Euclidean-Planck Metrics of Space, Particle Physics and Cosmology

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ABSTRACT

Recent research has introduced a novel model where a fundamental arena of the universe is infinite Euclidean space of Planck metrics, where time is merely mathematical parameter of universal changes. The history of the universe has merely a mathematical existence and is nonexistent in the physical sense. On the other hand, the future is not yet existent. The only existent physical reality is the universe, which exists in the timeless space of Euclidean-Planck metrics. This view is the basis of an "Energy-Mass-gravity" Model that unifies energy, mass, and gravity. Additionally, this model reveals some discrepancies in the Big Bang cosmology model that need to be examined in details in order to keep the Big Bang cosmology as the leading model of today's physics.

Key Words: Euclidean Space, Planck Units, Energy, Mass, Gravity, Cosmology, Gravitational Constant G

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Introduction

Recent research confirms that material changes run in timeless space. The linear time of "past-present-future" belongs to the mind. The time we measure with clocks is the duration of material changes, i.e. motion in timeless space (Sorli *et al.,* 2017).

In timeless space every physical object and every signal moves in space only, and not in time. This related understanding has far-reaching implications for the field of astronomy and cosmology. For example, although it might take a few billion light years for a signal from a distant star to arrive at the Earth, in which case the star has already died, we nonetheless have to understand that the star has both emitted the signal, and died, in the same timeless space.

NASA results confirm that universal space has the form of Euclidean space, which is infinite: "We now know (as of 2013) that the universe is flat with only a 0.4% margin of error. This suggests that the Universe is infinite in extent; however, since the Universe has a finite age, we can only observe a finite volume of the Universe. All we can truly conclude is that the Universe is much larger than the volume we can directly observe" (NASA, 2013).

"Euclidean-Planck metrics" (EPM) of universal space

The Euclidean-Planck metrics of universal space are developed from the standpoint of considering Universal space as being timeless and as having a Euclidean shape. In set theory a set A is a subset of a set B, or equivalently B is a superset of A, if A is "contained" inside B, that is, all elements of A are also elements of B.

$$A \subseteq B \quad (1),$$

$$B \supseteq A \quad (2).$$

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That A is the subset of B is denoted with (1). That B is the superset of A is denoted with (2).

We observe that in universal space there exists matter and electromagnetic energy, while theoretical research predicts the existence of dark matter and dark energy. Universal space S_U has properties of superset B (in sense that all elements of A are also elements of B). Matter M, electromagnetic energy EM, dark matter M_D and dark energy E_D have properties of subset A. We can write this in the following form:

$$S_U : \{M, EM, M_D, E_D\} \quad (3).$$

Out of (3) it follows that the set universal space S_U must also have physical properties, as it has as its subsets M, EM, M_D, E_D. The idea of 20th century physics of an empty space deprived of physical properties that contain matter and energy does not seem to be correct. By taking into account NASA's discovery that universal space has a Euclidean shape, combined with the idea that Planck units represent possible physical properties of universal space, we are able to develop the "Euclidean-Planck metrics" of universal space (EPM) in which each Planck volume l_P^3 of space contains an amount of Planck energy E_P, which means that empty universal space devoid of matter and fields has a Planck energy density ρ_{PE}:

$$\rho_{PE} = \frac{E_P}{l_P^3} \quad (4).$$

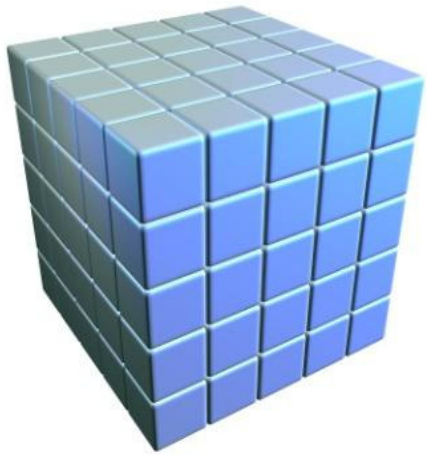

Figure 1. Euclidean-Planck metrics (EPM) of universal space

Every elementary particle with an amount of energy E and without inertial mass (as for example a photon) will change the Euclidean-Planck metrics of universal space (further on EPM) in the sense that it will diminish the Planck energy density of space by exactly the amount of its energy E:

$$\rho_{SE} = \rho_{PE} - \frac{E}{l_P^3} \quad (5).$$

$$E = (\rho_{PE} - \rho_{SE}) \cdot l_P^e \quad (6),$$

Where $(\rho_{PE} - \rho_{SE}) = \Delta_{EPM}$, so we can write:

$$E = \Delta_{EPM} \cdot l_P^3 \quad (7).$$

Every massive particle will change the Euclidean-Planck metrics, meaning every massive particle will diminish the Planck energy density of space ρ_{PE} in its centre as follows:

$$\rho_{SE} = \rho_{PE} - \frac{mc^2}{V} \quad (8),$$

Where m is its mass and V is its volume.
Out of equation (8) we derive the equation for mass-energy equivalence as follows:

$$E = mc^2 = \Delta_{EPM} \cdot V \quad (9).$$

A relativistic particle, because of its high speed, creates a "dragging effect" within universal space. Owing to this dragging effect, the energy of space is additionally absorbed by the relativistic particle, and that is why a relativistic particle gains its relativistic energy, which can be expressed by the formula:

$$E = \gamma \cdot \Delta_{EPM} \cdot V \quad (10),$$

where γ is the Lorentz factor.

Formula (9) is also valid for massive objects and stellar objects. For massive objects with a given velocity v and volume V the formula for its total energy is as follows:

$$E = \Delta_{EPM} \cdot V + \frac{\Delta_{EPM} \cdot V \cdot v^2}{2c^2} \quad (11).$$

Formula (11) we can develop:

$$E = \Delta_{EPM} \cdot V \cdot \left(1 + \frac{v^2}{c^2}\right) \quad (12).$$

Formula (12) shows that the kinetic energy of a moving body has its origin in a diminished value of EPM. The kinetic energy of a moving body is the energy of space that is additionally stored in that moving body. If that body hits a wall, its kinetic energy will be released as heat and light. In LHC part of the kinetic energy of two protons colliding is released as a Higgs boson.

Out of equation (10) we get the relation between the relativistic energy of a particle, the diminished value of EPM, and the Lorentz factor:

$$\gamma = \frac{E}{\Delta_{EPM} \cdot V} \quad (13).$$

Now, one can write the following formula for the relativistic rate of clocks in SR

$$\Delta t_0 = \Delta t \cdot \frac{mc^2}{\Delta_{EPM} \cdot V} \quad (14),$$

where Δt_0 is the elapsed time in a moving inertial system (in case of GPS satellite) and Δt is the elapsed time in the stationary inertial system (in case of GPS surface of the Earth) and m is the mass of the satellite. The Lorentz factor is primarily related to the diminished energy density of space caused by the dragging effect between space and the satellite. Δt_0 and Δt depend exclusively on the variability of the EPM, and not on some special position of the observer in the sense of an "inner observer" and an "outer observer." GPS system proves this beyond any doubt (Ashby, 2003).

Euclidean-Planck metrics and "Energy-Mass-Gravity" Model

Albert Einstein used to say: *"The mass of a body is a measure of its energy-content"* (Einstein 1905). In other words, according to Einstein, mass and energy are made out of the same "stuff" and can be converted into each other. According to Ervin Schrödinger, space is the fundamental energy of the universe: *"What we observe as material bodies and forces are nothing but shapes and variations in the structure of space"* (Laszlo 2006). In this article, a combined Einstein/Schrödinger view is developed by way of an "Energy-Mass-Gravity Model" (EMG Model) that will be presented in this chapter. In EMG Model universal space has properties of Bose-Einstein condensate and is in symmetry with all particles: every particle changes EPM of space in the sense that diminishes its energy density with respect to the Planck energy density exactly for the value of its energy and so mass. In EMG curvature of space-time, from the micro to the macro scale, represents only the mathematical description of the energy density of space. The changes of the energy density with respect to the EPM of space generate a curvature of space-time similar to the curvature produced by a "dark energy" density (Fiscaletti and Sorli, 2014; Fiscaletti, 2016), through a quantized metric, characterizing the underlying microscopic geometry of space, expressed by relation

$$d\hat{s}^2 = \hat{g}_{\mu\nu} dx^\mu dx^\nu \quad (15).$$

In equation (15) the (quantum operators) coefficients of the metric are defined (in polar coordinates) as

$$\hat{g}_{00} = -1 + \hat{h}_{00}, \quad \hat{g}_{11} = 1 + \hat{h}_{11}, \quad \hat{g}_{11} = 1 + \hat{h}_{11},$$
$$\hat{g}_{33} = r^2 \sin^2 \vartheta \left(1 + \hat{h}_{33}\right), \ \hat{g}_{\mu\nu} = \hat{h}_{\mu\nu} \text{ for } \mu \neq \nu \quad (16)$$

and

$$\left\langle \hat{h}_{\mu\nu} \right\rangle = 0 \text{ except}$$
$$\left\langle \hat{h}_{00} \right\rangle = \frac{8\pi G}{3}\left(\frac{\Delta\rho_{EPM}}{c^2} + \frac{35Gc^2}{2\pi\hbar^4 V}\left(\frac{V}{c^2}\Delta\rho_{EPM}^{DE}\right)^6\right) r^2 \quad \text{and}$$
$$\left\langle \hat{h}_{11} \right\rangle = \frac{8\pi G}{3}\left(-\frac{\Delta\rho_{EPM}}{2c^2} + \frac{35Gc^2}{2\pi\hbar^4 V}\left(\frac{V}{c^2}\Delta\rho_{EPM}^{DE}\right)^6\right) r^2 \quad (17).$$

In this scheme, dark energy is itself structured energy of space on the basis of equation

$$\rho_{DE} \cong \frac{35Gc^2}{2\pi\hbar^4 V}\left(\frac{V}{c^2}\Delta\rho_{EPM}^{DE}\right)^6 \quad (18).$$

This means, taking account the results of Santos (2009, 2010) about the link between the two-

point correlation function of the vacuum fluctuations and the space-time curvature, that the variable energy density corresponding to the dark energy acts as a two-point correlation function according to relation

$$\frac{c^4}{4\pi\hbar^4}\left(\frac{V}{c^2}\Delta\rho_{qvE}^{DE}\right)^6 \cong \int_0^\infty C(s)sds \qquad (19)$$

where $C(s)$ is the two-point correlation function of the fluctuations with respect to the value of the Planck energy density of EPM of space, which depends only on the distance between the two points. In EMG model, in the light of equations (15)-(19), the three-dimensional space defined by the quantized metric (15) determined by the changes and fluctuations with respect to the Planck energy density of EPM of space can be considered as the fundamental origin of the curvature of space-time characteristic of general relativity. In other words, there is a fundamental physical equivalence between curvature of space and diminishing of the energy density of the space.

According to equations (15)-(19), each form of energy has the property to modify the EPM of space, by generating the curvature of the space-time characteristic of general relativity. This means, in the light of equations (5)-(7), that in the EMG approach also the energy of a photon can cause a curvature. The physical origin of the curvature of space (and thus of the modification of the EPM of space) in the lowering of energy with respect to the Planck energy, implies therefore that also a photon, which has energy, as a consequence has got a mass in the sense of "mass as the amount of energy." A photon's mass can be defined by the following formula:

$$m = \frac{h \cdot v}{c^2} \qquad (20),$$

Where h is Planck's constant, v is frequency, and c is light speed. Unlike a proton, a photon has no rest mass, but its energy can also be presented as mass according to the mass-energy equivalence principle as well as the physical origin of the curvature of space in each form of change of energy density with respect to the Planck energy density. We could say that formula (20) shows that the photon's energy is equivalent to its "kinetic mass".

A given massive particle that is moving with velocity v mass m is the sum of rest mass m_0 and kinetic mass m_K :

$$m = m_0 + m_K \qquad (21),$$

where m_K is:

$$m_K = \frac{m_0 v^2}{2c^2} \qquad (22).$$

Moving particles interact with space in a so called "dragging effect" which increases it energy and mass. Kinetic mass m_K is the energy of space which is additionally integrated in the moving particle.

Combining formula (21) and (22) we get:

$$m = m_0 + \frac{m_0 v^2}{2c^2} \qquad (23)$$

and thus

$$m = m_0 \cdot \left(1 + \frac{v^2}{2c^2}\right) \qquad (24).$$

Also gluons, which represent 99% of proton mass, can be imagined as particles that have no rest mass, they only have kinetic mass that is equal to their energy. The same goes for quarks; i.e., we can imagine them as particles with no rest mass; they have their energy and correspondent kinetic mass. The rest mass of a proton m_0 is the sum of the kinetic masses of gluons $m_{K.Guons}$ and kinetic masses of quarks $m_{K.Quarks}$:

$$m_0 = \sum m_{K.Quarks} + \sum m_{K.Gluons} \qquad (25).$$

Formula (25) can also be written as follows:

$$m_0 = \sum \frac{E_{Quarks}}{c^2} + \sum \frac{E_{Gluons}}{c^2} \qquad (26).$$

In formula (26) the energy of quarks is presented according to the Schrödinger view (Huntley 2013), which means that it corresponds to the structured energy of space, and which view is also our view. This view does not need the existence of

some special field (Higgs field) in order to give quarks mass. The Higgs mechanism represents the ultimate in complexity in particle physics while not contributing to the clarity of physics. More than that: the Higgs mechanism has created a gap between mass and energy that is contrary to their unification as represented in Einstein's "mass-energy" equivalence principle. Adding to this the epistemological instability of the Higgs mechanism (Sorli, Kaufman, 2018), we assume that the Higgs mechanism will not have a long "life-time."

Particles that have rest mass are different structures of space energy, and they diminish EPM exactly for the amount of their mass-energy according to formula (9). A diminished EPM, and therefore the corresponding equivalence between curvature of space and each lowering of the energy density with respect to the Planck energy density, is the physical origin of both inertial mass and gravitational mass. The pressure of outer space, which has a relatively higher EPM, moving towards the centre of a massive particle, which has a relatively diminished EPM, is what gives birth to both inertia and gravity.

In this way, two massive particles or physical objects create an area of diminished EPM that is the origin of gravity. In this model, outer space has a relatively higher EPM than the space immediately surrounding two physical objects. This creates an energy gradient or pressure in the direction of the particles that produce the diminished EPM. In essence, the pressure of outer space pushes together inner space that has a diminished EPM as a result of the presence of the two physical objects. In this way, particles and physical objects that are in space are pushed together indirectly via space. In this model, gravity does not work directly between two massive bodies. Rather, in this model, gravity works on bodies indirectly via the energetic structure of space.

The model presented in this chapter regarding the origin of energy, mass, and gravity (EMG Model) works both without a hypothetical graviton, as well as without a Higgs field. The origin of the energy and mass of all massive particles is a diminished EPM. The Higgs mechanism is developed upon the proposition that, in general, all particles are mass-less. Particles which interact with the Higgs field (for example quarks) will gain mass, while particles which do not interact with the Higgs field (for example photons) will not gain mass. The Higgs mechanism does not continue the tradition of Einstein's view, in which mass and energy are made out of the same "stuff". The Higgs model has several epistemological instabilities that need to be carefully examined (Sorli A., Kaufman S., 2018).

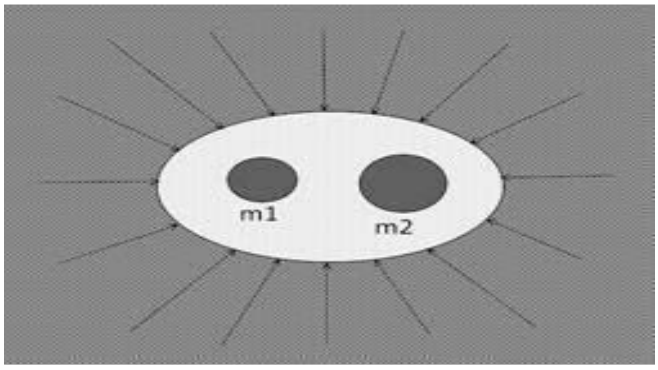

Figure 2. Gravity as the pressure of outer space that is created by the diminished EPM around two particles

The Higgs mechanism or model has its origin in supersymmetry, which is an extension of the Standard Model: "Supersymmetry predicts a partner particle for each particle in the standard model, to help explain why particles have mass. At first sight, the Standard Model seems to predict that all particles should be massless, an idea at odds with what we observe around us. Theorists have come up with a mechanism to give particles masses that requires the existence of a new particle, the Higgs boson" (CERN, 2018). In the EMG Model the fundamental symmetry of the universe is between a given massive particle (or physical object) and the variable EPM, which was expressed in formula (9). In the EMG Model the Higgs boson corresponds mathematically to a flux of released relativistic energy caused by the collision of two protons and its action physically derives from a more fundamental interplay of opportune fluctuations of the energy density with respect to the EPM of space. The manmade artificial flux generated in the collision of two protons has an extremely short life-time of $1{,}56 \cdot 10^{-22}\,s$ and does not prove the existence of the hypothetical Higgs field, inasmuch as it is indirect evidence, and not the direct evidence that is, or at least should be, required to establish proof (Sorli, Kaufman, 2018). The main theoretical failure of Higgs mechanism is the prediction that some field is giving mass to the particles without considering that if so this field should give to the particles also energy, because energy and mass are made out of the same stuff,

and there is a physical equivalence between curvature of space and each form of diminishing of the energy density with respect to the Planck energy density. In EMG Model there is no difference between mass and energy. Space is the source of mass and energy of all particles.

In the EMG Model, energy, mass, and gravity are intrinsically related to the variable EPM; the kinetic energy of a massive body additionally diminishes the EPM, thereby increasing the gravity force. Let's do a "thought experiment": we place two iron balls on a vertical axis at distance d and we then measure the gravitational force. Then we start rotating the balls, thereby giving them a high angular velocity, and we measure their gravitational force, and find that it is greater than that of the first measurement:

$$F_{g.rotating} \succ F_{g.still} \qquad (27).$$

This thought experiment has theoretical support in previous research regarding the relativistic mass of a rotating cylinder (Gilloch J.M., W.H. McCrea, 1951).

Euclidean-Planck metrics and CMB signal

Euclidean-Planck metrics introduces the idea that CMB moves in timeless space and that time is the duration of its motion. CMB radiation has its source in the period of recombination, circa 377,000 years after the Big Bang. We can imagine this epoch as a slice of a three dimensional ball (shown in figure 3 below marked as **RS**). At the time of recombination, and so when the universe was around 377,000 years old, the epoch radius of the universe was around 42 million light-years. Because recombination lasted around 100,000 years, the source of CMB lasted around 100,000 years, and so ended when the age of the universe was around 477,000 years. This means that the source of CMB has not been physically present in the universe for 13.7 billion years minus 477,000 years. Therefore, CMB is relic radiation of a source that was "extinguished" around 13,699523 billion years ago. As shown in figure 3 below, given that CMB radiation was produced in the recombination epoch, the signal is now reaching an area in universal space that is 13,699523 billion light years distant from the radius of the recombination epoch (point **A** in figure 3). Given as well that the radius of the universe today is around 46,6 billion light years, this means that CMB should not be reaching us yet and is around 32,9 billion light years distant from the planet Earth (point **B** on the figure 3). This discrepancy needs to be solved in order to for CMB to continue as the main proof underlying Big Bang cosmology.

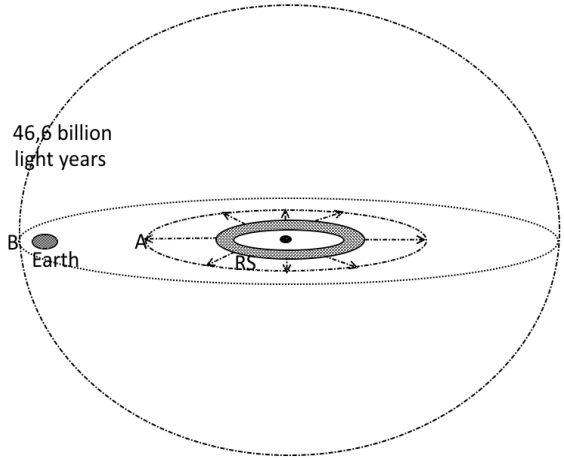

Figure 3. Plane of intersection of expanding universe

NASA results provide strong evidence that universal space has the shape of Euclidean space, which excludes the use of non-Euclidean geometries in cosmology. Universal space does not have an open curvature, it does not have a closed curvature, and universal space is flat. We can imagine the inflation of the universe as a balloon that is inflating in an infinite Euclidean space. Imagine that the idea that it is the expansion of the universe that is creating universal space is wrong. And then imagine instead that galaxies are moving away from each other in a stationary infinite space. The common understanding today, which is that the distances between galaxies are increasing because universal space is thought to be expanding like an inflating balloon, is not correct with respect to the results of NASA, because the NASA results show that "the Universe is infinite in extent," and that which is infinite cannot expand.

In the Big Bang model the estimated age of the universe is 13.7 billion years which is $4{,}1 \cdot 10^{17} s$. The radius of the observed mapped universe is 46,6 billion light years which is $4{,}4 \cdot 10^{26} m$. This means that, according to the Big Bang model, the universe should expanding since its beginning with the speed of $1{,}073 \cdot 10^{9} ms^{-1}$ which is 3,58 times of the speed of the light. This is against existent physical laws and against common sense.

The velocity of accelerated expansion today is valued at $68 kms^{-1}$ which puts (considering the age of the universe is 13,7 billion years) the radius of the universe at $2{,}78 \cdot 10^{19} km$. On the other hand, the radius of the observed universe is around $4{,}41 \cdot 10^{23} km$. This discrepancy of the rate 10^4 indicates there is a huge system error in the Big Bang model regarding the size of the observable universe.

Universe in dynamic equilibrium has stable value of gravitational constant G

We propose in this article a model of the universe in dynamic equilibrium. In intergalactic space, where the value of EPM is at a maximum, the energy of space is continuously transforming into cosmic rays that then themselves transform into elementary particles (Friedlander, 2002). In the centre of black holes the EPM value is at a minimum, and as a result atoms become unstable and disintegrate back into the energy of space. The calculation of EPM in the centre of black hole that has a mass M that is equal to the mass of the Sun, and has a radius r of 3000 metres gives the following value:

$$\rho_{SE} = \rho_{PE} - \frac{3M \cdot c^2}{4\pi \cdot r^3} = 4{,}633 \cdot 10^{113} - 1{,}582 \cdot 10^{36}\, J/m^3 \qquad (28)$$

and thus here one has

$$\Delta_{EPM} = \rho_{PE} - \rho_{SE} = \frac{3M \cdot c^2}{4\pi \cdot r^3} = 1{,}582 \cdot 10^{36}\, J/m^3 \qquad (29).$$

The value of EPM in the centre of a black hole the size of the Sun is smaller than in outer intergalactic space by $1{,}582 \cdot 10^{36}\, J/m^3$.

The circulation of energy just described, i.e., the process "formation of particles in outer space - formation of stars - black holes - disintegration of matter in space energy," is eternal; it has no beginning and will not have an end. Black holes are the "rejuvenating mechanisms" of the universe, where "old" matter is transformed back into the "fresh" energy of space itself. The universe as a whole has an infinite amount of energy which cannot be created and cannot be destroyed.

In a universe of dynamic equilibrium, the gravitational constant G is unchangeable. The value of the gravitational constant G can be written as follows:

$$G = \frac{l_P^3}{m_P \cdot t_P^2} = \frac{1}{\rho_P \cdot t_P^2} = \frac{c^2}{\rho_{PE} \cdot t_P^2} \qquad (18).$$

The calculation of G in the centre of a black hole, where EPM diminishes by $1{,}582 \cdot 10^{36}\, J/m^3$, confirms that the value of G remains unchangeable in the measurable rate and we can then consider that it is of the same value throughout universal space (Sorli *et al.*, 2018). Our research group plans an experiment to measure the value of G at three different places on the globe (India, Russia, and China) at the same time periodically every month for one year. In this way we will get statistically significant data about G values.

In the model that is being presented, which is a model of the universe in a permanent dynamic equilibrium, dark energy is the energy of space itself (Fiscaletti 2016). Space is neither empty nor filled with some type of energy; rather, space is the concrete fundamental energy of the universe as was proposed by Ervin Schrödinger (Huntley 2013). The curvature of space in General Relativity is the mathematical expression of its energy density. A higher curvature of space means a lower energy density of space (Fiscaletti, Sorli 2015) for which the actual geometry is Euclidean.

Cosmology without paradoxes

At night, we see the universe as a dark sky simply because the light coming from the galaxies is not strong enough to lighten all of universal space. When you put candles in a very large room, the room remains dark and you see the sources of light. You can imagine the universe as a room that is infinite in extension and has an infinite number of candles which are separated by enormous distances. The idea that universal space would be full of light if the universe was not expanding makes no sense. According to our model, in our observable space, the galaxies do not have enough light to fill all of universal space with light. Olber's paradox is a classic example of the way in which science sometimes creates a problem through the wrong reasoning.

The other problem with today's cosmology is the inflation model, which unsuccessfully tries to explain the appearance of energy in the first moments of the Big Bang. There is no reasonable

explanation for the appearance of energy in the so-called "first moments" of the Big Bang. We have known in physics, since the time of Newton, that energy cannot be created and cannot be destroyed; but it can be transformed. The Big Bang model does not satisfy the law of conservation of energy. On the other hand, the model of the universe presented here, which describes the universe as being in dynamic equilibrium, fully satisfies the law of energy conservation.

The inflation signal could not be detected by BICEP2 (Cortês, 2015) because it could not have yet reached the Earth (as was also shown for the CMB signal, in chapter 4). In the cosmological model that we present in this article, the appearance of energy is not a problem. Another problem with Big Bang cosmology is in its failure to account for both where the energy comes from for the "the initial kick" for the explosion, as well as what exactly it is that has exploded. Our model has no such problems. Big Bang cosmology needs a "creator," a someone who has given an initial energy that causes the "birth" of the universe. In this sense, the Big Bang cosmology has some "biblical elements" that are not deserving of being a part of cosmology. In our model, the universe is a non-created system in a permanent dynamic equilibrium; it works perfectly without a creator.

Conclusions

The idea that particles and fields exist in an empty space deprived of physical properties is the main obstacle standing in the way of the progress of physics. With the introduction of Euclidean-Planck metrics (EPM) of universal space, particle physics gains a new model regarding the origin of energy, mass, and the gravity of elementary particles. More than this, EPM applied to cosmology shows that the Big Bang model has insufficiencies that are unsolvable. NASA results confirm that universal space is Euclidean, which excludes the possibility that universal space could be finite, which itself then excludes the possibility that it could expand. The model of infinite universal space governed by the EPM presented in this article heralds the end of the Big Bang model of cosmology and introduces a model of the universe that is in a permanent dynamic equilibrium.

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