RESEARCH ARTICLE

The Role of Elementary Dimensions in the Creation of the Source of Elementary Particles

Shivan Sirdy*

Department of Physics, College of Science, Kirkuk University, Kirkuk- F. R. Iraq

***Author's email:** sheevan91@gmail.com

Received: 24-04-2020 **Accepted:** 25-11-2020 **Available online:** 31-12-2020

ABSTRACT

It is agreed that before the creation of particles, space was completely devoid of matter and radiation. In this study, we assume that the absolute void comprises 4 dimensions, namely 3 spatial dimensions and a force equivalent representing the factor of change among the elementary dimensions. Our hypothesis is based on the expansion of the spatial dimensions and the subsequent space instability. We demonstrated that when the equivalent outward force strength exceeds a critical limit, it collapses inwardly to restore the equilibrium of the system. Subsequently, the void inside the collapsed force equivalent acts as a void in a confined system, and the energy of the system remains conserved at all stages. With the decrease in the spatial dimensions owing to the collapse, the energy density increases, and at the final stage, the energy in the confined system becomes concentrated, thereby forming a solid state of energy. In this solid state of energy, a particle becomes the source of the elementary particles. The created high-energy sources are controlled by the internal and external forces of the source and all the entities in its external force field until equilibrium is reached. This article gives a summary of the Big Bang theory and its problems, which are further discussed in detail. This article will help in understanding how elementary dimensions play a role in the formation of elementary particles. Quark-gluon plasma, inflation, gravitational collapse, and gravitational lensing provide evidence that supports the elementary dimensions theory presented in this paper.

Keywords: Elementary particles, Elementary dimensions, Space, Force, Gravitational force, Quark-gluon plasma, Gravitational lensing

1. INTRODUCTION

At present, Astrophysics claims that our universe was formed as a result of the "Big Bang." It was confirmed by the astronomical observations of distant galaxies and the observation of a large redshift in the wavelength of thelight coming from these galaxies to the observer on Earth.

Access this article online

DOI: 10.25079/ukhjse.v4n2y2020.pp69-83 E-ISSN: 2520-7792

According to Hubble's law, the wavelength of light increases as the distance between the observer and galaxies increases. Doppler's law linked the cosmological redshift in the spectra of distant galaxies to their active expansion away from each other, including from the observer on Earth. The detection of relic radiation and gravitational waves have also confirmed that there was a Big Bang in the past.

There are 2 points of views on what constituted the Big Bang. According to the first one, known as the Gamow Big Bang theory, an ultra-dense elementary particle exploded about 15 billion years ago. Because of this explosion, our universe was formed. Following the explosion, the universe has been continuously expanding, and because of this, the galaxies scattered and they indicate this with a redshift in their spectra. Over time, as

the distance from the observer on Earth increases, the expansion rate increases. As the galaxies approach the edge of the visible universe, the wavelength of light increases much faster than that predicted by Hubble's law. The researchers who discovered the expansion of universe were awarded with a Noble Prize.

The second point of view arose from the insolvency of ideas about the explosion of a kind of "cosmic egg," which was the explosion of the largest nuclear bomb. Astrophysics today views space as empty and at best filled with electromagnetic radiation. Within the space available for observations, astronomers observe the explosions of stars but do not observe explosions of space between the stars. According to the second point of view, the expanding space entrains the galaxies. Because of this, galaxies disperse and, in accordance with the Doppler law, indicate this by extending the wavelength of the light. At the same time, the mechanism of interaction of material objects with space has not been defined. Previously, authors and supporters of space expansion agreed on the fantastic idea that space expands and that the galaxies remain in place and do not scatter. They argued that the cosmological redshift is in no way connected with the Doppler effect, but they do not offer an alternative explanation for this redshift in the spectra of distant galaxies. Therefore, the second point of view is no better than the first (Alice Collaboration, 2014; Burago Sergey Georgievich, 2017).

According to the current theories, the universe was created by the Big Bang, during which there was a stage in which matter existed as a sort of extremely hot, dense soup called quark-gluon plasma, which was composed of the elementary building blocks of matter. As the time passed, the universe cooled down and the quarks became trapped in composite particles such as protons and neutrons. This process or phenomena is called the confinement of quarks. The Large Hadron collider (LHC) is a machine that is able to produce quark-gluon plasma by accelerating and colliding 2 beams of heavy ions. In the collisions, the temperature exceeds that of the center of the Sun by 100,000 times. Under these conditions, the quarks are free and detectors, which are attached to the LHC, can observe and study the primordial soup, thus probing the basic properties of the particles and how they aggregate to form ordinary matter. It is also used for finding extra dimensions and providing information about the origin and expansion of the universe and the mass of stars or matter (Adolphi, 2008).

Observations undeniably suggest that the universe is expanding. Therefore, it might be difficult to debate that the space-time continuum did not start with the Big Bang. Before the creation of particles (before the Big Bang, if there was a Big Bang), it is agreed upon that space was devoid of matter and radiation (electromagnetic, heat, etc.), meaning that the absolute zero temperature was reached naturally. Hereafter, we call this kind of space absolute void (AV); in contrast, space devoid of matter but containing electromagnetic and heat radiation is simply referred as void.

The absolute zero temperature is reached naturally when all the sources of heat are nonexistent. Therefore, before the Big Bang, the absolute zero temperature was reached naturally because there were no particles or radiation as a source of heat.

Briefly, the differences between AV and void only are as follows:

- An AV exists in the spaces where the particles have not been created and radiation has not reached them yet. In this space, all sorts of heat sources are nonexistent, which allowed these spaces to reach the absolute zero temperature naturally. It is very challenging to create an AV in the laboratory because the removal of all sorts of matter and radiation for the creation of absolute zero temperature in a volume of space is very difficult.

- A void exists in the spaces where the particles have not been created but where radiation has reached them. In these spaces, electromagnetic and heat radiation are present, which causes the temperature of these spaces to be above absolute zero temperature. A void can be created by removing all sorts of particles (including radiation particles, such as alpha particles) from a volume of space.

Both the void and AV are 3-dimensional (space dimensions in the x, y, and z axis). However, if they only consisted of spatial dimensions, no change would occur, and the void would remain the only entity, and, therefore, particles would not be created. However, a fourth

dimension would lead to the creation of matter or particles. The question is if time is the fourth dimension.

Time is a hypothetical concept (McTaggart, 1908; Craig, 2010) that corresponds to changes during certain events, which can be compared with a constant rate of change event. Accordingly, time is a human defined concept used to organize our lives and history. Although time does not really exist, living beings can sense its effects. Therefore, time itself cannot be the fourth dimension, but the factor of change that time represents can be the fourth dimension.

To identify the factor of change, we need to study the properties of the void and AV using experiments. Creating a volume of AV is challenging. Creating a space void totally devoid of particles is also challenging; however, our experiment will allow us to identify the fourth dimension, which corresponds to the factor of change.

2. IDENTIFICATION OF THE FOURTH DIMENSION EXPERIMENT

Fig. 1 shows the creation of void by using a closed head syringe.

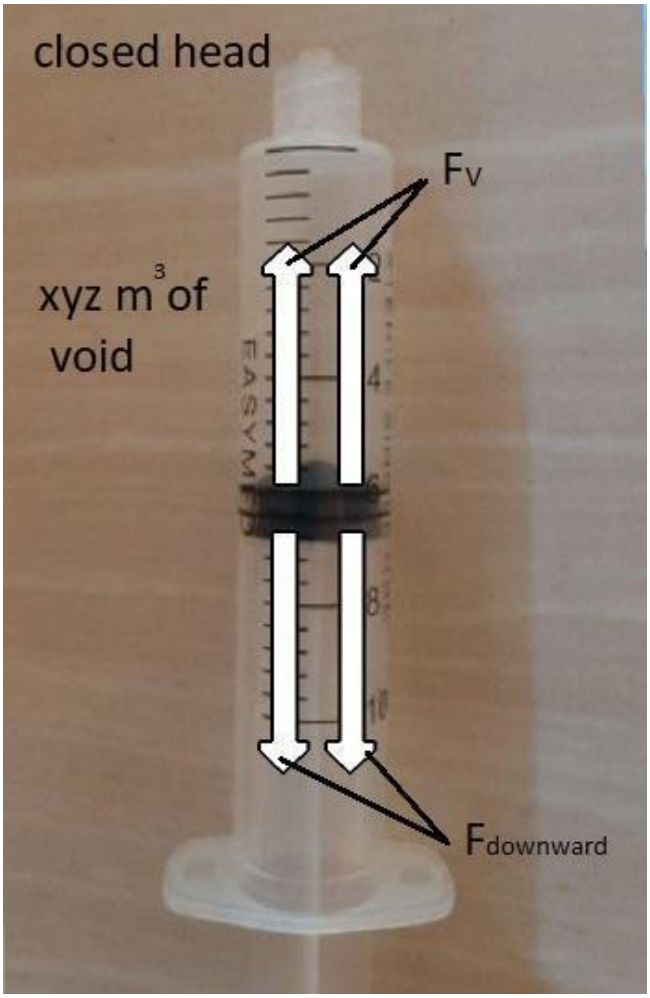

Figure 1. The void creation experiment setup with the use of a closed head syringe

Owing to lack of resources, a 10 ml syringe was used to identify the elementary dimensions of the void. The syringe head was closed, and the bottom part was pulled out by using weights to create the void in the syringe.

Through classical physics, the summation of the forces on the vertical axes equals zero, which is illustrated as follows:

$F_y = 0$, $Fv + F_{downward} = 0$,

where $F_{downward}$ is the force needed to pull the matter downward to create an xyz m^3 of void, and Fv is the equivalent force sourced from the void to resist the lack of matter. If,

$Fv + F_{downward} = 0$,

then, $Fv = F_{downward}$

Therefore, the force Fv corresponds to the factor of change, which means that the F equivalent is the fourth dimension in voids and AVs.

We can conclude from this simple syringe experiment that when a volume of void is existent, the following 2 forces are present in the system:

- Fv: represents the equivalent force that developed internally from the void to resist the lack of matter. Its direction is inward. It is the internal force F_i.
- $F_{downward}$: represents the external equivalent force needed to create the void. Its direction is outward. It is the external force F_e.

As already mentioned, the F equivalent identified in this experiment corresponds to the void. The F equivalent created in an AV space is significantly stronger.

It is well know that the 7 dimensions in physical quantity are:

1. Time (second)
2. Length (meter)
3. Mass (kilogram)
4. Electric current (ampere)
5. Thermodynamic temperature (Kelvin)
6. Amount of substance (mole)
7. Luminous intensity (candela)

However, force is not among those 7 dimensions, which leads us to emphasize the importance of the force equivalent. The equivalent force, which is mentioned above as the fourth dimension, is not the force that we are fond of in physics. The force that we are accustomed to is defined as any interaction that changes the motion of an object. In addition, in physics, force is defined as mass times acceleration. It means that a particle should exist for a defining force.

Following the discussions above, void and AV spaces are 4-dimensional and include x, y, and z axes, and the force.

3. FORCE PATTERNS

Figs. 2 and 3 show the force pattern direction of an absolute void and a void (AV&V) space in a confined and an open system, respectively.

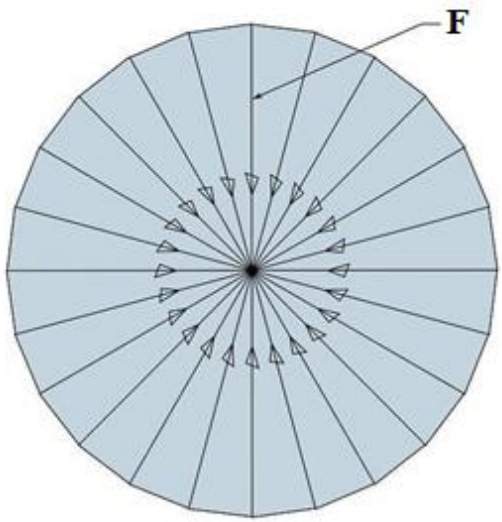

Figure 2. Forces sourced from the AV&V in a confined system

Similar to the experiment conducted in Fig. 1, the force acts to prevent the formation of the void by trying to crush the parameter of the surroundings toward the center in Fig. 2, and therefore, the direction of F is pointed toward the center of the void.

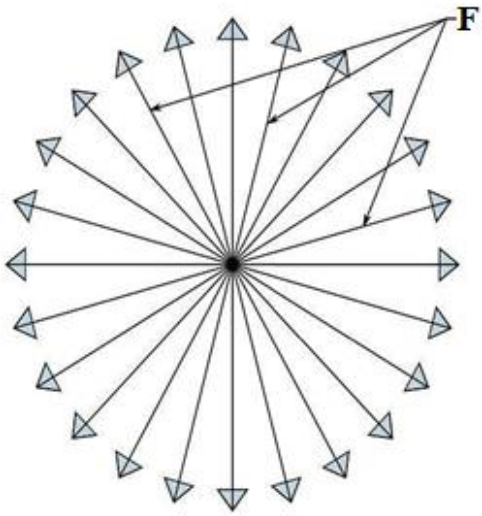

Figure 3. Forces sourced from the AV&V in an open system

However, the AV&V is considered an open system, in other words, the AV&V exists in a free form. At any point of the AV&V, the force is pointing outward as depicted in Fig. 3. Consequently, any point of the AV&V in a confined system acts as an AV&V in an open system, which means that the force is pointing outward (Fig. 4).

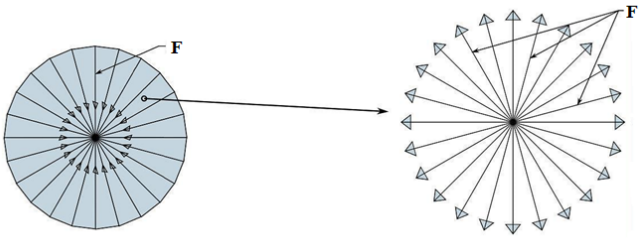

Figure 4. Any point of the AV&V in a confined system acts as the AV&V in an open system

4. CREATION OF THE SOURCE OF ELEMENTARY PARTICLES THROUGH ELEMENTARY DIMENSIONS

When the volume of the AV increases, the outward force subsequently increases, causing the space to become unstable and lose its equilibrium. When the outward force exceeds a critical limit, the system reaches the highest level of instability. To restore equilibrium in the system, the outward force collapses inward (Fig. 5).

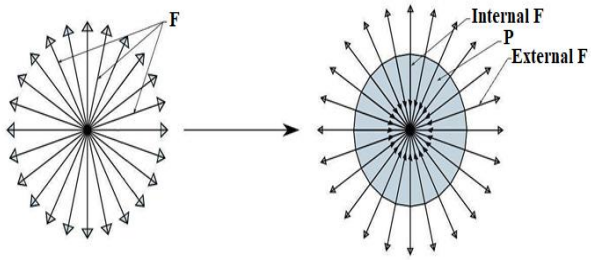

Figure 5. The transformation of AV in an open system to AV in a confined system or the birth of a source of elementary particles

Consequently, the AV transformed from an open system to a confined system, and the energy of the system remained conserved during all stages. However, with a decrease in the spatial dimensions, the energy density increases (Fig. 6).

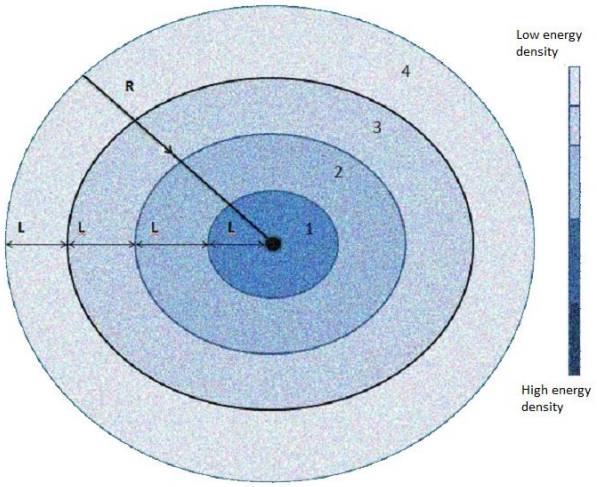

Figure 6. Increased energy density inside the collapse system

At the final stage, the energy in the confined system is concentrated and forms a solid state of energy. Within this solid state of energy, a particle is present, and from this particle, the elementary particles originate. Therefore, the created particle from the increased energy density is the source of elementary particles (hereafter, referred to as source for simplification). The source is created to absorb the surplus force and to decrease the level of instability in the system, thereby achieving equilibrium in space. At this stage, the source is controlled by the following 2 forces:

Internal force F_i, which originates from the void inside the particle, just like a void in a confined system, and is directed toward the center.

External force F_e, which originates from the void outside the born particle.

The force F_i causes the source to shrink or collapse, whereas the force F_e is the resisting force. Therefore, the source will collapse unless equilibrium is achieved between the internal and external forces. In the case, when more than 1 source-like entity exist relatively close together, the equilibrium process exists among all of them.

The source is a high-energy and an absolute zero temperature entity (the energy calculation is below in the gravitational collapse topic).

Before the creation of particles, infinite space of AV existed. Therefore, when unlimited numbers of the source-like entities were created, this was the first step toward the creation of the universe and before the occurrence of the Big Bang. However, deciphering the processes that took place after the source was created is based on a theory. Theoretically, the interactions and collisions among the created sources led to the increase in the temperature of the universe as explained below. This explains how the increase in temperature led to destruction of the sources, which caused the creation of elementary particles and the expansion of the universe.

5. THEORETICAL EVIDENCE

In this section, we discuss 4 phenomena that support the above mentioned elementary dimensions (EDs) theory.

5.1. Gravitational Force and Collapse

The process of gravitational collapse is similar to the process in which a void in an open system becomes a void in a confined system or the force changes from outward-directed to inward-directed. The force equivalent (the fourth dimension), mentioned in the illustrations above, corresponds to the gravitational force.

Demonstrated by observations (Bedran et al., 1996; Glavan and Lin, 2020), gravitational collapse occurs in the universe. Although the observable products of gravitational collapses (e.g., black holes) are not the sources themselves, both the product and the sources are created by the same process (Hacar et al., 2017).

The fact that black holes are also high-energy entities further proves their similarity to the sources. Specifically:

(1) The source in equilibrium state

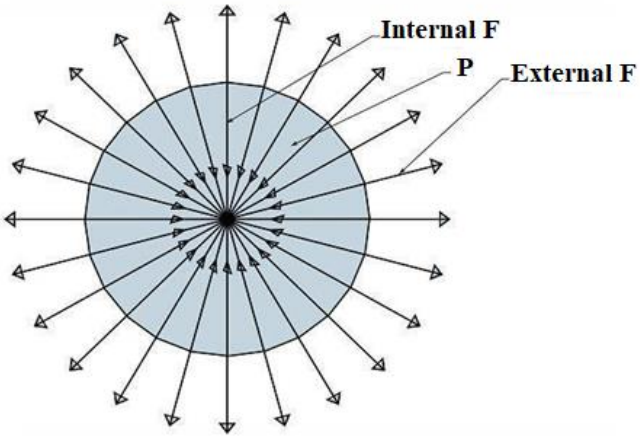

Figure 7. The source in a state of equilibrium, in which $F_i = F_e$

As already mentioned, the internal force causes the source to shrink or collapse, whereas the external force is the resisting component. The source collapses unless equilibrium is achieved between the internal and external forces, as shown in Fig. 7.

The equilibrium of the source is affected by external entities (other sources, stars, planets, etc.) present in its field of impact (Fig. 9). Because those entities have their own external and internal forces, equilibrium must be reached among all the forces of all entities, including the source.

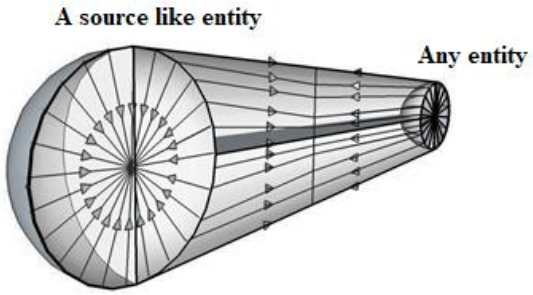

Figure 8. A source in a state of equilibrium with a sample entity in its field of impact with $F_i = F_e$

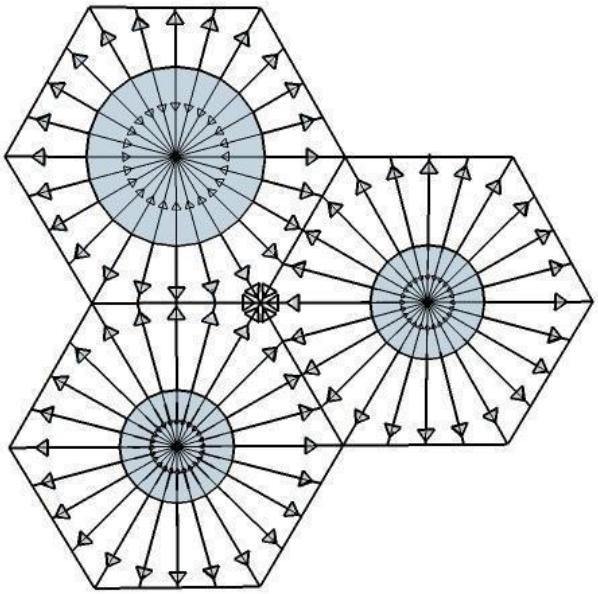

Figure 9. A source in a state of equilibrium with all the entities in its field of impact in which $F_{i,total} = F_{e,total}$

The system in Fig. 9 is in equilibrium when the summation of the internal equivalent forces equals the external ones and is indicated by the following equation:

$$\sum_{n=1}^{n} \quad F_n^{in} = F_1 + F_2 + \cdots F_n$$

The vector sum of each component along the x, y, and z coordinates for the internal forces can be calculated as follows:

$$\sum_{n=1}^{n} \quad F_x = F_{1x} + F_{2x} + \cdots F_{nx}$$

$$\sum_{n=1}^{n} \quad F_y = F_{1y} + F_{2y} + \cdots F_{ny}$$

$$\sum_{n=1}^{n} \quad F_z = F_{1z} + F_{2z} + \cdots F_{nz}$$

The same applies to the external forces:

$$\sum_{n=1}^{n} \quad F_n^{ex} = F_1 + F_2 + \cdots F_n$$

The vector sum of each component along the x, y, and z coordinates for the external forces can be calculated as follows:

$$\sum_{n=1}^{n} \quad F_x = F_{1x} + F_{2x} + \cdots F_{nx}$$

$$\sum_{n=1}^{n} \quad F_y = F_{1y} + F_{2y} + \cdots F_{ny}$$

$$\sum_{n=1}^{n} F_z = F_{1z} + F_{2z} + \cdots F_{nz}$$

Equilibrium implies that the resultant force is zero, hence:

$$\sum_{n=1}^{n} F_n^{in} + \sum_{n=1}^{n} F_n^{ex} = 0 \quad \rightarrow \quad \sum_{n=1}^{n} F_n^{in} = -\sum_{n=1}^{n} F_n^{ex}$$

5.1.1. The black hole in equilibrium state

Before a star dies, the space affected by the star is in equilibrium because the external and the internal forces of all the entities in the field are balanced. The stars and any other forms of particle clusters exert internal and external forces; however, the force impact is much lower than that of a black hole because such entities are low-energy entities (Fig. 10).

A star is made up of a cluster of particles. It is already in equilibrium with all of its own particles' internal and external forces balanced. However, the space region of the star is dependent on the star's forces, implying that a star can have forces bigger than the forces of the total entities in its external force field.

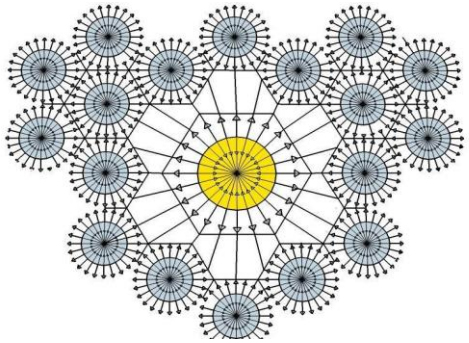

Figure 10. A star in a state of equilibrium indicating all the entities in its field of impact (not in scale), with $F_{star} \geqslant F_{entities}$

For larger stars above the Landau or Tolman-Oppenheimer-Volkoff limit (Pooley et al., 2018) (corresponding to approximately 2 solar masses), known forms of matter cannot provide the force required to balance gravity when the star dies. Therefore, there is nothing to stop the collapse.

When a particle collapses to its Schwarzschild radius (Schwarzschild, 1916; Ghez, 2008), it forms a black hole, a space-time region in which even light cannot escape. Following the theorem of Roger Penrose (Penrose, 1965) and general relativity, the formation of singularity is inevitable. According to Penrose's cosmic censorship hypothesis, the singularity is limited to the event horizon bounding the black hole, and therefore the encompassing space-time district maintains a usual geometry with a solid and limited bend. It is normal (Carter, 1971) to develop toward a fairly straightforward structure that can be described by the Schwarzschild metric in as far as possible and by the later Kerr metric if angular momentum is present. Therefore, a black hole is formed to restore equilibrium in the system.

According to the EDs analysis, a massive star dominates space. This star has the largest amount of internal force among all entities, meaning that the equilibrium of that region of space is mostly dependent on the internal force of the star. When the star dies, the system losses its equilibrium. Based on relative spatial dimensions, a star is not a high-energy entity, regardless of its mass. Therefore, a much smaller, high-energy entity is needed to substitute the star in the equilibrium process. For

instance, a black hole is a high-energy entity. The size of a black hole needed to substitute a star will be much smaller, smaller than the limit of the Schwartzchild radius of the star.

By using the Schwartzchild radius's equation, we can determine that the radius of a black hole needed to substitute a star is as follows:

$$r_s = \frac{2GM}{c^2}$$

where r_s is the black hole radius, G is the gravitational constant, M is the mass of the star, and c is the speed of light in vacuum.

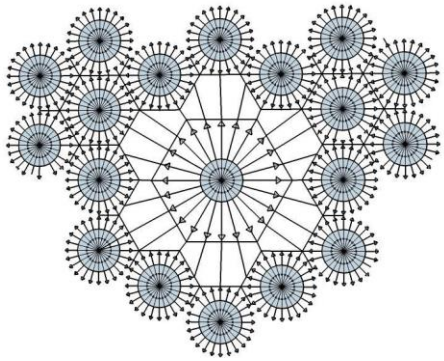

Figure 11. The formed black hole in a state of equilibrium with all the entities in the field of impact of the dead star (not in scale), in which $F_{i,total} = F_{e,total}$

We deduce that the source is formed to create equilibrium in space, because before the creation of the sources, only external forces existed. The sources collapse until equilibrium is achieved, and a black hole is formed in place of the dead star to restore equilibrium (Fig. 11).

5.1.2. Mass, energy, internal, and external force calculation for source-like entities

Through the same equation, we can calculate the mass-radius equivalent for source-like entities as follows:

$$M = \frac{r_s \times c^2}{2G}.$$

Because we have mass, using the energy-momentum relation (Forshaw et al., 2009), we can determine the energy E as follows:

$$E^2 = (pc)^2 + (Mc^2)^2$$

where, P is the momentum and M and c are the same as mentioned above.

Also (McGill and King 1995):

$$P = Mv$$

where, v is the velocity of the entity

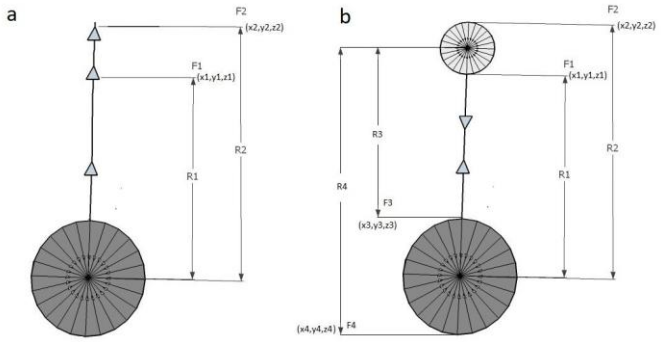

Figure 11. External force calculation

Fin αE

Fex α E and Fex $\frac{1}{R}$,

Therefore, Fex $\alpha \frac{E}{R}$ in $\frac{Joule}{meter}$ = newton, $R_n = \sqrt{x_n^2 + y_n^2 + z_n^2}$

F1 and F2 are the external force effects of the dominant entity, which shift the axis to the center of the smaller entity. The smaller entity also has an external force F3 and F4 effect on the dominant entity.

5.1.3. Thermal equilibrium

The source-like entities are absolute zero-temperature entities unlike stars, which are high-temperature entities. Hypothetically, the absolute zero entities have the ability to devour the high-temperature entities because of their temperature nature and enormous mass through thermal equilibrium (Lieb and Yngvason, 1999; Völkel et al., 2019).

[mCΔT]Source + [mCΔT] Star = 0

Here, msource = source's mass; mstar = star's mass; C = specific heat capacity

ΔT = the difference in temperature

5.2. Quark-gluon Plasma

In theoretical physics, the Hagedorn temperature (Gaździcki & Gorenstein, 2016), TH, corresponds to the temperature where the hadron is no longer stable and must either evaporate or convert to quark matter. Therefore, TH can be considered to be the boiling point of the hadron (Rafelski, 2020).

Quark-gluon plasma (QGP) (Bhalerao, 2014) is an interacting localized assembly of quarks and gluons at thermal (kinetic) equilibrium and close to chemical abundance equilibrium. The temperature of the QGP is above the Hagedorn temperature. QGP emerges as the new phase of strongly interacting matter manifesting its physical properties in terms of nearly free dynamics and quarks and gluons practically without mass (Rafelski, 2015; Koch et al., 2017).

The following procedure is considered when taking a random atom as a sample:

At medium (273–360 Kelvin) temperature, the structure of atoms is in a solid state.

By increasing the temperature, the degrees of freedom in atoms are increased, which changes their structure to a liquid state.

By increasing the temperature further, the increase in the degrees of freedom changes the atom structure to a gas state.

Excessively increasing the temperature to Hagedorn temperature causes the formation of the QGP state (as defined earlier).

This procedure differs from the method mentioned in EDs theory, in which it is stated that before the creation of particles, the universe was at an absolute zero temperature.

In fact, when temperature decreases to the absolute zero, the process occurs in reverse, implying that before the creation of particles when all types of heat sources were nonexistent and when the absolute zero temperature was reached naturally in a volume of space, all the components of the atom were merged. This means that fermions and bosons were compressed together at the same point to form a singularity (Shapiro and Teukolsky, 1991).

According to the EDs theory, singularity is a characteristic of the source of particles, and it is the state at which the absolute zero temperature is reached and all particle components (fermions and bosons) are in the same location. In the singularity state, the source of particles is at its maximum mass level in relation to the spatial dimensions.

With an increase in temperature, the source (singularity) decomposes to the elementary particles. However, once the elementary particles are created, the process cannot be reversed, meaning that achieving absolute zero temperature will not create singularity again. In this case, the elementary particles will be at ground state or vacuum state (Astrid Lambrecht 2002). However, singularity can be created through gravitational collapse.

The sources of elementary particles created from elementary dimensions are, therefore, at the singularity state and at the maximum mass level, which occupies a very small scale of the spatial dimensions.

5.3. Inflation

According to Overbye (2017), Whiting (2004), and Borağan Aruoba (2020), the Big Bang theory gives a lot of information about the origin of universe and explains why the universe is expanding as discovered by the Hubble Space Telescope. However, the Big Bang model was not complete because it had 3 problems: (1) horizon, (2) flatness, and (3) monopole. All of these problems were solved by using an inflammatory model of the universe, which assumes that from 10-36 to 10-33 or 10-32 seconds after the Big Bang occurred, the universe expanded by a factor of 1050 (Sapkota and Adhikari, 2017). The basics of inflation cosmology is explained below.

The source or the singularity is a high-energy entity, and when it decomposes into elementary particles, a tremendous amount of energy is released in different forms (electromagnetic and heat radiations, etc.). The temperature increases tremendously and the spatial dimensions consequently expand, leading to the expansion of the universe in every direction (the energy calculation for this is explained in the section of gravitational collapse).

The source may decompose because of the increase in the temperature, the interactions, or because of the collisions among the unlimited sources created in the infinite AV of the early universe.

The universe will keep expanding as long as there is a source of heat radiation that increases the temperature. When all sources of heat radiation are consumed, the expansion will stop.

When the expansion stops, because of the consumption of all the sources of heat, the universe will be at absolute zero temperature and infinite spatial dimensions, thereby bringing the universe back to the first stage before the creation of particles. From there, the system will collapse again, and thereby form the source of elementary particles.

The process above indicates that the universe is in a cycle.

5.4. Gravitational Lensing

Gravitational lensing (Einstein, 1936) emerged as an observational field following the 1979 discovery of a quasar with a double image that was lensed in a foreground galaxy. Following that discovery, many advanced imaging systems have been developed. Lensing is currently one of the most effective methods used for the determination and mapping of dark matter over a wide range of scales and also to find the nature of energy. One of the most effective lensing methods is microlensing, which is effectively used to determine the mass of planets (Jain, 2007; Mukherjee et al., 2020). The basic process of the gravitational mechanism is explained below .

A distribution of matter (e.g., galaxy clusters) between a distant light source and an observer can bend the light of the source as it travels toward the observer (Sauer, 2008). Gravitational lensing fits perfectly in the EDs theory, as shown in Fig. 13.

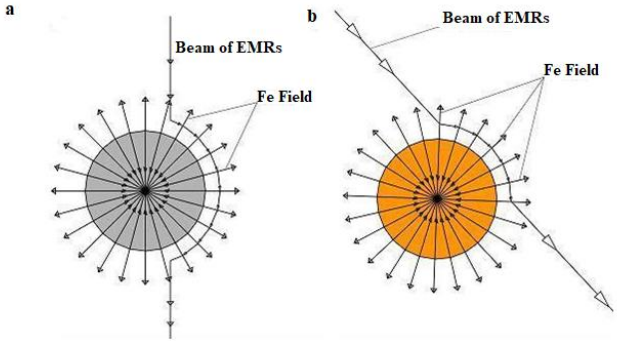

Figure 13. (**a**) Bending of a beam of light passing by the black hole; **(b)** Bending of a beam of light passing by a star

When a beam of light approaches a black hole or star, it is affected by the external force field of the system. Although the beam of light tends to travel straight toward the system, the force F_e prevents it from falling into the system, causing what is known as gravitational lensing (Mauro Sereno, 2018).

The same well-known equations can be used to measure the angle of deflection.

5.5. Particle Creation

Particles cannot materialize out of space to create the universe. In contrast, they must be created from the void and its dimensions, because the void is the predecessor of particles.

6. CONCLUSION

In this study, we hypothesized that there is a limit to the level of instability of the AV at absolute zero temperature, at which point the external force is huge. When the external force exceeds this limit, the force collapses inward, creating the source of elementary particles. Furthermore, we discussed that the source is governed by 2 forces, namely the internal force that leads to the collapse of the source and the resistant external force. The source is in a state of equilibrium when the external force equals the internal force. According to EDs theory, the source is a high-energy entity that exists at absolute zero temperature, meaning that all particle components are merged together into a singularity. Finally, we concluded that an AV consists of 4 dimensions, 3 of which are spatial dimensions and the fourth is a factor of change.

ACKNOWLEDGMENTS

I would like to express my gratitude to Editage for the scientific and English language editing and Mr. Izaiah Mulenga for providing consultations on the mathematical presentations.

REFERENCES

Adolphi, R. (2008). The CMS experiment at the CERN LHC. *The Journal of Instrumentation*, *803*, S08004.

Alice Collaboration. (2014). Performance of the ALICE experiment at the CERN LHC. *International Journal of Modern Physics A*, 29(24), 1430044.

Bedran, M. L. et al. (1996). Model for nonspherical collapse and formation of black holes by the emission of neutrinos, strings and gravitational waves. *Physical Review D*, 54(6), 3826.

Bhalerao, Rajeev S. (2014). Relativistic heavy-ion collisions. In: Mulders, M.; Kawagoe, K. (Eds.). *1st Asia-Europe-Pacific School of High-Energy Physics*.

Bhauvnesh Jain (2007). "Focus on Gravitational Lensing". New journal of physics.9. p-12

Borağan Aruoba, S. (2020). Term structures of inflation expectations and real interest rates. *Journal of Business & Economic Statistics*, *38*(3), 542-553.

Carter, B. (1971). Axisymmetric Black Hole Has Only Two Degrees of Freedom. *Physical Review Letters*, 26(6), 331–333.

Craig, W. L. (2010). *The Tenseless Theory of Time*. Berlin, Germany: Springer.

Dynamics and Relativity, J.R. Forshaw, A.G. Smith, Wiley, 2009, ISBN 978-0-470-01460-8

Einstein, Albert (1936). "Lens-Like Action of a Star by the Deviation of Light in the Gravitational Field". Science. 84 (2188): 506–507. Bibcode:1936Sci....84..506E. doi:10.1126/science.84.2188.506. PMID 17769014.

Gaździcki, M., Gorenstein, M. I. (2016). In: Rafelski, Johann (Ed.). *Hagedorn's Hadron Mass Spectrum and the Onset of Deconfinement*. Berlin, Germany: Springer International Publishing. p. 87–92.

Georgievich, B. S. (2017). About the theory of the Big Bang. *J Gen Sci.*

Ghez, A. M. et al. (2008). Measuring Distance and Properties of the Milky Way's Central Supermassive Black Hole with Stellar Orbits. *The Astrophysical Journal*, 689(2), 1044–1062.

Glavan, D., & Lin, C. (2020). Einstein-Gauss-Bonnet Gravity in Four-Dimensional Spacetime. *Physical Review Letters*, 124(8), 081301.

Hacar, A., Alves, J., Tafalla, M., & Goicoechea, J. R. (2017). Gravitational collapse of the OMC-1 region. *Astronomy & Astrophysics*, 602, L2.

K. Schwarzschild, "Über das Gravitationsfeld eines Massenpunktes nach der Einsteinschen Theorie", Sitzungsberichte der Deutschen Akademie der Wissenschaften zu Berlin, Klasse fur Mathematik, Physik, und Technik (1916) pp 189.

Koch, P., Müller, B., & Rafelski, J. (2017). From strangeness enhancement to quark–gluon plasma discovery. *International Journal of Modern Physics A*, 32(31), 1730024.

Lambrecht, A. (2002). In: Hartmut, F., Dieter M., Claus Z. (Eds.). *Observing mechanical dissipation in the quantum vacuum: an experimental challenge; in Laser physics at the limits*. New York: Springer. p. 197.

Lieb, E.H., Yngvason, J. (1999). The physics and mathematics of the second law of thermodynamics, Physics Reports, 314: 1–96, p. 55–56.

Mauro Sereno , Carlo Giocoli , Luca Izzo et al. (2018). "Gravitational lensing detection of an extremely dense environment around a galaxy cluster ". *Nature Astronomy*, *2*(9), 744-750.

McGill and King (1995). Engineering Mechanics, An Introduction to Dynamics (3rd ed.). PWS Publishing Company. ISBN 978-0-534-93399-9.

McTaggart, J. E. (1908). *The Unreality of Time*. Mind.

Mukherjee, S., Wandelt, B. D., & Silk, J. (2020). Probing the theory of gravity with gravitational lensing of gravitational waves and galaxy surveys. *Monthly Notices of the Royal Astronomical Society*, *494*(2), 1956-1970.

Overbye, D. (2017). *Cosmos Controversy: The Universe Is Expanding, but How Fast?*. The New York Times. Retrieved 21 February 2017.

Penrose, R. (1965). Gravitational Collapse and Space-Time Singularities. *Physical Review Letters*, 14(3), 57–59.

Pooley, D.; Kumar, P.; Wheeler, J. C.; Grossan, B. (2018). GW170817 Most Likely Made a Black Hole. *The Astrophysical Journal*, 859(2), L23.

Rafelski, J. (2015). Melting hadrons, boiling quarks. *Eur. Phys. J. A*, 51(9), 114.

Rafelski, J. (2020). Discovery of Quark-Gluon Plasma: Strangeness Diaries. *The European Physical Journal Special Topics*, 229(1), 1-140.

Sapkota, N., Adhikari, B. (2017). A review on Cosmic Inflation. *International journal of current research and academy*, 5, 2347-3215.

Shapiro, S. L.; Teukolsky, S. A. (1991). Formation of naked singularities: The violation of cosmic censorship. *Physical Review Letters*, 66(8), 994–997.

Tilman Sauer (2008). "Nova Geminorum 1912 and the Origin of the Idea of Gravitational Lensing". Archive for History of Exact Sciences. 62 (1): 1–22. arXiv:0704.0963. doi:10.1007/s00407-007-0008-4.

Völkel, S. H., Konoplya, R., & Kokkotas, K. D. (2019). Inverse problem for Hawking radiation. *Physical Review D*, *99*(10), 104025.

Whiting, A. B. (2004). The Expansion of Space: Free Particle Motion and the Cosmological Redshift. *The Observatory*, 124, 174.