles concerning the existence and the interactions of “epistemologically different entities”

In our previous works, working on the mind-body problem, we demonstrated the existence of epistemologically different worlds (EDWs).¹ Later, we applied this perspective to the main problems of quantum mechanics (entanglement, nonlocality, etc.) and then to the relationship between micro-entities and macro-entities. We constantly believed that the greatest problems of particular sciences are philosophical problems that require a new framework of thinking.²

In this chapter, we rethink one of the most important notions in cosmology today, the “dark matter,” within the EDW perspective. Therefore, let us introduce, very shortly in this section, the EDW perspective.³ We will illustrate the principles referring to the existence of nonliving objects and their interactions, in general. The questions to start with are as follows. Do the micro-entities and the electromagnetic waves really exist? Do the macro-entities (and gravity) really exist? Within the EDW perspective, the main idea has been that the “universe”/“world” cannot even exist; what really exist are epistemologically different worlds (EDWs).

We introduce the five principles concerning physical objects and their interactions:⁴

1. Epistemologically different interactions constitute epistemologically different objects, and epistemologically different objects determine epistemologically different interactions.
2. Any object exists only at “the surface,” due to the interactions that constitute it.
3. Any object exists in a single EW and interacts only with the objects from the same EW.
4. Any EW (a set of objects and their interactions) appears from and disappears into nothing.
5. Therefore all EDWs share the same objective reality, even if one EW does not exist for any other EDW ([7], pp. 25-26).

Every object exists in only one epistemological world (EW). It means that the object exists and interacts only with entities from the same EW. The electromagnetic waves, the microparticles, and the planets existed long before man appeared on the earth. The interactions of an entity constitute the surface of that object. The macro-objects interact among them; the micro-entities interact among them; and the electromagnetic waves interact among them. Essentially, a macro-entity does not exist for a micro-entity; an electromagnetic wave does not exist for either the micro-object or macro-object. There are only correspondences between ED entities that belong to the EDWs: a macro-object corresponds to a micro-object which corresponds to an electromagnetic wave. Obviously, all macro-objects exist in the macro-EW, and all

¹ In 2016, we tried to prove that in cosmology scientists deal pseudo-notions, such as dark matter, dark energy, the existence of space and time (or spacetime), inflation, and so on and so forth. For instance, taking into account the theory of simultaneous “Big Bang”, the notion of “inflation” can be rejected (Alan Guth, etc.).

² Paul Dirac believed that the greatest problems of quantum mechanics were philosophical problems.

³ For more details, see our previous works.

⁴ These principles appeared in Gabriel Vacariu’s previous works [1–6].

micro-entities exist in the micro-EW. A macro-object or a micro-entity exists just because it interacts with entities from the same EW. An electron exists just because it interacts with the microparticles from the same EW. An electron does not exist/interact for a table/planet but for an amalgam (which corresponds with that table/planet). Until we discovered the EDWs, physicists believed that a macro-entity is “identical” with an amalgam of microparticles. However, a table/planet is not identical with an amalgam of microparticles because the macro-entities and the micro-entities have different properties. For instance, we cannot reduce gravity to micro-entities. Also, we cannot reduce a microparticle to an electromagnetic wave.

In this context, we introduce our main assumption: *two objects cannot exist in the same place, at the same time*. Consequently, we cannot assume that a table and the corresponding amalgam of microparticles are “different (set of) entities in the same world,” and there is no point in claiming that the microparticles “form” or “compose” a table or a planet. Composition, emergence, supervenience, and identity are all obsolete notions created within an obsolete framework—the “universe”/world, or what we called the “unicorn world.” In this context, we can indicate that a planet appeared out of “nothing” (within the macro-EW) but this macro-EW corresponded to the micro-EW.

One of the greatest problems in the history of human thinking was the relationships between various “entities.” “Causality” is one of the main problems in the history of human thinking. Causality is strongly related to the “physical laws.” Related to “causality” is the notion of “levels.” It is meaningless to check for the causality between entities that belong to EDWs, since one EW does not exist for any EDW. We can talk about “causality” only between two entities that belong to the same EW, but not about causality that refers to entities that belong to EDWs! Searching for the “causalities” between the entities that belong to the EDWs has created many Ptolemaic epicycles during the entire history of human knowledge. Also, we have to mention here that some EDWs (the micro-EW or the macro-EW, for instance) do not really exist, that is, they do not have their ontologies; what really exist there are certain ED entities and their interactions that only *represent* those EDWs for us.

As observers, in order to observe (*indirectly*, through correspondences) the entities in a particular EW, we need certain conditions of observation. For example, we can observe an electron through a microscope (which can be regarded as a macro-object), but this is an indirect observation as the electron belongs to a micro-EW. The electron does not interact with the brain or the body of the researcher and not even with the microscope itself (a macro-object), but it interacts with an amalgam of microparticles that *corresponds* to that electronic microscope.

Through the processes, we observe entities belonging to EDWs are indirect and occur through *correspondence*, even in the case of macro-objects, not just for the micro-objects. We can change our conditions of observation in order to change observing indirectly EDWs. With our eyes, we can observe, indirectly (our mind-EW is involved) a table. By changing our conditions of observation (adding an electronic microscope), we can see, indirectly, an amalgam of microparticles which corresponds to that table. The table interacts with other macro-entities (a cup, a book placed on top), and this is the reason we consider that the table really exists. At the same time, an amalgam of microparticles that *corresponds* to a cup interacts with an amalgam of microparticles that corresponds to that table. In the world of microparticles, any macro-entity does not exist. In the world of electromagnetic waves, any microparticle or macroparticle does not exist!

In conclusion, the universe/world does not really exist but the EDWs do⁵. More exactly, the ED entities (like the macro-entities, the micro-entities, the

⁵ We emphasize that EDWs are totally different than “parallel worlds/universes” from actual physics.

electromagnetic waves) and their interactions really exist in the EDWs. We repeat the main principle of EDW perspective: one EW does not exist for any EDW!

2. Rethinking “dark matter” within the EDW perspective

The most difficult problem of cosmology in our days is the dark matter and dark energy. What is dark matter? Contemporary thinkers believe that the gravity of:

[...] dark matter must therefore be the “glue” that holds galaxies like our own together. The fate of the universe itself seems to hinge on the total amount of dark matter and the properties of a mysterious form of energy—often called dark energy—that appears to be counteracting the effects of gravity on large scales ([8], p. 445). Dark matter is the name given to mass that emits no detectable radiation; we infer its existence from its gravitational effects... dark matter is the name we give to whatever unseen influence provides the gravity needed to explain the motions we observe. Dark energy is the name given to the unseen influence that may be causing the expansion of the universe to accelerate with time. ([8], pp. 446-447).

There are direct and indirect methods of detecting the dark matter [9].⁶ For instance, the amount of dark matter in a galaxy is determined by comparing the mass of the galaxy with its luminosity (mass-to-light ratio)⁷. The main problem is that plotting “the orbital speeds observed at different distances for most spiral galaxies shows that these speeds do not drop off with distance from the center (...)” [8]. It is believed that in the first billion years of the “universe,” dark matter had no role even if it was present in that period. In fact, we consider that the EW of dark matter (the mega-EW) appeared when, in the macro-EW, the galaxies and the cluster of galaxies were formed. It means that if any galaxy was not formed in a particular place, then there was no EDW with the mega-entities that correspond to the galaxies. Probably, there are mega-entities that correspond to the individual galaxies, but there are also mega-entities that correspond to the “clusters of galaxies.”

Let us introduce the chronological order of some people who have worked on the dark matter. Krauss [13]⁸ mentioned the names of some important people working

⁶ Using the gravitational lensing method, Gilman et al. [10] detected the “existence” of cold dark matter. Their results are in concordance with the “predictions of cold dark matter.” We emphasize that the results refer to the “sub-galactic scales.” These sub-galactic scales refer, in fact, to the mega-entities that exist in the mega-EW. “At present, there’s no direct evidence in the lab that dark matter particles exist,” Birrer said. “Particle physicists would not even talk about dark matter if the cosmologists did not say it’s there, based on observations of its effects. When we cosmologists talk about dark matter, we are asking ‘how does it govern the appearance of the universe, and on what scales?’” [11]. Obviously, there are no “dark particles,” and the scale is the mega-scale, that is, the mega-EW.

⁷ “We can determine the amount of dark matter in a galaxy by comparing the galaxy’s mass to its luminosity. More formally, astronomers calculate the galaxy’s *mass-to-light ratio* (see Cosmic Calculations 16.1). First, we use the galaxy’s luminosity to estimate the amount of mass that the galaxy contains in the form of stars. Next, we determine the galaxy’s total mass by applying the law of gravity to observations of the orbital velocities of stars and gas clouds. If this total mass is larger than the mass that we can attribute to stars, then we infer that the excess mass must be dark matter” [8]. “There was clearly a discrepancy between the luminous mass observed with telescopes and the mass inferred from dynamical measurements (...)” ([12], p. 25).

⁸ As many other physicists, Krauss [13] tries to show that the “Universe” appeared from “nothing” (even space and time). (For a short introducing to “Nothing” see also Close 2009) As we showed with the EDWs perspective, the universe/world does not exist but the EDWs are.

in cosmology in the first decades of the twentieth century⁹ (but we added other persons on his list): Lord Kelvin who introduced the “dark bodies” and Poincare (1906) who used the term “dark matter” [15]; Lemaitre who proposed the Big Bang in the 1920s; Hubble, one of the most important astronomers:¹⁰ together with Milton Humason, he proposed the “Hubble law” and radio astronomy pioneer [16].

Krauss mentioned a problem: “comparing with the abundance of light elements, the density of protons and neutrons produced by Big Bang should be doubled that it exists and consequently, it was necessary the introduction of “dark matter”, something mysterious that flowed between the stars and ran the whole gravitational show we call a galaxy” ([13], p. 46).¹¹

It has been supposed that the particles that produce the dark matter are weakly interacting massive particles (WIMPs), axion, neutrino, neutralino, or many other particles¹². It is completely meaningless to search for the microparticles that compose the “dark matter” since the mega-entities belong to the mega-EW. Therefore, the microparticles do not exist for the dark matter, and the dark matter does not exist for any kind of microparticles! Obviously, from our EDW perspective, there are no “atoms” (microparticles) that “form” the dark matter. The movements of the galaxies (their masses) have to be regarded in relationship with other galaxies and not with the masses of planets (the macro-EW) to “form” the galaxies. Within the macro-EW, the galaxies do not have any ontological status but only the planets that represent, for us, the galaxies. The same principle is available for investigating the relationship between the microparticles and the macro-entities: *there are ED laws for ED entities*.¹³ The microparticles *correspond* to the planets, so it would be wrong to consider that the microparticles “form” the planets. In consequence, it would be wrong to consider that the “planets form the galaxies”! Indeed, the “missing mass” is not “something else” in the macro-EW, but there are the mega-entities (the mega-EW) that correspond to the “galaxies” (the macro-EW)!¹⁴ In the mega-EW, the planets or the microparticles do not even exist; this EW has more ED entities and ED laws than the macro-EW or the micro-EW! From our viewpoint, dark matter does not exist within “our universe” at all! In fact, there are no “mysterious particles” that we cannot observe empirically since they do not exist in any

⁹ For the history of a longer period of cosmology, see [14].

¹⁰ “Hubble was able to use his measurement of Cepheids and Leavitt’s period-luminosity relation to prove definitively that the Cepheids in Andromeda and several other nebulae were much too distant to be inside the Milky Way” ([13], p. 31).

¹¹ “Take it [dark matter] away from a galaxy like our own Milky Way, and all its stars and planets would fly away like bullets in intergalactic space!” ([12], p. vii). One of the great reasons that support the existence of dark matter is that the “orbital speeds” in the Milky Way are very high even if the stars are very far from the center of the galaxy [8]. In contrast, because the gravitational field of the sun decreases with its distance from our solar system, the orbital speeds decrease with this distance!

¹² “Physicists have proposed literally tens of possible dark matter candidates, including neutralinos, gravitinos, sneutrinos, sterile neutrinos, axions, fuzzy dark matter, WIMPs, WIMPzillas, superWIMPs, self-interacting dark matter, cryptons, Kaluza–Klein dark matter, D-matter, branons, Q-balls, and mirror matter, to name a few” ([12], p. 61).

¹³ We emphasize that the expression “the ED entities” does not involve that one entity (from a particular EW) is the *sum* of other entities (from an EDW). For instance, a mega-entity that corresponds to a galaxy or cluster of galaxies has properties other than the properties of the planets (and their “empty space”) that represent, for us, the “galaxy.”

¹⁴ Until we have written this paper, we used the notion “the macro–macro-EW,” but based on Prof. Ilie Parvu’s suggestion, we replaced this notion with “the mega-EW.”

macro-EW¹⁵ that we have discovered. There are only some phenomena that involve the ED entities and the ED interactions that belong to an EDW! These phenomena only *correspond* to some strange phenomena that cannot be explained in the macro-EW. The macro-EW that contains macro-objects, planets, and stars that “form,” for us, the galaxies is not the largest macro-EW. In fact, “largest” has no meaning regarding the comparisons of EDWs. It is a notion that presupposes the notion of space (but in our book 2016, we indicated that space and time (or spacetime) cannot have any ontology. Moreover, an EW does not exist for any EDW, so the notion “the largest EW” has no meaning. A “galaxy” (no ontological status) in the macro-EW corresponds to an EDW, the mega-EW.¹⁶ Essentially, a star appeared with other planets that “formed in a flattened disk surrounding it” ([8], p. ...). This idea is quite important in explaining the “dark matter” of a “galaxy.”

Let us imagine a disk (a CD) threw in air by a human hand in an “empty space” (long distance from any planet and their gravitation). The CD will rotate exactly as a galaxy rotates. The margin of that disk rotates with a speed much greater than the speed of points closer to the center of the disk. The force acting on the disk (centrifugal force) corresponds to the micro-forces that bring together these micro-particles and their rotation even if we cannot understand the origin of this centrifugal force. In the micro-EW, there are the microparticles, their micro-forces, and their “dark” rotation. In the macro-EW, there is a disk with a centrifugal force (and maybe gravitational force). According to the principles of EDW perspective, the microparticles exist just because of their interactions within the micro-EW, and the macro-entities (stones, planets) exist because of their interactions within the macro-EW. The “dark matter” (the mega-entities) from the mega-EW corresponds to the planets and the empty space among them (which only represent, for us, the galaxies). Essentially, from the EDW perspective, *the mega-entities that represent the mega-EW exist just because of the mega-interactions between them within this EW*. A mega-entity does not exist for a planet (or a galaxy) (a planet does not exist for a mega-entity) just because their interaction is meaningless, since the mega-entity and the planet are ED entities that belong to EDWs which do not exist for the other!¹⁷

¹⁵ Not surprisingly (from our viewpoint), recent experiments for searching the dark matter particles furnished negative results: Large Underground Xenon (LUX) (Dakota); XENON1T, XENON10, and XENON100 (Italy); PandaX-II (China); and LHC (Geneva) found no evidence for dark matter particles ([17], p. 40)! Some researchers introduced the notion of “unseen particles”/forces (“hidden sector”) [17]. Within the EDW perspective, the so-called unseen particles is a totally wrong notion! Quite interestingly, in 2016, McGauch et al., measuring the “gravitational pull” from “normal matter” of 150 galaxies with gravitational pull from dark matter, discovered a strong “correlation between dark matter and normal matter” ([17], p. 41)! In fact, it is about the correlations between the ED entities that belong to two EDWs: the macro-EW (galaxies) and the mega-EW (the mega-entities). The correlation refers to two kinds of “gravity”: the gravity of “galaxies” and the gravity of mega-entities.

¹⁶ Moreover, there are other EDWs: for instance, Krauss informs us that “the largest gravitationally bound objects in the universe are called superclusters of galaxies. Such objects can contain thousands of individual galaxies or more and can stretch across tens of millions of light-years. Most galaxies exist in such superclusters, and indeed our own galaxy is located within the Virgo supercluster of galaxies, whose center is almost 60 million light-years away from us” ([13], p. 48). These superclusters of galaxies (which do not have any ontological status in the macro-EW) correspond to ED entities that belong to an EDW, the mega-EW.

¹⁷ In general, there are two alternatives for the existence of dark matter: either “dark matter microparticles” or “changing the gravity equations” (initiated by Mordehai Milgrom in 1983 who modified Newton’s laws, creating “modified Newtonian dynamics” (MOND)). Recent observations of gravitation in galaxies favor the modified gravity theories over dark matter ([17], p. 38).

In 1937, Zwicky proposed that using Einstein’s method of gravitational lens, it is possible to test general relativity, to magnify more distant objects, and to find out why clusters appear to weigh more than what can be accounted for by visible matter ([13], p. 51).

More important is the observation about the dark matter “haloes”¹⁸, “big blobs of dark matter in which galaxies were embedded—were necessary to keep the structures of many spiral galaxies stable”¹⁹ ([14], p. 334). The “haloes” (no ontological status within the macro-EW) and the galaxies (no ontological status) formed by planets (macro-ontological status) correspond to the mega-entities that exist in the mega-EW.

How was each galaxy formed? The main force was gravitation that “acts and isolates clumps of matter on all scales” ([14], p. 334). This idea mirrors one of Gabriel Vacariu’s main principles from his works ([2, 21], 2008, etc.): in this case, the main principle is “The interactions constitute the entities, the entities determine their interactions.” According to the gravitation, we cannot explain the movements of planets that are at the margin of the disk: these planets have too much speed in relationship to gravitation. Our bodies (our eyes) are particular entities within the macro-EW where we can find the planets and their movements. We cannot see any “supersystem galaxies” since this “supersystem” is an entity (or maybe an amalgam of entities) that exists in the mega-EW. That mega-EW does not exist for our bodies, for planets and galaxies that we can observe, or for our minds since all these entities belong to EDWs.

One of the most important actual cosmologists regarding “dark matter” is James Peebles who mentions that it “might be the DM that gravitationally binds clusters of

The astronomers consider that all that exist are the galaxies and reject the existence of dark matter. They have worked within the unicorn world: the mega-entities really exist but in the mega-EW. In reality, Einstein’s general theory of relativity is available only for planets (the macro-EW), but not for the mega-entities (the mega-EW)! So, we do not need to modify this theory; we have to discover the new laws governing these mega-entities!

¹⁸ “By knowing the number of galaxies, cosmologists then estimate the amount of dark matter in the universe” ([18], p. 120). “Dark matter and light elements like hydrogen and helium were produced in the first few minutes after the Big Bang. Dark matter halos then slowly grew from seed structures and merged into ever-larger systems, until gas fell under their gravitational pull and sunk to their centers” ([12], p. 28). “The component of the galaxy that is *not* seen, because it is too diffuse, is the galactic halo, a spherical region of diameter so large that it encompasses the whole of the visible part of the galaxy. The stars within the halo are solely older Population II stars and many of these are within globular clusters. The most important component of the halo is what we cannot see — dark matter” ([19], pp. 115–116). “The studies found that dark matter surrounds most galaxies in roughly spherical clouds, called halos. Dark matter halos are significantly larger than the visible part of most galaxies, and often extend well into intergalactic space” ([20], p. 19). “Encompassing the Milky Way galaxy is a halo of dark matter. The particles making up this enormous dark matter cloud travel through every corner of our galaxy, oblivious of the planets, stars, dust, and other forms of ordinary matter around them. To a particle of dark matter, the world is a lonely and quiet place” ([20], p. 106). Indeed, to a “particle”/entity of dark matter, from what we know that exists, nothing exists! Therefore, there is only the mega-EW, and no other EDW exists for this world. We strongly emphasize that the “halo” is similar to “ether” in the end of the nineteenth century!

¹⁹ “Looking towards the constellation Sagittarius, you’ll be looking at the Galactic center, which is at the same time the center of the disk of stars and gas of our galaxy, which constitutes essentially everything you can see in the sky with the naked eye, and the center of a spheroid of dark matter, the halo, about ten times larger, and ten times more massive than the disk” ([12], p. 5). The “halo” is similar to the mental causation in philosophy of mind or graviton in physics. In fact, the haloes are nothing in the macro-EW but *correspond* to certain entities/processes that belong to the mega-EW, for instance.

galaxies^{15,16} ([22], p. 1)²⁰, but we have to be aware that the dark matter “does not bind clusters of galaxies” and the mega-entities that belong to the mega-EW correspond to the clusters of galaxies (planets and empty spaces among them). In 2015, Peebles writes about the “galaxy phenomenology,” proposing the concept of “pure disk galaxies” in which “most of the stars move in streams in directions close to the plane of the disk, as in whirlpools and bars” ([24], p. 12248).

However, from the EDW perspective, the “disk galaxies” have no ontology [the galaxies are formed by planets, but these planets and the empty spaces among them correspond to the mega-entities (the mega-EW)]! Peebles’s “galaxy phenomenology” sends directly to our hyper ontology of EDWs: it is about the mega-entity (a mega-disk) within the mega-EW.

More interestingly, in a paper from 2014, the entire Part 4 has the title “Island universes.” Peebles concluded that “two broad classes of galaxies, pure disks and elliptical, have evolved in near isolation from their surroundings, as island universes” ([25], p. 10). From our viewpoint, Peebles needs the EDW perspective to provide the *ontology* of dark matter, namely, the ontology of “island universes”: these are the mega-entities that belong to the mega-EW.²¹ Cosmologists believe that:

Dark matter provides, in a way, the ‘stage’ for the ‘cosmic show’, a stage that was assembled when the universe was young, way before the time when stars started to shine and planets started to form, and this stage is still evolving. It is, in short, the supporting structure of the universe. It solves in a single stroke many problems in astrophysics and cosmology, and it provides a self-consistent framework for the structure and evolution of the universe. ([12], p. 4).

We can make an analogy between a table and the corresponding amalgam of microparticles. The format of that amalgam of microparticles has no meaning: why this format has that shape? Within the micro-EW, we cannot find any meaning for the format of that amalgam of microparticles. However, everything gets a meaning if we introduce the *correspondence* between that amalgam of microparticles and the macro-table that belong to EDWs. Also, the galaxies have a particular format: their constituents (the planets) move with a particular speed just because they correspond to a “disk,” a mega-disk.²² If we rotate a disk in the macro-EW, a second person, using a microscopic electron, will observe an amalgam of microparticles that is arranged under a “disk format,” where all microparticles moving with the same speed! So, we can presuppose that, because of the Big Bang and other

²⁰ “... Jim Peebles had pointed out that the absence of fluctuations in the cosmic microwave background at a level of $\sim 10^{-4}$ was incompatible with a Universe that was composed of only baryonic matter, and argued that this problem would be relieved if the Universe was instead dominated by massive, weakly interacting particles, whose density fluctuations could begin to grow prior to decoupling (239) (see also, Ref. [79])” ([23], p. 58).

²¹ For instance, Peebles writes that “How could the progenitor fragments of pure disk galaxies have ‘known’ not to have participated in this generally high global star formation rate? One piece of the matter tumbling together according to the Λ CDM picture of the formation of the pure disk galaxy in Figure 3 ‘knew’ it was going to host the growing disk, and start growing it at redshift well above unity if the age of the disk of the Milky Way [11] was typical of pure disk galaxies, while the rest of the fragments ‘knew’ they had to hold off star formation until they had reached the growing disk. It is a curious situation” ([25], p. 8). It is a “curious situation” within the unicorn world (the universe); however, within the EDW perspective, that problematic notion, “knew”, has a meaning: the growing disk corresponds to a mega-entity (the mega-EW).

²² “Spiral arms are waves of star formation that spread through our galaxy’s disk” [8].

phenomena, billions of planets of a galaxy have been moving under the format of a disk, all planets having the same speed. These “galaxy disks” correspond to the mega-entities, the mega-disks (the mega-EW)!

Working within the unicorn world, the physicists logically believe that dark matter does not “emit or absorb electromagnetic radiation” (it is “dark”) and does not have any kind of interactions with the “known matter” ([14], p. 334). Again, dark matter cannot interact with anything from the macro-EW (in which there are planets that form, for us, the galaxies, for instance); it cannot emit or absorb electromagnetic radiation, since it does not exist for the ED entities and ED forces that belong to EDWs. Anyway, working within the unicorn world, many scientists believe that dark matter does not interact with any kind of matter that we know,²³ but it is impossible for us to see the causes of such strange phenomena. Hooper claims that the dark matter is not just “out there” but it is everywhere, in our world, and at the same time, this “new type of elementary particles” does not exist ([20], p. v). Also, there is no “direct influence” or any kind of “interactions” between the dark matter (the mega-entities that belong to the mega-EW) and any kind of matter that belongs to EDWs.

There are the macro-EW, the micro-EW, the wave-EW, the mind is an EW, therefore, there has to be the mega-EW, an EW, in which there is the “matter” (the mega-matter) that corresponds to the *indirect effects* (i.e., through *correspondences*) in the macro-EW and the macro-entities like planets that form, for us, the galaxies and the clusters of galaxies. The dark matter has to be a kind of nonbaryonic matter since any star is formed from baryonic, normal matter.²⁴ There are no interactions between baryonic matter and nonbaryonic matter since one kind of matter does not exist for the other kind of matter. The amount of dark matter in a galaxy is determined by comparing the mass of galaxy with its luminosity (mass-to-light ratio). “The evidence of dark matter is by and large gravitational. The discrepancy between the luminous mass and the gravitational mass gives an indication of the presence of a huge unseen mass in the Universe” ([27], p. 89). Dark matter has an *indirect* influence on the “empty space,” but this “nothing” corresponds to “something” that belongs to the mega-EW!

Exactly as an electron does not interact with a planet but with an amalgam of microparticles, the dark matter does not exist for the macro-objects (like planets). The galaxies (the planets and the space among them) correspond to an entity that belongs to the mega-EW. Nothing can stop us to introduce this idea. The human body is placed between the microparticles and the galaxies, but we can push further the dimension of certain entities: these are the mega-entities that have “greater” dimensions than the macro-objects. Just as macro-observers, we cannot perceive/understand the rotation of a “galaxy” from the viewpoint of a mega-entity (mega-entity) since the mega-entity

²³ Similar ideas have been invented for the explanations of the “entanglement” in quantum mechanics or the “mental causation” in philosophy of mind. Using the EDW perspective, in our previous works, we indicated that entanglement, nonlocality, and many other notions from quantum mechanics are pseudo-notions constructed within the unicorn world, the universe! (For these pseudo-notions, see our previous works). “As I have mentioned above, dark matter particles are all around us-in the room in which I am typing, as well as ‘out there’ in space. Hence we can perform experiments to look for dark matter and for the new type of elementary particle or particles of which it is comprised” ([13], p. 54). For us, Krauss’ idea mirrors the “correspondences” between entities, phenomena, and forces that belong to EDWs.

²⁴ The “dark matter cannot consist of normal matter made up of neutrons and protons; if it did, the density of neutrons and protons in the early universe would have been much higher, and the resulting abundances of light elements in the universe would have been much different from what we actually observe” ([26], p. 376). Again, the dark matter (the mega-matter) corresponds to the planets that correspond to the microparticles (neutrons and protons) that correspond to the electromagnetic fields.

does not exist for the planets that form the galaxies! Most probably, the rotation of a “galaxy” *corresponds* to the rotation of a mega-entity (the mega-EW).

Today, there are several reasons for supporting the Big Bang, the phenomenon that did take place approximately 13.78 or 13.82 billion years ago. From our viewpoint, exactly as the gravity does not exist for the electron (there are no “gravitons”), the indirect effects of gravitation exist for the microparticles.²⁵ What is important is that cosmologists believe that a star appeared with other planets that “formed in a flattened disk surrounding it” ([8], p. ...). This idea mirrors exactly the existence of the mega-entities. A galaxy (no ontology) (formed by planets with ontological status in the macro-EW and the empty space among them) corresponds to a mega-entity that belongs to the mega-EW. Exactly as an electron cannot “perceive”/interact with a table (because the table does not exist for the electron), we cannot perceive/interact with a mega-entity. The mega-entity rotates exactly as a macro-disk rotates in the macro-EW. With external limits, the disk rotates with much greater speed than its center. This analogy is very approximate because the spiral galaxies are not spinning similar to the solid bodies and they do not mimic the motion of the planets around the sun, where velocity decreases with distance ([28], p. 21). The “disk” in the mega-EW is not exactly like a disk in the macro-EW: there are different properties of these two disks (the macro-disk and the mega-disk), but we are unable to identify, directly, the properties of the mega-disk. We will be able to identify these properties only indirectly since our bodies are macro-entities that do not exist for the mega-entities. In 2007, writing about Kant’s philosophy, Gabriel Vacariu concluded that within the EDW perspective, the galaxies are entities different from tables, stones, or even individual planets, and exactly as an electron “does not exist” in a macro-EW, a planet “does not exist” in a macro-macro-EW ([29], p. 17). There are no “causations” that would require direct relationships between the ED entities that belong to two EDWs since the entities from an EW do not exist for the entities that belong to an EDW. From indirect observations, we can conclude that the “dark matter” really exists but in the mega-EW.

We return to our analogy between a macro-disk and the corresponding amalgam of microparticles: if a micro-observer observes the rotation of an amalgam of microparticles (without being able to observe the macro-disk), then that micro-observer would introduce certain “dark matter” for explaining the rotation of the microparticles. For the micro-observer, the macro-disk cannot even exist! We can continue the analogy introducing the rotation of a planet which corresponds to a huge amalgam of microparticles. The micro-observer would need to introduce dark matter/energy for explaining the rotation of that amalgam of microparticles! In this context, we make an important analogy regarding the relationship between “gravity and microparticles” and the relationship between “dark matter/energy and macroparticles”:

Gravity (the curvature of spacetime that “belongs” to the macro-EW) for microparticles that belong to the micro-EW is quite similar to dark matter and dark energy that belong to the mega-EW for the macro-entities that belong to the macro-EW.

²⁵ In his PhD thesis and his first book, Gabriel Vacariu [5] indicates that “gravity” does not exist as a force (Newton) or as a “curved spacetime” (Einstein) but as “nothing” in the macro-EW (no ontological status!) which *corresponds* to the curved electromagnetic fields that belong to the field-EW. In other words, it is the electromagnetic field that is *indirectly* “curved,” and the “curvature” is not produced by the planet (which does not exist for any electromagnetic field) but by a huge amalgam of electromagnetic waves (field-EW) which corresponds to a huge amalgam of microparticles (the micro-EW) which corresponds to the planet (the macro-EW). In our book (2016), we indicated that “spacetime” cannot have any ontological status—it would produce strong ontological contradictions; in 2017, we rewrote Einstein’s both special and general theories of relativity not using “spacetime” (which has no ontological status) but the *motions* of ED entities that belong to the EDWs!

A microparticle (a photon, for instance) does not “perceive”/interact with a planet; therefore, gravity does not exist for the photon. However, in its trajectory, the photon follows the “curvature of spacetime” produced by a planet/galaxy. The photon would “think” “It has to be a *dark matter*, a *dark halo* that surrounds this huge amalgam of microparticles!” The photon cannot even “perceive” that the spacetime is curved. We can think that there is a halo of dark matter that surrounds a galaxy, but exactly in the same way, an electron that moves around the proton would ask about certain “gravitational force,” a planet would ask about the “dark matter” that surrounds a galaxy. Exactly as the “gravitation” does not exist for photons, dark matter does not exist for planets (and their galaxies). However, the photons follow the spatiotemporal paths (curved space) between planets, even if a planet does not exist for a photon. From the viewpoint of photons, we can think of certain microparticles (“gravitons”) that produce this curvature, but the gravitons do not really exist. In the same way, the galaxies are “biased” with respect to the dark matter,²⁶ but the dark matter does not exist for the planets.²⁷

Within the EDW perspective, what does it mean by the “density” of dark matter? It seems that there are some entities/interactions that belong to an EDW, an EW does not exist for any EDW, and therefore, the density of dark energy is constant. Between entities and processes that belong to the EDWs are just correspondences and these

²⁶ In order to explain the existence of dark matter, some researchers try “to explain the nature of the galaxy”, and for this, “they are trying to redefine gravity ... We need dark matter in order to grasp how galaxies work”. “Martin Kunz, an astrophysicist at the University of Geneva, explains that the structures of the Universe just could not function on a huge cosmological scale without dark matter. The current best cosmological model also depends on it: the so-called Lambda-CDM model, also known as the Standard Model. Using just a few parameters, it describes the development of the Universe since the Big Bang. It can explain important observations, such as the Universe’s accelerating expansion rate, the cosmic microwave background, or the honeycomb-like distribution of galaxies with enhanced clusters of galaxies linked by thin, thread-like structures with vast empty spaces between them – the so-called voids” (idem). In fact, the galaxies and the so-called voids do not have any ontological background, but they correspond to the mega-entity that belongs to the mega-EW! Oliver Müller (Strasbourg) found dwarf galaxies in the constellation of Centaurus moving on a plane, all in the same direction around the central galaxy Centaurus A. They were not distributed randomly either, as is predicted by the large cosmological simulations using the standard model. Müller’s subsequent article, published last year in the specialist journal ‘Science’, caused quite a stir. The distribution of galaxies such as those of Centaurus is still allowed in the Lambda-CDM model, but it predicts that only one out of a thousand galaxies could have such a structure. The problem is that the same phenomenon can be seen in our own local group of galaxies, both in the Milky Way and in the Andromeda galaxies. “If the three closest galaxies have to be regarded as outliers, then something cannot be right about the basic assumptions found in the Standard Model,” says Müller. However, he does not simply assume that the whole standard model is wrong, because it offers too many observations of the universe that are correct. Müller is simply pointing out certain discrepancies between his observations and the simulations of dark matter. “Perhaps we are missing something additional in the simulations,” he says. “It’s also possible that our galactic neighbors are just very special’. This is because the Milky Way, the Andromeda Galaxy and Centaurus A all lie on the edge of a huge void, and have the Virgo cluster of galaxies in direct proximity. Their mass distribution could thus lead to unusual phenomena”. The standard model maybe is available for the macro-entities, but not for the mega-entities! In reality, the galaxies and the cluster of galaxies correspond to certain mega-entities that belong to the mega-EW.

²⁷ “It is possible that dark matter may have its own rich phenomenology hidden from the ordinary matter. This hidden dark matter sector might possess new forces and particles, some of which could be viable dark matter particles that are strongly self-interacting” ([30], p. 3). In reality, dark matter belongs to the mega-EW which does not exist for the macro-EW; therefore, it is not about a “hidden” dark matter but an EDW!

correspondences are always constant since, for instance, in the macro-EW, where there are the “galaxies” (no ontological status), planets, and “nothing” and all these correspond to “something” that belong to an EDW (the mega-EW, for instance)! It has to be clear that the dark matter/energy belongs to an EDW rather than to the micro-EW (microparticles), the macro-EW (planets), and the field-EW (electromagnetic fields/waves); therefore, it is meaningless to check for the interactions between the dark matter and planets, microparticles, and electromagnetic waves.²⁸

3. Recent cosmological results which strongly support the being of the mega-EW

In a recent article, Hutsemékers et al. indicated that the “quasar spin axes are likely parallel to their host large-scale structures” ([32], p. 1).²⁹

Assuming that quasar polarization is either parallel or perpendicular to the accretion disk axis as a function of inclination, as observed in lower luminosity AGN, and considering that broader emission lines originate from quasars seen at higher inclinations, we inferred that quasar spin axes are likely parallel to their host large-scale structures. Galaxy spin axes are known to align with large-scale structures such as cosmic filaments. Till now, such alignments are detected up to redshift $z \sim 0.6$ at scales ≤ 100 Mpc.³⁰

²⁸ A team from MIT realized certain experiments to detect the axions that would form the dark matter: “The team reports that in the first month of observations, the experiment detected no sign of axions within the mass range of 0.31 to 8.3 nanoelectronvolts. This means that axions within this mass range either do not exist or they have an even smaller effect on electricity and magnetism than previously thought” [31]. Within the EDW perspective, such experiments are meaningless: the dark matter does not exist for electricity or magnetism at all. “While they are thought to be everywhere, axions are predicted to be virtually ghost-like, having only tiny interactions with anything else in the universe” [31]. Quite wrong, dark matter is not composed of microparticles like axions, and moreover, there are not “only tiny interactions with anything else in the universe.” On the contrary, the dark matter (the mega-entities) exists only in the mega-EW, but it does not exist for anything else in the EDWs! However, in the same article, there is an essential paragraph: “‘As dark matter, they should not affect your everyday life,’ Winslow says. ‘But they are thought to affect things on a cosmological level, like the expansion of the universe and the formation of galaxies we see in the night sky’” [31]. Winslow (the principal investigator of the experiment) is quite correct, but she is missing the EDW perspective! In 2018, the researchers from MIT, using a magnetar, tried to detect the axions (the ABRACADABRA experiment). “The team proposed a design for a small, donut-shaped magnet kept in a refrigerator at temperatures just above absolute zero. Without axions, there should be no magnetic field in the center of the donut, or, as Winslow puts it, ‘where the munchkin should be.’ However, if axions exist, a detector should ‘see’ a magnetic field in the middle of the donut” [31]. Obviously, the results were negative: there are no microparticles that compose the dark matter (the mega-entities) since the microparticles and the mega-entities belong to the EDWs!

²⁹ In 2008, the astronomers from the University of Colorado Boulder indicated that they found the missing normal matter (baryons) in the spaces between galaxies. “‘We think we are seeing the strands of a web-like structure that forms the backbone of the universe,’ said CU-Boulder Professor Mike Shull. ‘What we are confirming in detail is that intergalactic space, which intuitively might seem to be empty, is in fact the reservoir for most of the normal, baryonic matter in the universe’.. The team also found that about 20 percent of the baryons reside in the voids between the web-like filaments. Within these voids could be dwarf galaxies or wisps of matter that could turn into stars and galaxies in billions of years, said the CU-Boulder researchers” (University of Colorado Boulder).

³⁰ “Likewise, in 1989 Margaret Geller and John Huchra, analyzing redraft survey data, discovered the immense ‘Great Wall,’ a ‘sheet’ formed from galaxies many light years apart. That first large-scale

Since coherent orientations of quasar polarization vectors, and then quasar axes, are found on scales larger than 500 Mpc, our results might also provide an explanation to the very large-scale polarization alignments reported in Papers I–III. In this case those alignments would be intrinsic, not due to a modification of the polarization along the line of sight. The existence of correlations in quasar axes over such extreme scales would constitute a serious anomaly for the cosmological principle (Hutsemékers et al., p. 5)³¹.

Maybe, the “host large-scale structure” or “cosmic filaments” mirror the existence of the mega-EW. However, if these “cosmic filaments” refer to “intergalactic gas filaments” (baryonic matter), then it is not about the mega-EW. In principle, the mega-entities (the mega-EW) cannot be directly observed by the humans and their macro-tools! Anyway, the “cosmological principles” have to be changed, since the “universe/world” does not exist but the EDWs do. The scientists have noticed that some “galaxies” move together in odd and often unexplained patterns, as if they are connected by a vast unseen force. It is supposed that the dark matter was less influential in the first period after the “Big Bang.” Ferreira considers that there is a sort of an influence of the so-called large-scale structures which influence the interactions between distant galaxies, structures made of hydrogen gas and dark matter, and take the form of filaments, sheets, and knots that link galaxies in a vast network called the cosmic web [34, 35].

Nevertheless, this “unseen force” has to be some entities or processes that belong to the mega-EW, but we are unable to notice them because they do not exist for the macro-entities (for our bodies and our instruments of observation, for instance). The “cosmic web” has to be something that belongs to the mega-EW, but not to the macro-EW. We emphasize again that the galaxies have no ontological status in the macro-EW but they correspond to the mega-entities that belong to the mega-EW.

Again, all these statements support the existence of certain mega-entities/processes that belong to the mega-EW. The secret of the “synchronized galaxies” is the existence of EDWs, i.e., the existence of mega-entities that belong to the mega-EW. Obviously, the wave-EW, the micro-EW, and the macro-EW really are. Because of the same reasons, the mega-EW should exist. *If the dark matter (mega-matter) really exists*,³² then this matter exists in the mega-EW and have *indirect influence* (through *correspondences*) on the macro-entities and the macro-processes (the trajectories of planets, for instance) that belong to the macro-EW.³³

structure is 500 million light-years long, 200 million light years wide, and with a thickness of 15 million light years” [33].

³¹ The secret of these synchronized galaxies may indeed question the main cosmological principle that the universe is uniform and homogenous at extremely large scales, as Ferreira points out. He also mentions the work of Hutsemékers and his colleagues regarding “the correlations in quasar axes over such extreme scales.” Furthermore, he considers that one of the most contentious debates in cosmology these days is centered around the unexpected way in which dwarf galaxies appear to become neatly aligned around larger host galaxies such as the Milky Way ([34], his highlights). It seems that not only a galaxy corresponds to a mega-entity but there are some mega-laws that involve these mega-entities. Obviously, since the “universe” does not exist, the old “cosmological principle” fails: the EDWs are not “uniform and homogenous” since one ED does not exist for any EDW! Here, it is about the structure of the mega-EW, not of the macro-EW (where large groups of planets form the “galaxies,” for us, the observers).

³² See Powell (2019) if dark matter really exist...

³³ Several groups of researchers which investigations have led to the conclusion that dark matter and dark energy do not exist at all! For instance, in “November, astronomers at the Chinese Academy of Sciences in Beijing published a paper identifying 19 galaxies which might violate the most fundamental theory of how the universe first formed. They had been searching the sky for yet-undiscovered galaxies which seem to be lacking the usual dark matter component, aiming to add more evidence to a baffling

The “standard” Lambda-CDM model of cosmology is quite accepted today: the total mass energy of the “universe” is 5% ordinary matter and energy, 27% dark matter, and 68% dark energy.³⁴ Obviously, this idea is constructed within the unicorn world! We strongly emphasize again that the “matter” from the micro-EW does not exist for the “matter” from the macro-EW and the matter from the macro-EW does not exist for the matter from the mega-EW! (the same idea is available for “energy” and “mater”!). Therefore it is meaningless to check for the microparticles that form the “dark matter”!³⁵ An electron will never be able to interact with a planet just because the planet does not exist for the electron! The reader trying to discover dark matter has to imagine as being a photon (the micro-EW) searching the reason of its “curbed trajectory” near a huge amalgam of microparticles (which

phenomenon scientists had begun observing last year. And they claimed to have found a whole group of them” [36]. Van Dokkum and his team identified several galaxies without dark matter at all [36]! Also, Go Ogiya (Observatoire de la Côte d’Azur in France) “suggests a process by which galaxies might form without ever containing dark matter. So-called ‘tidal dwarf galaxies’ could form when dark matter and baryonic matter is ‘ejected’ from an existing galaxy due to tidal forces, but the dark matter component evaporates due to its higher velocity, leaving only stars and gas to form a new galaxy” [36]. “It may be that we do not yet fully understand how matter and energy evolved over time, particularly at early times,” says his colleague Sherry Suyu, from the Max Planck Institute for Astrophysics, in Germany [37]. “Nicolas Martin, a researcher at the Observatory Astronomical De Strasbourg in France, believes that the observations needed to drive research forward are just beyond the limits of what is possible with the best apparatus around at the moment. Emailing while on location at one such cutting-edge telescope, he said that the research community would likely have to wait for two next-generation telescopes, currently planned or under construction in Chile and Hawaii, before they could generate even more precise measurements of the velocity of stars in the dwarf galaxies” [36]. Obviously, we will need more investigations regarding the existence of dark matter and dark energy, but we furnish this very recent information about dark matter and dark energy just to indicate that the framework necessary for explaining these processes is our EDW perspective: if dark matter really exists, it belongs to an EDW (the mega-EW) rather than to the EDWs that we already know. If the dark matter does not exist, it is very possible other mega-matter/processes will be discovered in the future, and this matter/process would belong to the mega-EW but not to the macro-EW! Indeed, being constructed under the wrong framework (the “universe”/world), cosmology of our days (physics, in general) has been in a crisis exactly as quantum mechanics has been in the last 100 years (with its great problems constructed within the wrong framework—the “universe”, as we called the “unicorn-world”). We have solved all great problems of physics of the last century replacing the wrong framework, the “universe”/“world,” with a much better framework, the EDW perspective!

³⁴ The standard Λ CDM cosmology assumes the general theory of relativity. This is an extrapolation of some 14 orders of magnitude in length scale from the precision tests on the scales of the Solar System and smaller. It assumes that 95% of the present mass of the universe is in two hypothetical forms, dark matter and dark energy” ([34], p. 1). “Observations over the past decades | obtained by combining a variety of astrophysical data, such as type-Ia supernovae, cosmic microwave background (CMB), baryon oscillations and weak lensing data | indicate that most of our Universe energy budget consists of unknown entities: 27% is dark matter and 68% is dark energy, 1 a form of ground-state energy” ([26], p. 1). (About these percentages, see also Panek 2011).

³⁵ “Although the existence of dark matter is generally accepted by the scientific community, some astrophysicists, [38] intrigued by certain observations which do not fit the dark matter theory, [20] argue for various modifications of the standard laws of general relativity, such as modified Newtonian dynamics, tensor-vector-scalar gravity, or entropic gravity. These models attempt to account for all observations without invoking supplemental non-baryonic matter. [17]” ([39], “Dark matter”). The idea of modifying the standard laws of general relativity is totally wrong! In reality, in order to explain dark matter, the physicists have to change their framework of thinking (the macro-EW) with the mega-EW!

corresponds with a planet in the macro-EW). Its curbed trajectory is due to the gravity of the planet, but the planet does not exist for the photon.

With the EDW perspective (2002, 2005, 2007, 2008), we generated the new framework of a new *Philosophiae Naturalis* necessary for (1) the main problems of quantum mechanics of the last 100 years and (2) the relationship between Einstein’s general relativity and quantum mechanics, and (3) we furnished a new explanation of dark matter/energy (which presupposes the existence of mega-entities that belong to the mega-EW) and (4) many problems of cosmology today introducing the missing ED ontologies for many ED entities that belong to the EDWs! (see our previous works). The real great problems are hard not only because they require a “crazy new idea” (see the motto) but they require a new paradigm of thinking. Dark matter and many other problems of cosmology today (physics, in general) require the replacement of the “universe” (the “unicorn world”) with our new paradigm of thinking, the EDW perspective!³⁶

³⁶ If you reject the existence of mega-entities (the mega-EW), then you also have to reject the existence of the macro-entities (the macro-EW). It means if your brain (a macro-entity) does not exist, then your mind (an EW which corresponds to your brain/body) cannot exist! So, your “rejection” (a statement that is a thought, a mental state, anyway) would be meaningless. A huge amalgam of neurons cannot produce thoughts but only chemical and electrical reactions (for the mind-brain problems, see [2–7]).

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References

- [1] Vacariu G. The Epistemologically Different Worlds Perspective and Some Pseudo-Notions from Quantum Mechanics. *Analele Universitatii Bucuresti*; 2006
- [2] Vacariu G. Mind, brain and epistemologically different worlds. In: *Synthese Review*. USA; 2005
- [3] Vacariu G, Vacariu M. Physics and Epistemologically Different Worlds. *Revue roumaine de philosophie*. 2009, 2009;**53**:1-2
- [4] Vacariu G. Kant, philosophy in the last 100 years and an epistemologically different worlds perspective. *Revue Roumanie de Philosophie*. 2007;**51**
- [5] Terhesiu D, Vacariu G. Brain, mind and the perspective of the observer. *Revue Roumanie de Philosophie*. 2002; **46**:1-2
- [6] Vacariu G, Terhesiu D. Brain, mind and the role of the observer. In: Botez A, Popescu B, editors. *Philosophy of Consciousness and Cognitive Science*. Bucharest: Cartea Romaneasca; 2002
- [7] Vacariu G, Vacariu M. Dark Matter and Dark Energy, Space and Time, and Other Pseudo-Notions in Cosmology. *Datagroup-Int, S.R.L.*; 2016
- [8] Jeffrey BO, Megan DO, Nicholas S. *The Cosmic Perspective*. 6th ed. Addison-Wesley; 2010
- [9] Vasiliki MA. Dark matter: experimental and observational status. IFIC/19-17, Cornell University. 2019. Available at: <https://arxiv.org/abs/1903.11589>
- [10] Daniel G, Birrer S, Nierenberg A, Treu T, Xiaolong D, Benson A. Warm dark matter chills out: Constraints on the halo mass function and the free-streaming length of dark matter with eight quadruple-image strong gravitational lenses. *Monthly Notices of the Royal Astronomical Society*. 2019; **491**(4):6077-6101. DOI: 10.1093/mnras/stz3480
- [11] Hubble’s Team. Hubble detects smallest known dark matter clumps. 2020. Available at: <https://www.nasa.gov/feature/goddard/2020/hubble-detects-smallest-known-dark-matter-clumps>
- [12] Gianfranco B. *Behind the Scenes of the Universe - from the Higgs to Dark Matter*. Oxford University Press; 2013
- [13] Krauss L. *The Universe from Nothing – Why there Is Something than Nothing*. Simon & Schuster; 2012
- [14] William S, Christopher CJ. *Galactic Encounters - Our Majestic and Evolving Star-System, from the Big Bang, to Time’s End*. Springer; 2015
- [15] Stephanie BM. A history of dark matter. 2017. Available at: <https://arstechnica.com/science/2017/02/a-history-of-dark-matter/>
- [16] Einasto J. Dark Matter. *Braz J Phys*. 2013;**43**:369-374
- [17] Sabine H, Stancy MGS. Is dark matter real? *Scientific American*. 2018
- [18] John MW. *Reinventing Gravity - A Physicist Goes beyond Einstein*. HarperCollins e-books; 2008
- [19] Michael WM. *Time, Space, Stars and Man - the Story of the Big Bang*. 2nd ed 2013
- [20] Dan H. *Dark Cosmos – In Search of our universe’s Missing Mass and Energy*. Harper Collins e-books; 2006
- [21] Vacariu G. *Epistemologically Different Worlds*. Editura Universitatii din Bucuresti; 2008

- [22] Peebles P, James E. Growth of the nonbaryonic dark matter theory. *Nature Astronomy*. 2017, 2017;1:art. 0057
- [23] Bertone G, Hooper D. A history of dark matter. 2016. FERMILAB-PUB-16-157-A, arXiv:1605.04909v2 [astro-ph.CO] May 24, 2016
- [24] Peebles P, James E. Dark matter. *PNAS*. 2015;112(40):12246-12248
- [25] Peebles P, James E. The natural science of cosmology, proceedings of the 7th international conference on gravitation and cosmology (ICGC2011) IOP publishing. *Journal of Physics: Conference Series*. 2014;484:012001. DOI: 10.1088/1742-6596/484/1/012001
- [26] Stacy P, Laura K, Brad S, George B. *Understanding Our Universe*. W. W. Norton & Company, Inc.; 2012
- [27] Debasish M. *Dark Matter - An Introduction*. CRC Press Taylor & Francis Group; 2015
- [28] Alain M, Vincent LB. *Matter, Dark Matter, and Anti-Matter - In Search of the Hidden Universe*. Springer; 2009
- [29] Vacariu G. *Epistemologically different worlds [PhD thesis]*. Sydney, Australia: University of New South Wales, School of Philosophy; 2007. Available at: https://www.unsw.edu.au/primo-explore/fulldisplay?vid=UNSWORKS&docid=unsworks_5143&context=L
- [30] Zavala J, Carlos FS. Dark matter haloes and subhaloes. 2019. arXiv: 1907.11775v1 [astro-ph.CO] [Accessed: 26 July 2019]
- [31] Chu J. Dark matter experiment finds no evidence of axions. 2019. <https://www.sciencedaily.com/releases/2019/03/190328150940.htm>
- [32] Hutsemékers D, Braibant L, Pelgrims V, Sluse D. *Alignment of quasar polarizations with large-scale structures*. *Astronomy & Astrophysics*. 2018
- [33] Robby B. Is the universe controlled by gigantic structures? 2019. Available at: <https://bigthink.com/large-scale-structures>
- [34] Ferreira B. Cosmic web: Growing evidence that the universe is connected by giant structure. 2019. Available at: <https://www.sott.net/article/423867-Cosmic-web-Growing-evidence-that-the-universe-is-connected-by-giant-structures>
- [35] Ferreira B. There's growing evidence that the universe is connected by giant structures. 2019. Available at: https://www.vice.com/en_us/article/zmj7pw/theres-growing-evidence-that-the-universe-is-connected-by-giant-structures
- [36] Minsky C. Strange dark matter findings could rewrite the universe's history. 2020. Available at: https://www.vice.com/en_ca/article/pkedvy/strange-dark-matter-findings-could-rewrite-the-universes-history?fbclid=IwAR04yKJgFNG_D9FyVU22YGsE8N52KDH4uqcylb6OAm8czkodY7NiqM9ohoQ
- [37] Richard LA. The Hubble Constant is constantly perplexing. 2020. Available at: <https://cosmosmagazine.com/space/the-hubble-constant-is-constantly-perplexing?fbclid=IwAR08qDR1onzyRyroDxGHzs8xymfvVCE9zUEJtoUNZM4ska9lnhCtrATdH-k>
- [38] Paul H. *Edge of the Universe – A Voyage to the Cosmic Horizon and beyond*. John Wiley and Sons, Inc.; 2012
- [39] Wikipedia. Dark matter. 2020. Available at: https://en.wikipedia.org/wiki/Dark_matter