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The Role of elementary dimensions in the creation of the Source of elementary particles

Keywords: elementary particles; elementary dimensions; space, force; gravitational force; quark gluon-plasma; gravitational lensing

Abstract

It is agreed that before the creation of particles, space was absolutely devoid of matter and radiation. In this study, we assume that the absolute void comprises four dimensions; three 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 outward force equivalent strength exceeds a critical limit, it collapses inward to restore equilibrium in the system. Then, the void inside the collapsed force equivalent acts as a void in a confined system, the energy of the system remains conserved at all stages. With the decrease of the spatial dimensions due to the collapse the energy density increases, at the final stage the energy in the confined system is concentrated forming a solid state of energy. In which, this solid state of energy is a particle become the source of the elementary particles. The created high-energy sources are controlled by the internal and external forces of the source and all entities in its external force field until equilibrium is reached. The article gives the summary of Big bang theory and its problems which are further discussed in inflation. This article will help in understanding that how elementary dimensions play a role in the formation of elementary particles. The quark gluon plasma, inflation, gravitational collapse, and gravitational lensing provide evidence supporting the elementary dimensions theory presented in this paper.

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I. Introduction

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

There are two points of the view on what constituted the Big Bang. According to the first of these, known as the Gamow Big Bang theory, about 15 billion years ago an ultra-dense elementary particle exploded. Due to the explosion , our universe was formed. Since than it has been continuously expanding and as a result of this, the galaxies scattered and signal it with a red shift 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 the predicted by Hubble's law. The researchers were awarded with Noble Prize, who discovered the expansion of universe.

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, at best filled with electromagnetic radiation. Within the space available to 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, signal this by extending of the length of the light wave. At the same time the mechanism of interaction of material objects with space is not developed. Sometimes authors and supporters of space expansion was agreed with fantastic ideas that space expands, and galaxies remain in their places and do not scatter. They argue that the cosmological redshift is in no way connected with the Doppler effect and does not bother explaining what in this case causes a red shift 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 is created from the Big Bang, during the Big Bang there was a stage in which matter existed as a sort of extremely hot, dense soup called quark-gluon plasma which are composed of the elementary building blocks of matter. As the time passes, the universe cooled, the quarks became trapped into composite particles such as protons and neutrons. This process or phenomena was called confinement of quarks. The Large Hadron collider (LHC) is a machine which is able to produce the quark gluon plasma by accelerating and colliding together two beams of heavy ions. In the collisions, the temperature exceeds 100,000 times that of the centre of the Sun. Under these conditions the quarks are free and detectors which are attached with the LHC can observe and study the primordial soup, thus probing the basic

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properties of the particles and how they aggregate to form the ordinary matter. It is also using in finding extra dimension, gives the information about the origin and expansion of universe and mass of star or matter (Adolphi, R. (2008)).

Observations undeniably suggest that the universe is expanding. Therefore, it might be difficult to debate that space-time 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 that space was devoid of matter and radiation (electromagnetic, heat, etc.), i.e., the absolute zero temperature is reached naturally. Hereafter, we call this kind of space absolute void; contrarily, 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 non-existent. Therefore, before the big bang, the absolute zero temperature was reached naturally because there weren't any particles or radiations as a source for heat.

Brief differences between absolute void and void only:

- Absolute void: exists in the spaces where the particles have not been created yet and the radiations have not reached them yet. In this space, all sorts of heat sources are non-existent. Which made these spaces to reach the absolute zero temperature naturally. It is very challenging to create absolute void 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.
- Void: exists in the spaces where the particles have not created but radiations reached them. In these spaces, electromagnetic and heat radiations are present which create the temperature of these spaces above absolute zero temperature. Void can be created by removing all sorts of particles (including radiation particles, like alpha etc...) in a volume of space.

Both the void and absolute void are three-dimensional (space dimensions in the x, y, and z axis). However, if they only consist of spatial dimensions, so no change occurs, and the void remains the only entity and particles are not created. However, a fourth dimension leads to the creation of matter or particles. The question is whether time is the fourth dimension?

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

To identify the factor of change, we need to study the properties of the void and absolute void from experiments. Creating a volume of absolute void 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.

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II. Identification of the fourth dimension experiment

Figure 1 shows the creation of void through using a closed head syringe:

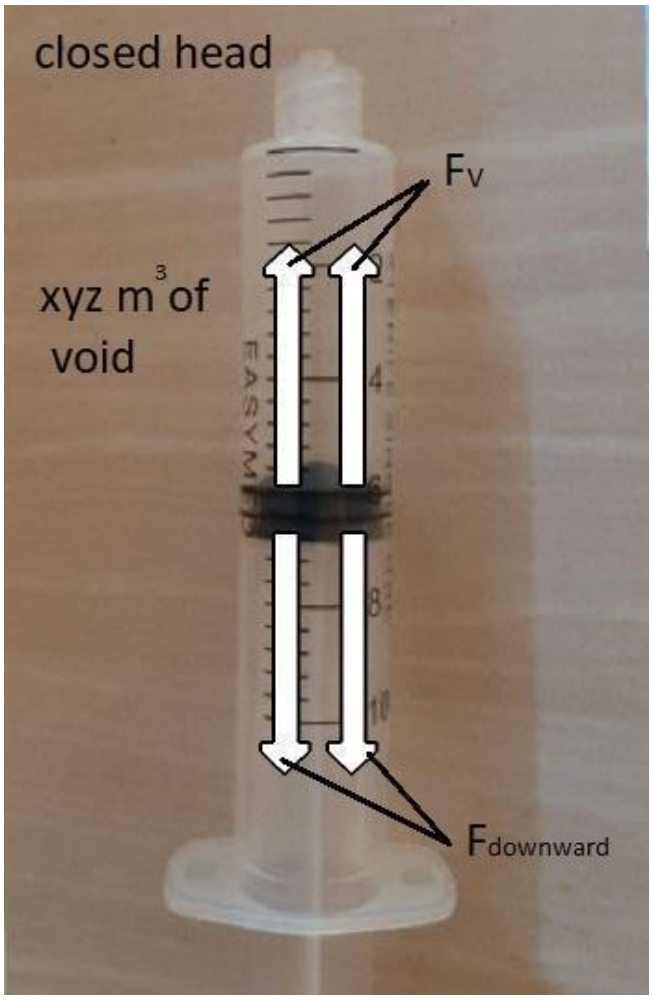

Figure 1. Void creation experiment through using a closed head syringe.

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 by using weights to create the void in the syringe.

Through classical physics, the summation of forces on the vertical axes equals zero

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

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

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

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

We can conclude from this simple syringe experiment, when a volume of void is existent, there are two forces in the system.

- Fv: manifests the equivalent force developed from the void internally to resist

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the lack of matter. Its direction is inward. It is the internal force F_i.

- $F_{downward:}$ manifests the external equivalent force needed to create the void. Its direction is outward. It is the external force Fe.

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

It's a well know that the seven dimensions in physical quantity are:

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

Where force is not among those seven, which lead us to emphasize the importance of force equivalent. The equivalent force which is mentioned above as the fourth dimension is not the force, we are fond of in physics. Where 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 defining force. Following the discussions above, void and absolute void are four-dimensional which are x, y, z axis, and the force.

Acronyms guideline for the below topics:
Absolute void-AV, Void-V
Absolute void and Void-AV&V
The force-F, internal force-Fi, external force-Fe

III. Force patterns

The figure 2 and 3 shows the force pattern direction of an AV&V space in a confined and an open system, respectively.

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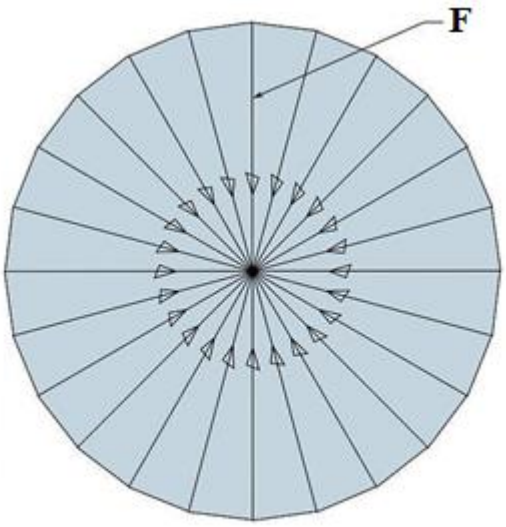

Figure 2. Forces sourced from the AV&V in a confined system.

Similarly, the experiment conducted for Figure 1. In Figure 2 the force acts to prevent the formation of the void by trying to crush the parameter of the surroundings toward the centre; i.e., the direction of F is point toward the centre of the void.

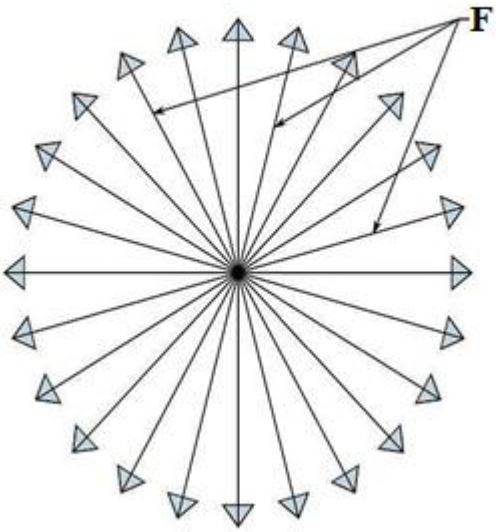

Figure 3. Forces sourced from the AV&V in an open system.

However, the AV&V is considered an open system, namely the AV&V exists in a free form. At any point of the AV&V, the force is pointing outward, as depicted in Figure 3.

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Consequently, any point of AV&V in a confined system acts as AV&V in an open system, which means that force is pointing outwards(see Figure 4).

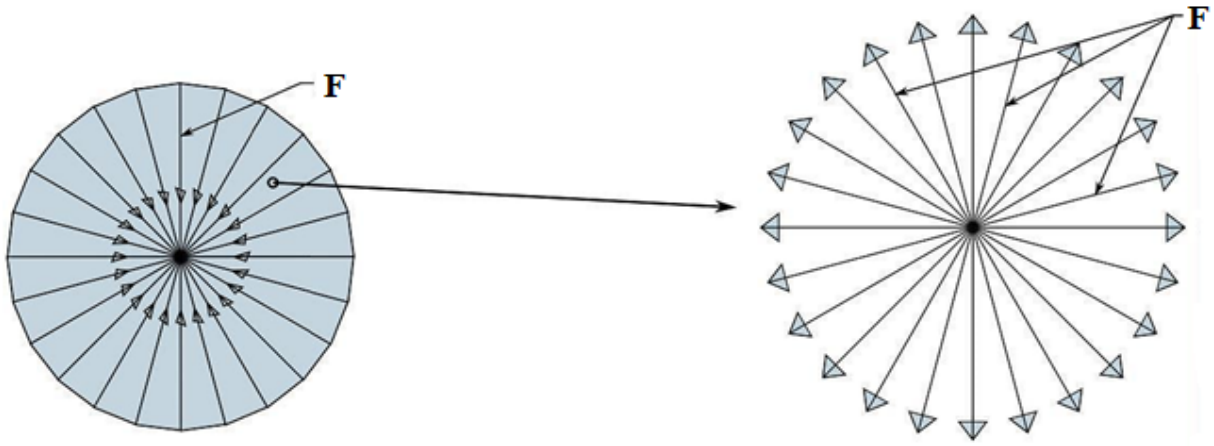

Figure 4. Any point of the AV&V in a confined system acts as AV&V in an open system.

IV. Creation of the source of elementary particles through elementary dimensions

When the volume of absolute void increases, the outward force subsequently increases, while the space becomes unstable and losses equilibrium state. 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 (see Figure 5).

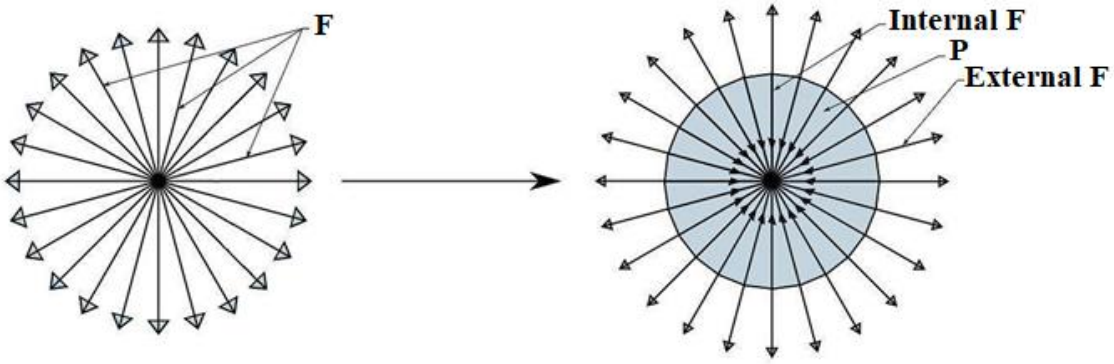

Figure 5. The transformation of absolute void in an open system to absolute void in a confined system or the birth of a source of elementary particles.

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Consequently, the absolute void has transformed from an open system to a confined system, **the energy of the system remains conserved** at all stages. However, with the decrease of the spatial dimensions the **energy density increases** (see figure 6).

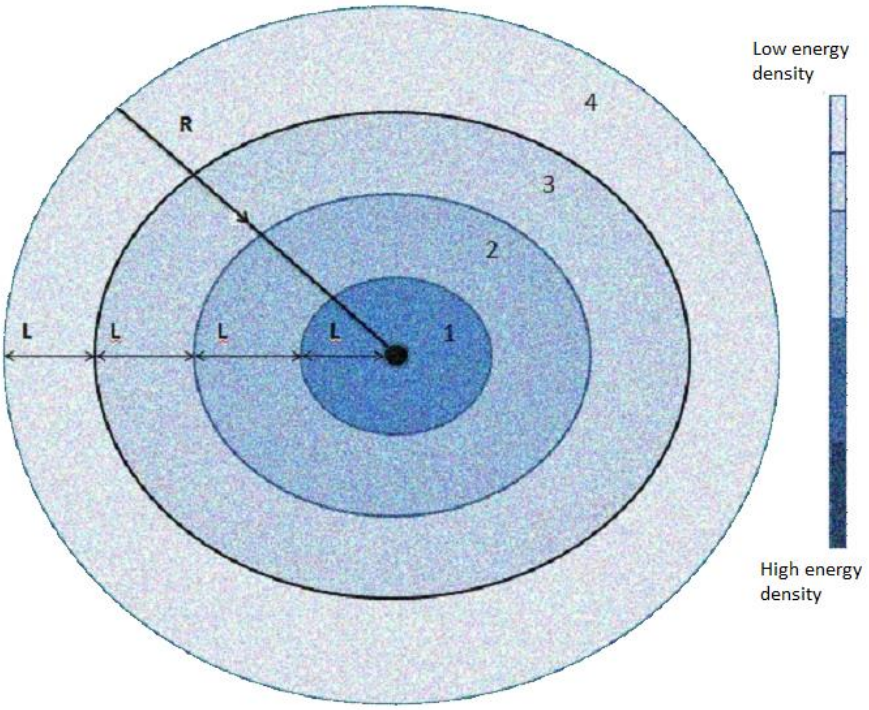

Figure 6. Increased energy density inside the collapse system

At the final stage the energy in the confined system is concentrated forming a solid state of energy. In which, this solid state of energy is a particle and from this particle originates the elementary particles. 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 achieving equilibrium in space. At this stage, the source is controlled by two forces:

a. Internal force F_i, which originates from the void inside the particle, just like void in a confined system, and is directed toward the centre.
b. External force F_e, which originates from the void outside the born particle.

The force F_i causes the source to shrink or collapse, while the force F_e is the resisting force. Therefore, the source collapses until equilibrium is achieved between the internal and external force. In case, more than one source-like entity are existents near each other relatively, the equilibrium process is 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 absolute void existed. Therefore, unlimited numbers of the source-like entities are created, this was the first step toward the creation of the universe and before the big bang. However, describing the processes

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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, which are explained below. Which explain that how this increase in temperature is led to breaking down the sources to cause the creation of elementary particles and the expansion of the universe.

V. Theoretical evidence

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

1. Gravitational force and collapse

The process of gravitational collapse is similar to the process in which void in an open system becomes void in a confined system, or the force 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, gravitational collapse (Bedran, ML et al. (1996), Glavan, D., & Lin, C. (2020)).occurs in the universe. Although the observable products of gravitational collapse (e.g., blac holes) are not the sources themselves, both the product and the sources are created by the same process (Hacar, A., Alves, J., Tafalla, M., & Goicoechea, J. R. (2017)).

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

a. The source in equilibrium state

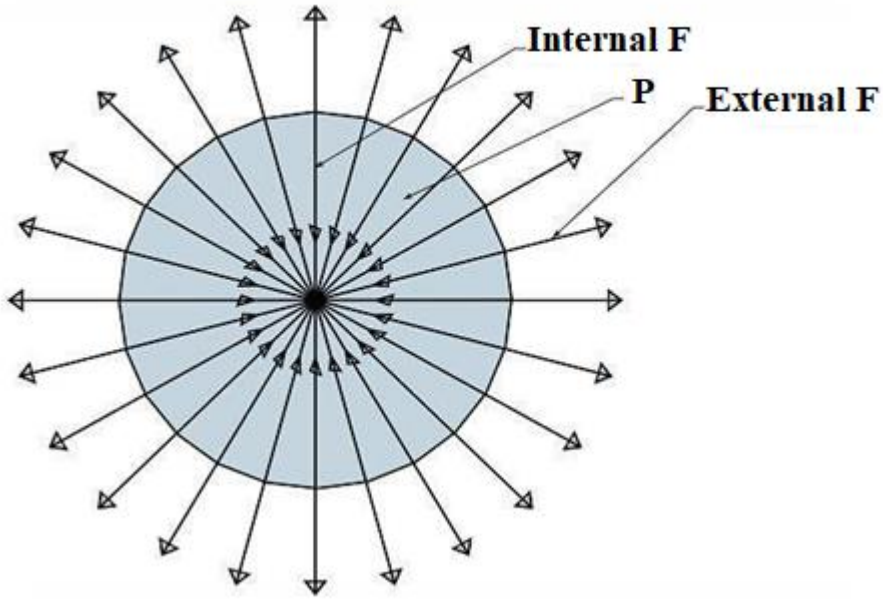

Figure 7. The source in a state of equilibrium, i.e., F_i=F_e.

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

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

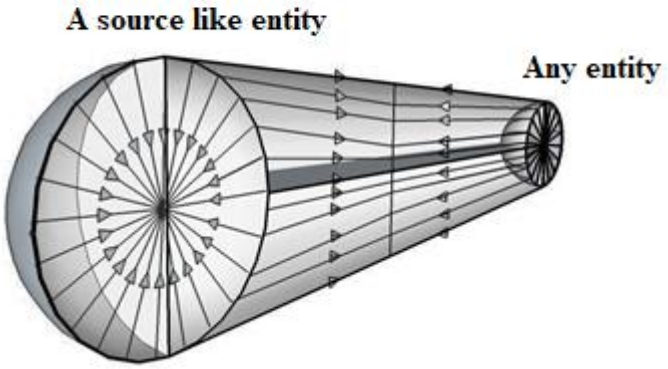

Figure 8. A source in a state of equilibrium a sample entity in its field of impact, i.e., $F_{i,} = F_{e,}$

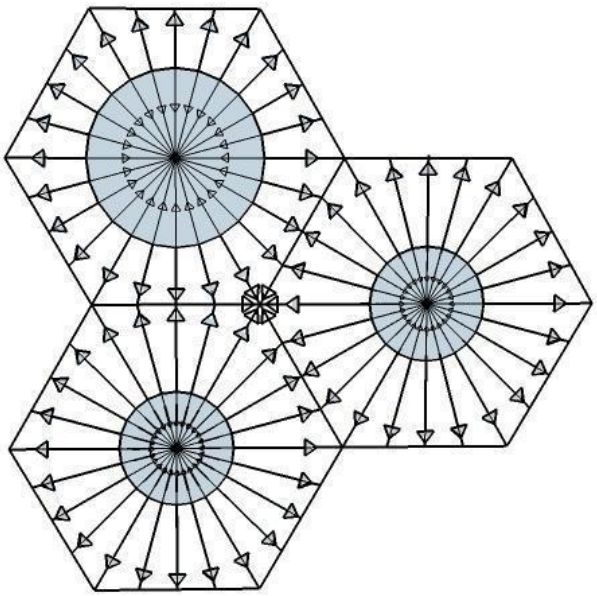

Figure 9. A source in a state of equilibrium with all the entities in its field of impact, i.e., $F_{i,total} = F_{e,total}$.

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The system in figure 9 is in equilibrium, when the summation of internal equivalent forces equals the external ones:

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

The vector sum of each component along x, y, and z coordinates for the internal forces:

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

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

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

The same for 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 x, y, and z coordinates,

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

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

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

Equilibrium implies to the resultant forces is zero, hence:

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

b. The black hole in equilibrium state

Before a star dies, the space affected by the star is in equilibrium as the external and the internal forces of all entities in the field balance. 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 ones (see Figure 10).

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

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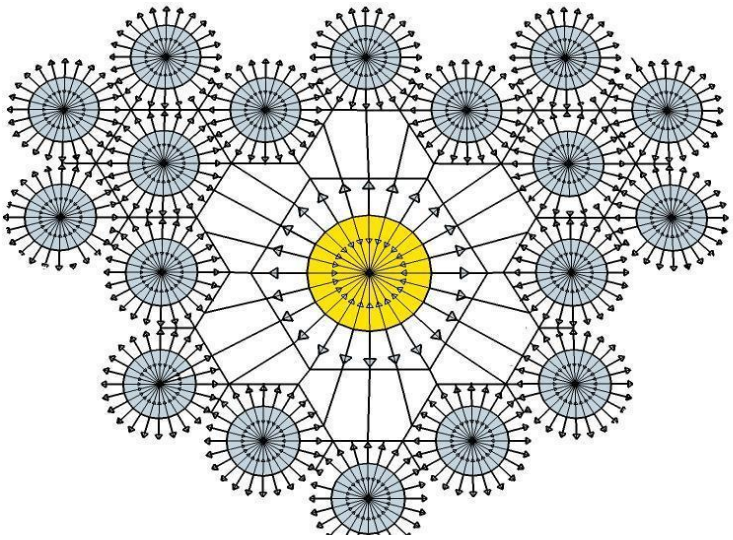

Figure 10. A star in a state of equilibrium with all the entities in its field of impact (not in scale), i.e., $F_{star} \geqslant F_{entities}$.

For large stars above the Landau/Tolman-Oppenheimer-Volkoff limit (Pooley, D.; Kumar, P.; Wheeler, J. C.; Grossan, B. (2018-05-31)) (approximately two solar masses) ,when the star dies known forms of matter cannot provide the force required to balance gravity. Therefore, there is nothing to stop the collapse.

When a particle collapses to its Schwarzschild radius (K. Schwarzschild, 1916), (Ghez, A. M, 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, so the encompassing space-time district keeps up a usual geometry with solid and limited bend. This is normal (Carter, 1971) to develop towards a fairly straightforward structure describable 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 to the system.

Depending on the EDs analysis, a massive star dominates the space. The star has the largest amount of the internal force among all entities, meaning that 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. Relatively based on 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 to the limit of Schwartzchild radius of the star.

Through using Schwartzchild radius's equation, we can identify the radius of a black hole needed to substitute a star:

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

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.

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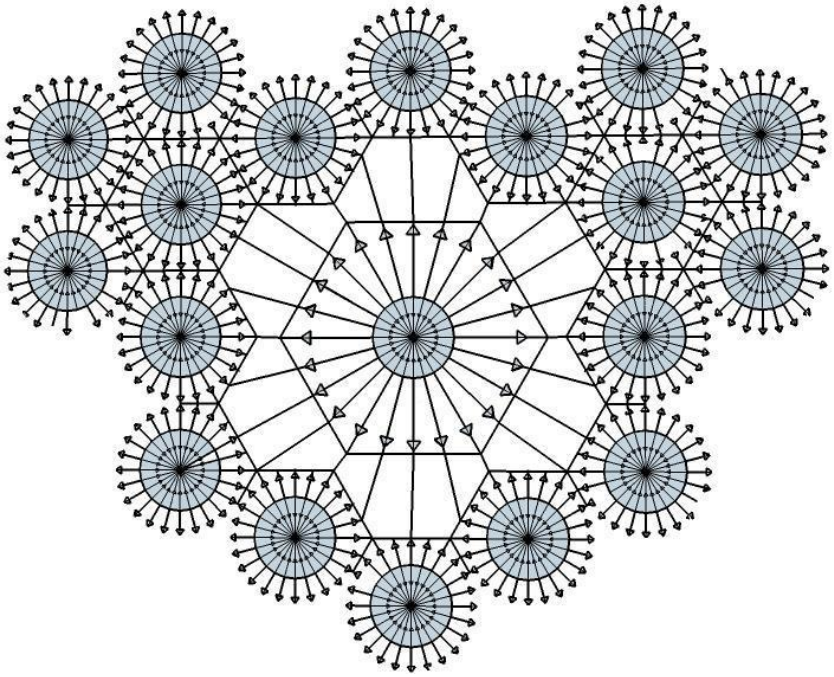

Figure 11. The formed black hole in a state of equilibrium with all entities in the field of impact of the dead star (not in scale), i.e., $F_{i,total} = F_{e,total}$.

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

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:

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

Now we have mass, using energy–momentum relation (J.R. Forshaw, A.G. Smith, Wiley, 2009), we got the energy E:

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

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

P=Mv, (McGill and King (1995)), v is the velocity of the entity

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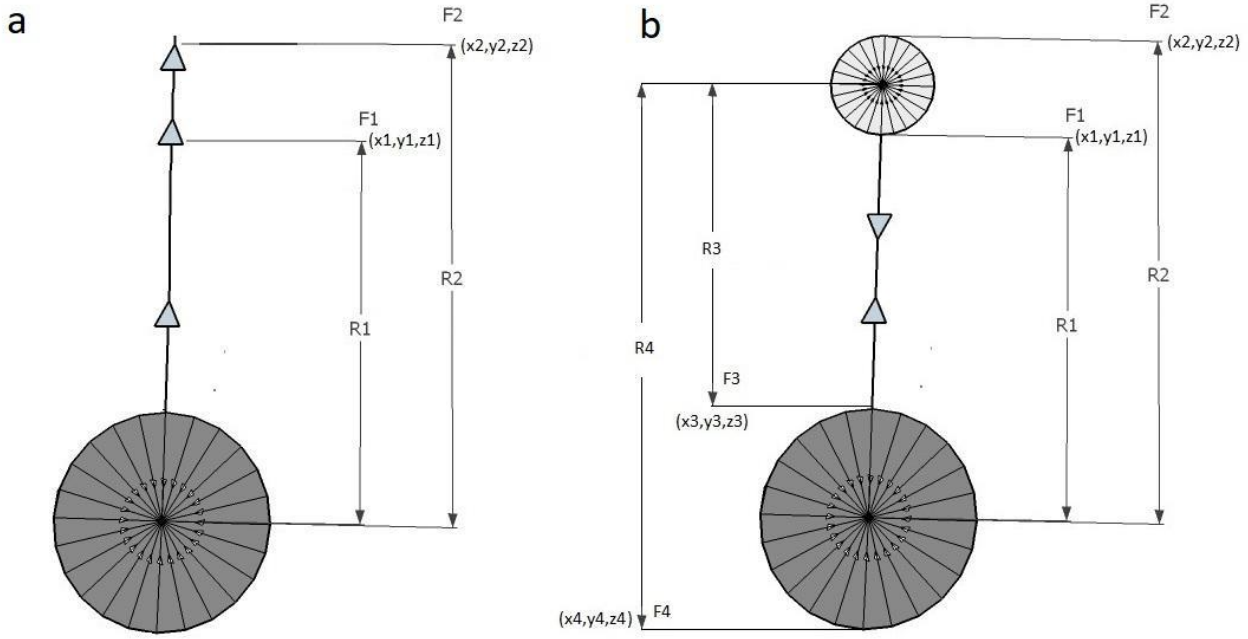

Figure 11. External force calculation

$F_{in}\ \alpha E$

$F_{ex}\ \alpha$ E and $F_{ex}\ \frac{1}{R}$,

Therefore $F_{ex}\ \alpha \frac{E}{R}$ 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. Shifting the axis to the centre of the smaller entity. The smaller entity also has an external force F3 and F4 effect on the dominant entity.

Thermal equilibrium:

The source-like entities are absolute zero temperature entities, unlike stars that are high temperature entities. Hypothetically, the absolute zero entities have the ability to devour the high temperature entities due their temperature nature and enormous mass through thermal equilibrium (Lieb, E.H., Yngvason, J. (1999), Völkel, S. H., Konoplya, R., & Kokkotas, K. D. (2019).).

$[mC\Delta T]Source + [mC\Delta T]\ Star = 0$

Here; m_{source} = source's mass, m_{star}=star's mass, C = specific heat capacity

ΔT = the difference in temperature

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2. Quark-gluon plasma (QGP)

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

QGP (Bhalerao, 2014) is an interacting localised 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 of practically quarks and gluons without a mass (Rafelski, J. (2015), Koch, P., Müller, B., & Rafelski, J. (2017)).

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

1. At medium (273-360 Kelvin) temperature, the structure of atoms is at a solid state.
2. Increasing the temperature increases the degrees of freedom in atoms, which changes their structure to a liquid state.
3. Further increasing the temperature and the degree of freedom, changes the atom structure to a gas state.
4. Excessively increasing the temperature to Hagedorn temperature leads to the QGP state (as defined earlier).

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

In fact, when the temperature decreases to the absolute zero, the process occurs in reverse; i.e., which indicates before the creation of particles when all types of heat sources were non-existent, when the absolute zero temperature was reached naturally from a volume of space all components of the atom were merged. This means that fermions and bosons were compressed together in the same point forming a **singularity** (Shapiro & Teukolsky, 1991).

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

With the increase of temperature, the source (singularity) breaks down to the elementary particles. However, once the elementary particles are created, the process cannot be reversed. Meaning **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). Hartmut Figger; Dieter Meschede; Claus Zimmermann). Though, singularity can be created through gravitational collapse.

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

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3. Inflation (Overbye, 2017; Whiting, 2004; Borağan Aruoba, S. 2020)

The Big Bang theory gives a lot of information about the origin of universe and gives the logic that universe is expanding as discovered by Hubble. However, the Big Bang model was not complete because it has three problems. First is horizon problem, second is flatness problem and third is monopole problem. All of these problems were solved by using inflammatory model of the universe i.e. by assuming that from 10^{-36} to 10_{-33} or 10_{-32} seconds after the Big Bang, the universe expanded by a factor of 10^{50} (Nirakar Sapkota and Binod Adhikari, (2017)). The basics of inflation cosmology is explained below.
The source or the singularity is a high energy entity, when it breaks down to elementary particles, a tremendous amount of energy is released in different forms (electromagnetic and heat radiations, etc...). The temperature takes a huge leap and the spatial dimensions consequently expand, leading to the expansion of the universe in every direction. (The energy calculation is explained in the section of gravitational collapse).
The source may be break down due to increase in the temperature, due to the interactions or due to the collisions among the unlimited sources created in the infinite absolute void 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 due to the consumption of all the sources of heat, the universe will be at absolute zero temperature and infinite spatial dimensions. Bringing the universe back to the first stage before the creation of particles. From there, the system will collapse again forming the source of elementary particles.

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

4. Gravitational lensing (Einstein, 1936):

Gravitational lensing emerged as an observational field following the 1979 discovery of a doubly imaged quasar lensed by a foreground galaxy. After that a lot of advance imaging systems have been discovered. Lensing is currently one of the effective methods for the determination and mapping dark matter over a wide range of scales and also find the nature of energy. One of the most effective lensing methods is microlensing which is effectively used for the determination of the mass of planed (Bhuvnesh Jain, (2007), Mukherjee, S., Wandelt, B. D., & Silk, J. (2020)). The basic process of 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 towards the observer (Sauer, 2008).Gravitational lensing fits perfectly in the EDs theory, as shown in Figures 13.

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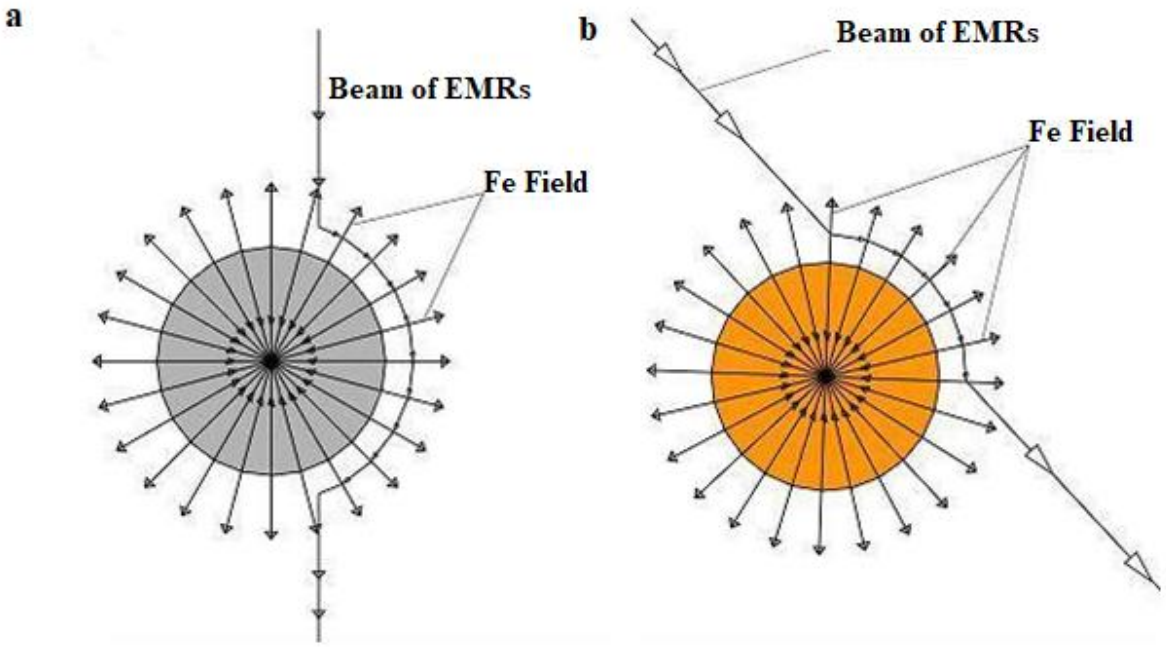

Figure 13. a. Bending of a beam of light passing by the black hole. b. Bending of a beam of light passing by a star

When a beam of light approaches a black hole or star, it is affected by the external force field of the system. While 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. Particle creation

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

VI. Conclusion

In this study, we hypothesised that there is a limit in the level of instability of the absolute void at absolute zero temperature, where the external force is huge. When the external force exceeds this limit, the force collapses inward, creating the source of elementary particles. Further, we discussed that the source is governed by two forces, the internal force that leads to the collapse of the source and the resistant external force. The source is in 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 the absolute void consists of four dimensions, three spatial dimensions and a factor of change.

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