The Universe as two-dimensional membrane on the event horizon of singularity

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Abstract

Present short communication introduced comprehensive model in which the universe may be seen as the two dimensional membrane on the event horizon of singularity which occurred within the mother universe during supermasive star collapsed to the black hole. Presented here simplified and comprehensive model struggle to describe cause of the universe occurrence, defining nature of initial inflation and present status of our observable particle horizon. Introduced idea leads to the multiverse model similar to shown by Anderi Linde but multiplied on each generation. Such creation of multiverses may continue into the great or almost infinite number of ancestor's and descendants universes until space energy level permits.

Keywords — *Universe origin, singularity event horizon*

I. INTRODUCTION

Over the millennia, people learned about basic laws and mutual cause-and-effect relationships in their immediate surroundings. It took a long time before man realized that he was just infinite small part of this huge interconnected system called the universe. We then began to learn more universal laws that embrace the larger collection of cosmic bodies available for research.

Knowledge of the general laws of the universe resembles these from observations under the magnifying glass of enormously large organism to make a judgment about the appearance and functioning of the whole body based on the study of its small fragments. Already at the end of the romantic era, it began to realize that our imagination is significantly limited in relation to reality. Therefore, it was thought that courts should be issued on the basis of a comprehensive analysis of meticulously collected partial information.

Since the beginning of the seventeenth century when Galileo invented the use of a telescope for astronomical observations, attempts have been made to determine the template in which known celestial bodies coexist within the universe. Initially, data on the distribution of objects located relatively close to the Solar System were collected. Realizing that we are part of a huge cluster of stars called the Galaxy was a breakthrough in understanding the Universe as a hierarchically constructed collection of objects of unimaginably large sizes. It turned out at the beginning of twenties century that the Galaxy was considered only an extremely small component of entire universe.

Fig 1: Camille Flammarion 1888 lithography from the book ' L'atmosphère: météorologie populaire' presents the medieval illustration of the universe and its border.

It is now believed that the size of the universe's radius is dictated by its age, which is 13.8 Giga years (Gyr) which is age 0, the beginning of our universe. This is also the radius of the observable universe, which is 13.8 Giga light years (Glyr). As a reminder: one light year is the distance that light travelling through vacuum at a speed of 300,000 km/s make distance during a year. From a star closest to us, α-Centauri, light must travel about 4 years. This would be the case if the universe would be in stable from its inception to today. However, as early as 1929, Edvin Hubble showed that the universe is not stable, but seems to be expanding and the more distant the objects in space from us, the faster they seem to move away from us. It has been calculated that the speed of the Universe expansion increases by 71 km/s/Mpc, i.e. by 71 km/s for every million parsecs (1pc ~ 3 light years). The idea based on the study of the redshift of spectra of distant galaxies was interpreted on the basis of the Doppler phenomenon. This phenomenon has not yet been confirmed by independent methods, such as the study of the distance difference on time from observable variable stars, Cepheid.

After taking into account the effect of expansion of space, the current radius of the observable universe, also called the *particle horizon*, i.e. the distance from where the rays emitted by the objects that sent this light immediately after the birth of the universe reach us, turned out to be much larger today and amounts to about 46 Giga light years (Glyr). This distance is also called the *event horizon of the* observable universe because, as a result of the increase in the speed of expansion of space as a function of distance the most distanced object are much father now in comparison to the tome they emitted light at the beginning of the universe. Objects which are in further distance away from us than the radius of the universe's event horizon will simply fall out of from our universe and become invisible to us. The light sent by these objects will never reach us, which means that they will cease to exist for us, just like distant lands beyond the circle of the Earth's horizon. Therefore, the question remains what is beyond this horizon of the observable universe. There may be continuing of space filled with worlds similar to those we see around us. There may also be an empty vacuum filled with the ocean of quantum fields, so that at the tops of some of the more energetic waves of this universe ocean, other universes similar to ours or drastically different could be created. This question will probably remain open for speculation of philosophers, poets and thinkers for a long time if not forever.

Philosophers and scholars have pondered the nature of the universe since done of civilization. Cosmology which was spined of the philosophy developed its ideas in ancient times and concerned mainly the Solar System. Published by Newton in 1687, the Latin work "Philosophiae Naturalis Principia Mathematica" popularly known as "Principia" proved to be the most important scientific dissertation in the history of civilization and led to the emergence of Newtonian Cosmology. This dissertation showed how the cosmic bodies of the solar system move thanks to the learned laws of gravitational interactions. Throughout the 20th century, astronomers have realized that the universe is much larger than our planetary system described sufficiently clearly by Newtonian cosmology. As a result, more and more new cosmological models were created as observational data increased, in order to explain the previously incomprehensible phenomena observed using more accurate modern research instruments.

A whole new cosmological paradigm arose when in March 1916 Albert Einstein submitted for publication an article entitled "General Theory of Relativity". From this event it can be said that the period of development of relativistic cosmology has begun and has been going on since then to the present day. At that time, Russian Alexander Friedmann [1] in 1922 introduced the idea of the expanding universe along with all material bodies it contained. In 1929, Edwin Hubble discovered a way to measure distances to distant galaxies, and by studying the spectra of 46 known galaxies, he found the relationship between the speeds of these galaxies as a function of their distance. This relationship is known today as Hubbel's law, which was later confirmed and verified by testing hundreds of distant galaxies.

From the time Friedman's ideas arose, the French clergyman Georges Lemaître came to the conclusion in 1927 that if you track the expansion of the universe backwards in time, you can find the beginning of the universe from an extremely small point. It was the beginning of the birth of the cosmological concept of the expanding universe. This dynamic model in the light of the general relativity theory gave rise to the emergence of new cosmological theories such as stationary state theory, and the widely recognized the Big Bang theory.

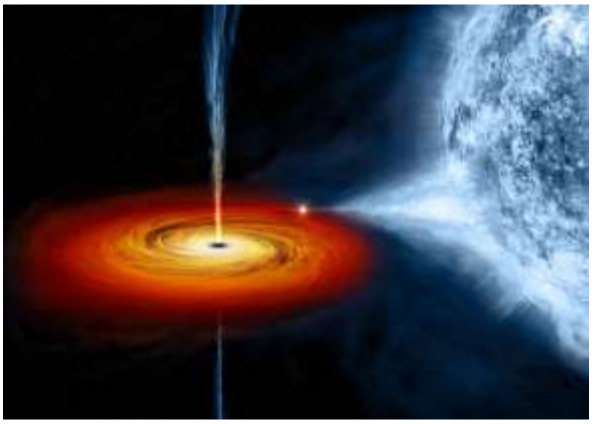

Fig 2: Art black hole vision that feeds with accreting matter from the accompanying star prop errors increases, and the surface energy by the event horizon (NASACXCM_Weiss)

The steady state theory published in 1948 by Bondi and Gold [2] assumed that the universe may expanding while maintaining a constant density of matter and energy through the proposed phenomenon of creating new matter from empty space. Because of this, despite the observed phenomenon of expansion, the universe was to maintain a constant balance. In 1948 Dutch researcher Casimir [3] discovered energy of the empty space when studying the chemistry colloids to uncover the nature of the van der Waals forces. This empty space energy in form of measurable force was known as the Casimir force. The formation of elementary particles from empty space energy has been experimentally confirmed. It turned out that the density of the empty space (filled with quantum fields) is ~ 10^{-29} g/cm^3 and for incomprehensible reasons it is equal to the density of matter within the universe.

New idea, the Big Bang theory was a kind of counterweight to the steady state theory mentioned above which name was coined by Fred and Hoyle, who developed it from the earlier results of Einstein, Friedman , Lemaître and Hubbleia [4]. Proposed by this theory ideas proclaim that the universe was created in unimaginably violent event from which time it continues to expand. Due to the density of matter and energy decreases such an expansion threatening at the end by the heat death of the universe.

All theories from Newton to Einstein are based on the so-called "Cosmological Principle", which maintains that, apart from local irregularities, the universe looks identically, regardless of where the observer is located. This principle is derived from the earlier and simpler Copernicus Principle, which maintains that there is no place or privileged point within the universe.

Many other elements were added during the expansion of the widely recognized the Big Bang theory, such as inflation theory, string theory, accelerating expansion theory, or multiverse theories based mostly on inflation theory. Rise of the theory of inflation in the last decade of the twentieth century led to a deviation from the Cosmological Principle and allowing the possibility that so called the grand universe being unimaginably huge includes separate space volumes in which the laws of physics may vary. However, the inhabitants of these various parts of the grand universe, being beyond the horizons of local horizon events, are unable to see it and can actually be located as in separate universes. Historically, many different versions of the multiverse theory have been created based on various interpretations of quantum mechanics, quantum cosmology, and it is not the intention of this article to discuss the intricacies of these ideas. Generally, it can be said that these multiverses have been named after their general idea derived from the theory of inflation as "inflation multi-worlds" whose advocate is Andrei Linde of Stanford University.

As a result of the microwave background research, the so-called "flatness problem" was solved and it turned out that mathematically, our universe, within the limits of observation error, is neither closed nor open, but flat and looks like a flat, two-dimensional plane of the membrane abbreviated as "Brane".

II. DISCUSSION

As a result of the microwave background research, the so-called "flatness problem" was emerged and it turned out that mathematically, our universe, within the limits of observation error, is neither closed nor open, but flat and looks like a flat, two-dimensional plane of the membrane frequently abbreviated as "Brane".

None of the existing cosmological theories explain how the universe was created and what its nature might be. When in an article [6] Hawking and Penrose proposed that the past of our universe was *singularity*, it gave an idea which was formulated in [7] that consequently, the universe can resemble the two-dimensional "Brane", fragment on the event horizon of *singularity*.

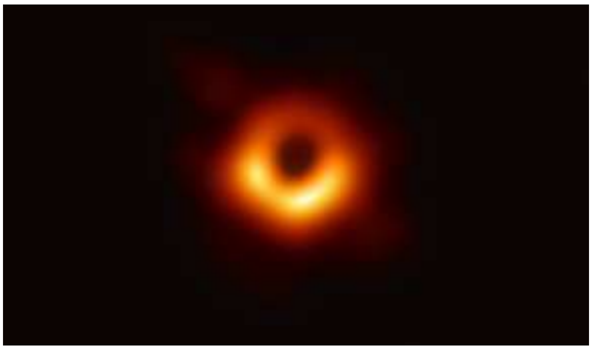

Fig 3: Scientists first received a picture of a black hole using Event Horizon Telescope by observing the centre of the M87 galaxy. The image shows a bright ring formed by bending a line of light in the intense gravitational field of a black hole weighing 6.5 billion larger than the mass of the sun. This image is by far the most credible confirmation of the existence of super massive black holes in space and opens new possibilities for studying these extremely mysterious phenomena of nature, which are black holes, their event horizons and gravity. (Event Horizon Telescope Collaboration).

This short statement was the nucleus of an idea in which the universe is located not inside a black hole as postulated by some of the multiverse ideas, but on the ***event horizon of the singularity*** from which it arose at the time when this *singularity* was born (Fig. 4). The only form of *singularity* known to modern science is the core of the *black hole* where all the laws of physics known to us break down and where space and time swap roles. Because of this, singularity is frequently positioned not as a point in space but rather an instant in time. Thus, the universe in which we live may constitute the two-dimensional surface, approximately spherical, at or near the event horizon of a black hole, which could have been the result of the collapse of a super massive body (star) in the mother universe (precursor or ancestor universe).

So, the new paradigm may shows the “Grand Universe” that may be so vast it cannot be observed as a sphere. The only tiny fragment of this sphere can be seen as the Brane fragment of the observable universe, which resembles our universe within frame of the particle horizon. Thus, from the Schwarzschild equation, the Grand Universe, embracing this observable by us universe as well as the rest of the whole hidden from us beyond the particle horizon may constitute approximately a sphere with a radius;

$$R = 2GE / c^4$$

Where R - is the distance from the singularity to the event horizon, G- cosmological constant, E - the energy of the Universe, c - the speed of light.

Observable universe may looks flat because curvature of this surface fragment (Brane) falls beyond error of measurement. So our observable universe may looks like a tiny prick on the spherical surface of the event horizon surrounding singularity from which all grand universe was born. The grand universe emerged at the event horizon of singularity in the instant of time when singularity in violent processes appeared. Theories of inflation may answer further questions how fast an event horizon raises from singularity.

Picture drawn from an independent observer placed outside an event horizon of our grand universe may differ from what we observe within our observable universe. However, it may be possible now to assume what imaginary observers placed outside and within the grand universe may see and experienced.

Inside the grand universe, an observer may notice only tiny fragment embraced within an event horizon, and may see far away galaxies which red-shift increases proportionally to their distance from observer. According to well accept Big Bang theory this red-shifting effect was interpreted on base of the Doppler shifts which arise from relative motions between emitter and observer. On this basis red-shifting of distant galaxies was interpreted as the expansion of all objects from the observer point of view. However no independence measurements of the delta distance over time were conducted. Precision measurements conducted on Cepheid's gave knowledge about distances to other far away placed galaxies but tells nothing about distance increase in time, which may be relevant to the Hubble's Law.

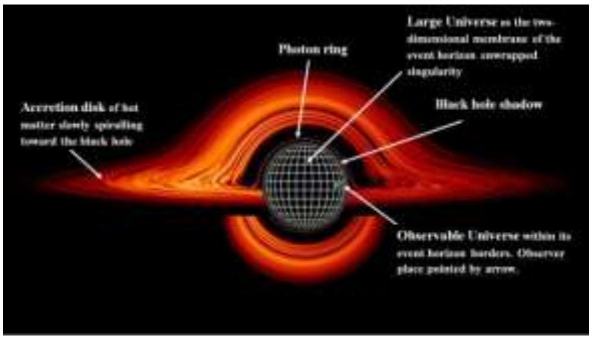

Fig 4: The image in the above illustration shows various aspects of black hole visualization. (NASA's Goddard Space Flight Center / Jeremy Schnittman)

It may seem that the same observed phenomenon of shifting spectra of distant galaxies towards red can be interpreted differently. Photons can lose their energy, for example, when leaving the depths of the gravity well, just like photons coming from the surface of the Sun, they lose energy expressed by lengthening their wavelength. The flow of time is slower near a great mass, as at the surface of the Sun compared to places farther away from this surface. A similar effect may be responsible for the red-shift of the spectra of distant galaxies seen by the observer within the particle horizon of the observed universe. Accordingly to the cosmological principle, the same view shall be able to be seen by a travelling observer anywhere in the entire sphere of the grand universe (Fig. 5). Observer placed within observable universe will be travelling with the entire event horizon of the observable universe and he always will be in a central point of it. Thus, the observer wandering around the sphere of the grand universe will still be at the centre of his own particle horizon seen all around him. The only change will be that as they move forward, new galaxies will continue to appear in front of his travel direction, and those remaining behind will fall off behind the horizon and become invisible to the observer. The effect of red-shifting the spectra of distant galaxies will not change at all, and the galaxies towards he will be heading will show a smaller red-shift of spectrum in comparison to those remaining behind.

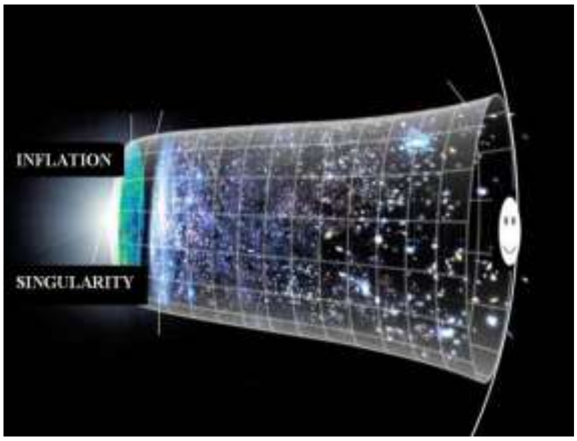

Fig 5: Two-dimensional face of the Flatlman at the event horizon of singularity (circle sphere white portion) as could be seen by external observer and a fragment of four-dimensional space as Flatman may observe from his vantage point. It should be added here that for the sake of simplicity the illustration shows only a fragment of the sphere which is the Flatman observable universe. This fragment should be rotated in all directions around the Flatman face to create a sphere of space-time wells around the inside observer.

A completely different picture can be seen by an observer placed outside the grand universe. This is only a theoretical consideration, because it is impossible for an external observer to see the processes occurring inside the black hole and at its event horizon. Observer placed outside the sphere of the grand universe would see an extremely strange picture in no way similar to that seen by observer placed at the surface of the event horizon within the universe. Well, an external observer would see his colleague as a two-dimensional Flatman moving on the two-dimensional surface of the event horizon of the black hole.

From the perspective of an external observer, one of the dimensions perfectly visible to the observer placed on the surface of the event horizon would be rolled to infinity thanks to the well-known relativistic cosmology effect described by the law of Lorentz's shortening [8, 9, 10]. This effect will have its source in the same reason in which the internal observer sees the spectra of distant galaxies red-shifted. From the perspective of an internal observer, his universe will have all dimensions of space unwrapped. Likewise to an astronaut travelling at speeds close to the speed of light, he will not see the shortening of his own body and the rocket he travels in, while an external observer will be able to observe him as the Flatman in a completely flattened space vehicle. This picture may not be entirely true as this shortening may be however sensed as heterogeneous in space dimension properties as recent results from Chandra X-ray Observatory suggests [5].

The question remains whether astronomers can see the singularity from the Flatman world perspective. It seems that this image may resemble extremely prolonged microwave background radiation waves, which lengthened from high-energy gamma rays when battling the gravity well of singularity.

The black hole phenomenon is a special case of solving Einstein's equations. This case was discovered by Karl Schwarzschild [11] and is known as Schwarzschild's solution, which describes the geometry of a straight, non-swirling black hole. This law shows the proportional relationship between the mass and the surface of the black hole event horizon. Further works of such scholars as Werner Israel, Stephen Hawking and many others diversified this simple image, which was expanded to the form generally recognized by physicists. For simplicity, the black hole consists of the singularity is placing in central point of a black hole and is surrounding by the event horizon, whose radius will remain in relation to the mass of the black hole accordingly to the relationship contained in the Schwarzschild equation. It should be remembered, as mentioned before that singularity is not a place in space but rather is a moment in time, as well as the black hole is only known cause of singularity occurrence. No other forms of singularity occurrence are known. Thus, in present model the singularity creates its own space-time, although embedded within the mother universe. The mutual relations of these separate but co-existing (interpenetrating) spaces are not known, but they can be an interesting topic for future theoretical considerations.

Metaphorically, a black hole can be seen as a crater struck in the space-time of the mother universe, alike to the craters observed on the surface of the Moon. The singularity may appear as a result of the collapse of a super massive star in the mother universe and this event may create its event horizon determined by the Schwarzshild radius. This process of rapid rise of the event horizon from almost nothing to the Schwarzshild radius can be seen as an effect proposed by astrophysicists in the theory of "inflation" which is an extremely important stage in shaping the universe at the time of the Big Bang event. Even if the universe at the time of its creation could have a very small size, on the order of 10^{-33} cm, in the result of some inflation models, after about 10^{-35} fraction of second could grow to unimaginably large sizes counting in centimetres, one followed by a trillion zeros. Of course, this size varies depending on the studied inflation theory model, but according to Andrea Linde [12] this value is much higher by the diameter of the observable universe (10^{-28} cm).

If a black hole formed in the mother universe, absorbs matter from its surroundings, then its mass increases and, in accordance with Schwarzschild's equation, the surface of the event horizon of this black hole increases. In the Flatman's universe, this can be observed as the apparently flat sphere fragment of the observable universe is expanding, which may be calls the universe's expansion. Because this expansion may be heterogeneous in all space dimensions, the anisotropy of the space-time expansion can be measurable as shown in [5].

Metaphorically, a rubber balloon with a dotted surface can be present as an example. Baloon energy may be increased by pumping it up. As the air is pushed into a balloon, its surface increases, and the individual dots move further away from each other. Our Flatman observing the others from his dot perspective may have impression that all other dots are pushing away from each other under the influence of a mysterious antigravity force. This repulsive force can be seen as negative pressure caused by equally mysterious dark energy. However, for an external observer, it is clearly visible that the balloon surface is stretched evenly in two dimensions due to the increase in pressure inside the balloon. There is no place here to create an additional surface on the balloon's membrane, but only to stretch it due to the increase in energy in another dimension of the universe, not visible to the Flatman.

Similarly, the effect of spreading on our Universe, if real, may be seen as the absorption of matter from the mother universe by singularity.

If the black hole existing in the mother universe does not absorb matter, its size does not change, and the entire effect of the red-shifting of distant galaxies spectra observed in the Flatman world can be caused by the process of lengthening the wave of light emerged from the bottomless abyss of gravitational well of singularity like described earlier.

Because, black holes are commonly occurring within our universe (Fig. 3), consequently, each of occurring black holes generation may create its own universes generation on their event horizons. Multiverse ideas where not new, like described by Linde [11] and shown in (Fig. 6). In the Linde's multiverse concept, universes are to be enclosed within inflationary pockets bursting with the result of heterogeneous inflation of the inflationary space-time. In presented model, infinite number of universes may be created within the black holes event horizons, of successive generations of black holes. Inflation theories in Linde-like models do not link inflation to the appearance of singularities but rather to the fluctuation of quantum anomalies. In the presented model the event horizon appears at the moment of singularity occurrence. Did the surface of the event horizon appear simultaneously with the appearance of singularities and how quickly did it develop? Probably the inflation theories may be able to explain this issue in future.

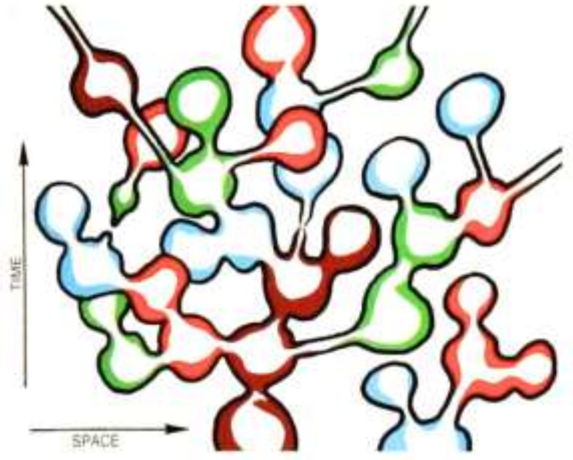

Fig 6: Picture of the global self-reproducing structure of inflationary multiverse according to Linde, (Linde 1998)

If within subsequent generations of multiverses other generations will be born, then this image can be projected up and down arrows of time through the ancestors and descendants universes generations. This, in turn, gives an almost infinite collection of universes whose generations may form a sequence striving for infinity. Metaphorically, this may happens in a similar way to a Russian doll model, but on steroids, where inside one doll instead of another but smaller doll, we may find hundreds of billions of dolls, and in each of these hundreds of billions of dolls a similar number of next generation of dolls can be contained and such a sequence may approach infinity likewise in the fractal model show in (Fig. 7).

It is possible that there is a limit to these strings of creation, and it depends on the energy of the vacuum fluctuation. Each new generation of universes can have ever lower vacuum energy, and the creation of new universes will end when the vacuum energy of the next generation of universes will be so low that no quantum particles can arise from the quantum vacuum fluctuation. If there will be no material particle creation so, stars and black holes will never forms and this will cause the final end to the almost infinite generations of multiverses. Could this be the end of our concept of creation, and how this unimaginably large multiverse may looks like in space and time? Well, it can be assumed that the scheme outlined above applies only to a small fragment of the Mega-Universe (Universum), which is the ubiquitous

Fig 7: Fractal images of emerging multiverses on the surfaces of inflation balloons of the singularity event horizon which appearing randomly on the surface of each of the singularity event horizons generation.

ocean of scalar quantum fields where at the top of the more energetic waves the local grand universe with its streams of multiverses will emerge again.

III. CONCLUSIONS

The model described above may not be true, but it is a voice that simplifies the complex nature of our world, how it was created, where it goes and what it may looks like at the largest possible scale. It is also a response to an appeal by Lee Smolin [13] who wrote: "*Without a doubt, the picture presented here does not have to be a real in every detail, as well as others may occur with their independent models and various ideas. However, the current impasse in science suggests that only bold ideas can on to give a new impetus to push forward our knowledge*". The idea presented above is an alternative vision of the universe in which we live. Is this a real idea or is it an illusion, let Lee Smolin answer it himself.

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