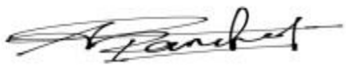
MY RESEARCH

ON ASTROPHYSICS.

BY,

AJAY PANCHAL



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There are many questions associated with science in nature that are still the subject of in-depth research. We will discuss the solution of some of these questions here as we will understand the formation of a neutron star, we will also understand a black hole theoretically. Understand their types and the differences between them, Origin of the universe and many more. There is an important principle associated with many theories. Which is the principle of the energy efficiency (energy capacity) of matter. We will understand this basic principle before presenting our research work.

The principle of energy efficiency (capacity).

Every object has its own fixed capacity to store the given energy (whatever it may be), which is called the energy efficiency (capacity) of the object. The energy potential of each substance is different. Which depends on its functioning . It also depends on its physical nature and chemical composition.

'If any object is given more energy than its energy capacity, that object absorbs the energy according to its energy capacity and releases the excess energy into space. But not every object does this. The extra energy for each object acts differently than the energy capacity they get.

We will now turn our attention to our research work,

The relationship between neutron star and energy efficiency (capacity).

According to Einstein's theory of relativity, mass is another form of energy. And mass energy can be converted into other forms of energy such as kinetic energy etc. Conversely energy can be converted into mass energy. Here we will understand the neutron star with the help of Einstein's relativity. The energy efficiency of a neutron star is very high. A neutron star stores as much energy as it can store in its nucleus. And releases excess energy into its other parts. The energy released here is in the form of light. Plenty of energy is stored in the center of the neutron star and some of the released energy is absorbed around the center of the neutron star and some part is released in the form of light energy. This is because more energy than the energy capacity in the center of the neutron star is released in its other parts as well. Here the light energy released by the neutron star is negligible compared to the energy stored in the center of the neutron star. The mass 'm' of a neutron star is much greater than its size. This can be understood with the help of Einstein's relativity.

According to relativity, an energy can be converted into a form of mass energy. The energy potential of a neutron star is very high. So that it can store a lot of energy. Here energy is stored not in the form of mass but in the form of mass properties. This property is stored in the form of mass. So that the size of the neutron star does not change but its mass changes relative to the size.

Thus from the above discussion we can divide the matter in nature into two parts.

1) Substance having α properties.
2) Substance having β properties.

1.Substance having α properties.

Substances with properties of $\alpha$are substances present in nature that change their properties and dimensions when they receive more energy than their energy efficiency (capacity).That is, if it is in solid state it is converted into liquid and if it is in liquid state it is converted into gas. Such objects are unable to accumulate more energy than their energy potential (capacity) as a mass property., Examples= water, air, steel etc...

2.Substance having β properties.

Substances with β properties are those present in nature which get more energy than their energy capacity and use it as a mass property, the neutron star is an best example of this, Substances with β properties can be divided into two parts.

1) Substance with static β properties.
2) Substance with volatile β properties.

* 1) Substance with static β properties.*

A hypothetical substance with the property of β are in a fixed state i.e. they are not in a state of orbit or rotation.Such a substance can be defined as substance with static β properties.

2).Substance with volatile β properties.

Substance with the property of β that are not in a static state i.e. they have their own orbit and rotation. The neutron star is an example of this.

Now we will get the equation to find the actual mass of objects having β properties. Intuitively, when an substance with anβ property is given more energy than its energy capacity, the mass before it is called its actual mass.

Suppose an substance with β properties has a mass M_o before it is given more energy than its energy capacity(E), So after giving it more energy E_{ext} than its energy capacity E, this extra energy accumulates as a mass properties and gives the total mass (resulting mass) M_c. Whose mathematical representation can be as follows.,

$M_c \propto E_{ext} M_o$

It is important to note here that the additional energy E_{ext} received by any neutron star cannot be more than the equivalent energy of that neutron star.

Figure (1.1)

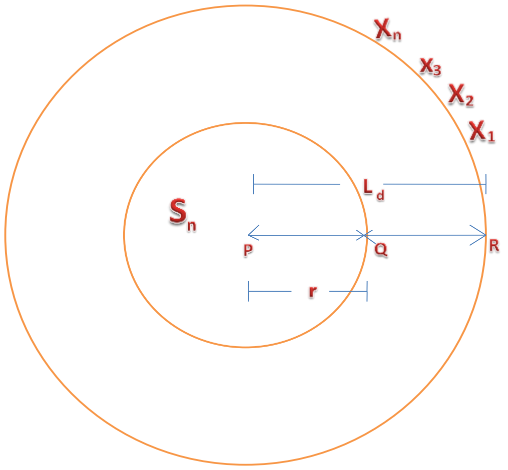


Figure (1.1) shows a single star. Which is denoted by S_n.This is a star that will become a neutron star in the future.We know that when a star's gravity overwhelms it, it breaks down into a neutron star, resulting in a black hole or a white dwarf star. Here the star $S_n$in Figure (1. 1) is selected which will result in a neutron star after the rupture.

The center of this star is P as shown in Figure (1.1). And the radius of this star is PQ meaning 'r'. it is clear from the figure that the surface of this star is Q. Now when this star collapses, the small and large particles and parts of this star will spread in a fixed circular space. As shown in the figure, the particles and small large parts of this broken star are confined to a circular space with a radius of PR i.e.L_d.Here L_d is called the diffusively length of this star, which is defined as follows.

'When an object breaks down, its parts propagate to a certain distance from its center. This is called the diffusively length L_d of the object. Also, when an object exerts a force on a part at a certain distance from its center to towards its center, the length is also called the diffusively length $L_d$of that object'.

As shown in the figure, these broken star's particles and small large parts $x_{1,}x_{2,}x_3 \ldots\ldots x_n$are located at the edge of space with a radius (diffusively length) L_d.Now the way the neutron star has a lot of energy in its center. In the same way this star S_n which results in a neutron star also has a lot of energy in its center. Because gravity dominates itself, it collapses. But the energy in the center is not wasted. But the energy in the center of this star has to expend energy to bring its broken particles and parts back to the center P from a diffusively length L_d.

Thus, theoretically, the lower the energy expenditure of the center of the star, the greater the mass of the neutron star formed by this star, because here the energy is stored in the form of a mass properties. So the more energy there is, the more it will accumulate in the form of mass properties .If the energy required to bring particles and small large particles from distance$L_d$to the center part P is E_u. So according to our discussion,

$$M_c \propto \frac{1}{E_u}$$

As shown in the figure, when this starS_n breaks down, its particles and small and large parts are scattered$x_1, x_2, x_3, \ldots x_n$in the radius of L_d.The center part P have to work to collect them back from a distance L_di.e. back to the center part P. If the force exerted by the center part P towards the scattered part of star S_n to bring it back to the center P from a distance of $L_d$is "F" then the total work done here,

$$W = F \times L_d \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The total work done is equal to the energy E_u used by the center part to bring these particles and small large parts $x_1, x_2, x_3, \ldots x_n$from the center part of the star to the center P.

$$\therefore W = E_u$$

We have seen earlier that the mass of a neutron star is based on the following physical quantities.,

$M_c \propto E_{ext} M_o$and ,

$$M_c \propto \frac{1}{E_u}$$

Thus associating both results,

$$M_c \propto \frac{E_{ext} M_o}{E_u}$$

$$\therefore M_c = K \left(\frac{E_{ext} M_o}{E_u}\right) \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where $K = constant.$

If the extra energy (E_{ext}) received by a neutron star is taken as its maximum value, it will be equal to its equivalent energy.

$\therefore E_{ext} = M_o c^2$......................... (3)

Where ,

M_o = The actual mass (original mass) of neutron star I.e. the mass of $S_n$star.

c= The speed of light in vacuum= $3 \times 10^8 m/s$.

Putting the value of equation (3) in equation (2),

$$M_c = K\left(\frac{M_o c^2 \times M_o}{E_u}\right)$$

$$\therefore M_c = K\left(\frac{{M_o}^2 c^2}{E_u}\right) \text{..................... (4)}$$

If the extra energy E_{ext} received by a neutron star is considered to be equal to its equivalent energy then the constant $K = 1$. This is because if the value of constant K is greater than 1, then the additional energy received by the neutron star will be greater than its equivalent energy, which is not possible.

Thus Equation (4) is written as follows,

$$\therefore M_c = \frac{{M_o}^2 c^2}{E_u} \text{....................... (5)}$$

As we have seen earlier $W = E_u$

Thus,

$$\therefore M_c = \frac{{M_o}^2 c^2}{W} \text{..............................(6)}$$

Putting the value of W from Equation (1) into Equation (6),

$$\therefore M_c = \frac{{M_o}^2 c^2}{F \times L_d} \text{...................(7)}$$

Suppose that the particles at a distance L_d from the center part P and the small and large parts $x_1, x_2, x_3, \ldots x_n$ are attracted to their center with the same constant acceleration as $'a'$. So here the force exerted by the center part can be given by the following equation,

$F = M_o a$....................... (8)

If the masses of these particles and small-large parts $x_1, x_2, x_3, \ldots x_n$were $m_1, m_2, m_3 \ldots\ldots m_n$ respectively,So the total mass of these particles and small large parts,

$M_o = m_1 + m_2 + m_3 + \ldots + m_n$

This total mass is the mass of this star S_n. Because the small-large parts and particles that are broken are only part of this star. So the total mass is denoted by M_o.

Now putting the value of equation (8) in equation (7),

$M_c = \frac{{M_o}^2 c^2}{M_o a \times L_d}$.................... (7)

$\therefore M_c = \frac{M_o c^2}{L_d a}$................... (8)

Or,

$M_0 = \frac{L_d a M_c}{c^2}$.................. (9)

Equation (8) and equation (9) are applicable for an object having β properties in addition to any neutron star.Two points are worth noting here.

1)According to Equation (8), if we have a star in our vision that is going to result in a neutron star after death, and we have the mass M_o of that star and the other two physical quantity $'a'$ and L_d , then we can get the mass $M_c$of the neutron star formed by this star. But the equation (8) that we have got, if we want to examine it experimentally, it takes thousands of millions of years. Because we have to note the mass M_o of a star resulting in a neutron star to test, then we have to wait until it collapses, then we have to find out how many small and big parts of it are from the center of the star to the surface of the circular space. And we have to find the radius L_d of this circular space.It is necessary to note how much constant force is applied by the center P on the part at a distance of L_d. All of these things take a very long time for experimental testing.

2)Experimental demonstration of Equation (9) is not possible because for that we have to get the values of $'a'$ and $'L_d'$, which are related before the formation of a neutron star.

Thus, Equation (8) and Equation (9) are one and the same. The difference is that we will need a long time to note the experimental value of M_c i.e. to test Equation (8) experimentally. When Equation (9) cannot be tested experimentally.

The relationship between diffusively length(L_d), acceleration (a) and speed of light (c).

It is not necessary for every star to change into a neutron star after its death i.e. after it has collapsed.

As we have saw earlier, if the mass of a neutron star is M_c, then its actual mass is M_o, i.e. the mass of the star from which the neutron star is made is given by the following equation,

$M_o = \frac{L_d a M_c}{c^2}$

$\therefore L_d a M_c = M_o c^2$

$\therefore L_d = \frac{M_o c^2}{a M_c}$.............................. (1)

If a broken star does not convert into a neutron star, thenM_c= M_o will occur, because since a broken star does not convert into a neutron star, the mass $M_c$is unlikely. Also the mass of the broken parts is the same mass of that broken star.

Hence equation (1) will be as follows,

$L_d = \frac{c^2}{a}$...................... (2)

$\therefore c^2 = L_d a$

$\therefore c = \sqrt{L_d a}$ .... (3)

Thus, if a star does not transform into a neutron star after a breakdown, that is, if it has a diffusively length(L_d). And if it has an acceleration $'a'$ towards its center on objects from its center to its diffusively length(L_d), then it is related to equation (3).

Thus we can give the condition of becoming a neutron star for any star as follows,

For a star that transforms into a neutron star after it collapses,

$L_d a \neq c^2$

Here we naturally have a question why this? So we know that the energy in the center of a star after a collapsed is used to bring its parts back to the center from a distance of L_d. From this it can be seen that the value of $L_d a$ is equivalent to c^2 which is very large, so that the energy in the center will be expended so that there will be no extra energy to become a neutron star.

Thus, for a star that does not transform into a neutron star after it has collapsed,

$L_d a = c^2$

The relationship between black hole and diffusively length (L_d)

When a massive star dies (collapsed), it results in a supernova and then a black hole. Or when two massive neutron stars collapsed into each other, a black hole is formed. The thing to note here is that even black holes have their own diffusively length(L_d).That is, a black hole also absorbs objects from its center to at a certain distance from its center. This fixed distance means the diffusively length(L_d) of the black hole.

Black-holes have not received more energy than their energy potential. That is, if the mass of the star from which it is made is M_o, its mass will remain M_o even in the case of a black hole.Or if it were formed by the rupture of two neutron stars into each other, its mass would be equal to the total mass of those two neutron stars even in the case of a black hole. Thus we can associate Equation $L_d = \frac{c^2}{a}$ with a black hole.

Thus, if an object is located at a distance from the center of a black hole equal to its diffusively length (L_d), and the acceleration toward its center by the center of the black hole is $'a'$, then the acceleration applied to it, according to equation $L_d = \frac{c^2}{a}$,

$$a = \frac{c^2}{L_d}$$

Through the relationship that we have derived here, we can estimate many noticeable results associated with black holes. For example we can find orbital velocity of objects on the edge of the event horizon of any black hole, which is equal to the speed of light. Also we can derived the escape velocity of the object at the edge of the event horizon.

The event horizon of any black hole is the surface of its radius from the center of the black hole.

Thus, if an object is at a distance from the center of a black hole equal to its event horizon, that is, the radius R of the black hole, and the centripetal acceleration toward its center by the center of the black hole is $'a'$, then this centripetal acceleration applied to it, according to Newton.

$$a = \frac{v^2}{R} \text{..........................(1)}$$

Where,

$v =$ The orbital velocity of objects on the surface of the event horizon of a black hole.

From Equation $L_d = \frac{c^2}{a}$,

$$a = \frac{c^2}{L_d} \text{.........................(2)}$$

In the case of event horizon here, diffusively length (L_d) will be equal to the radius R of that black hole because here we are only discussing the objects on the surface of its event horizon. Thus, $L_d = R$.

Thus Equation (2) is written as follows,

$$a = \frac{c^2}{R} \text{.........................(3)}$$

Now comparing Equation (2) and Equation (3),

$\frac{v^2}{R} = \frac{c^2}{R}$

$\therefore v^2 = c^2$

$\therefore v = c$……………………(4)

Thus the orbital velocity of objects on the edge of the event horizon of any black hole is equal to the speed of light (c).

Currently the escape velocity near the event horizon is considered to be equal to c. But that is not true, because if that were true than even the light itself would be freed from the event horizon.

If the mass of the black hole is M and its radius is R then the orbital velocity of the object near the event horizon,

$v = \sqrt{\frac{GM}{R}}$ ………………………………(5)

Where,

G= Universal constant of gravitation=$6.67 \times 10^{-11}\ Nm^2/kg^2$.

M= Mass of the black hole.

R= Radius of the black hole.

If the mass of the black hole is M and its radius is R then the escape velocity of the object near the event horizon,

$v_{esc} = \sqrt{\frac{2GM}{R}}$…………………………(6)

Where,

G= Universal constant of gravitation=$6.67 \times 10^{-11}\ Nm^2/kg^2$.

M= Mass of the black hole.

R= Radius of the black hole.

Now taking the ratio of Equation (5) and Equation (6),

$\frac{v_{esc}}{v} = \frac{\sqrt{\frac{2GM}{R}}}{\sqrt{\frac{GM}{R}}}$

$\therefore \frac{v_{esc}}{v} = \sqrt{2}$

From equation (4),

$v = c$

Hence,

$\frac{v_{esc}}{c} = \sqrt{2}$

$\therefore v_{esc} = \sqrt{2}$ c

Thus the value of escape velocity is even greater than c.

The relationship between diffusively length and Schwarzschild radius.

We know that a black hole absorbs matter by accelerating it towards its center on the surface of its event horizon and on a objects that extended to its diffusively length (L_d) from its center.

Through the relationship between the diffusively length(L_d) and the Schwarzschild radius, we can learn about a black hole that absorbs every object from its center to a distance L_d with an acceleration equal to its maximum and its own gravitational acceleration.

The diffusively length (L_d) associated with any black hole,

$L_d = \frac{c^2}{a}$ … … … … … …. (1)

Now if a black hole accelerates at its maximum value to each object around its event horizon and from its center to diffusively length (L_d), the acceleration applied here will be equal to the gravitational acceleration of the black hole.

According to Kepler's law, the gravitational acceleration of this black hole,

$a = \frac{GM}{R^2}$.................... (2)

Where,

M= The mass of the black hole.

R= The radius of the black hole.

G= Universal constant of gravitation=$6.67 \times 10^{-11}\ Nm^2/kg^2$.

Putting the value of equation (2) in equation (1),

$L_d = \frac{c^2}{GM/_{R^2}}$

$\therefore L_d = \frac{c^2R^2}{GM}$

$\therefore c^2R^2 = GML_d$

$\therefore R^2 = \frac{GML_d}{c^2}$ .... (3)

$\therefore R = {}^{1}/_{c}\sqrt{GML_d}$ .... (4)

The radius of a black hole is known as the Schwarzschild radius, which is given by the following equation,

$R = \frac{2GM}{c^2}$............................ (5)

$\therefore R^2 = \frac{4G^2M^2}{c^4}$ ....(6)

In equation (5),

M= The mass of the black hole.

G= Universal constant of gravitation=$6.67 \times 10^{-11}\ Nm^2/kg^2$.

c= The speed of light in vacuum= $3 \times 10^8 m/s$.

Thus the radius of a black hole with mass $'M'$ according to Schwarzschild radius is associated with equation (5).

Now comparing Equation (6) and Equation (3),

$\frac{GML_d}{c^2} = \frac{4G^2M^2}{c^4}$

$\therefore L_d = \frac{4GM}{c^2}$ .... (7)

Now taking the ratio of Equation (7) and Equation (5),

$\frac{L_d}{R} = \frac{\left({}^{4GM}/_{c^2}\right)}{\left({}^{2GM}/_{c^2}\right)}$

$\therefore \frac{L_d}{R} = 2$

$\therefore L_d = 2R$

Thus the diffusively length(L_d) of a black hole that absorbs objects from its center to its diffusively length with the same maximum acceleration as its own gravitational acceleration is twice the radius of that black hole.

The area of the circular space(Photosphere at the event horizon from the center of the black hole) around the center of the Schwarzschild black hole that the black hole covers itself,

$A = \pi {L_d}^2$....................... (8)

Putting the value of equation (7) in equation (8),

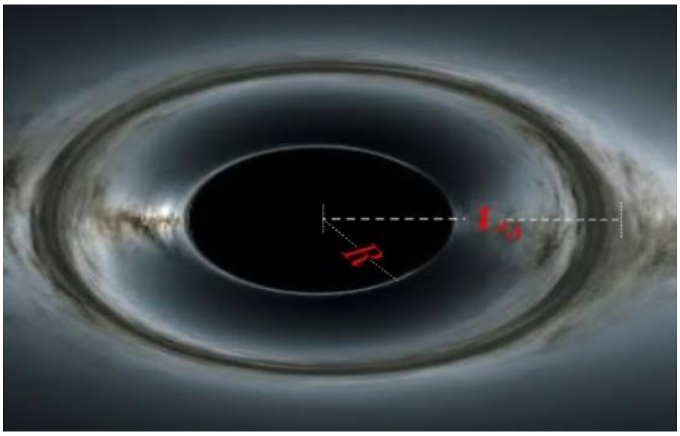
$A = \pi \left(\frac{4GM}{c^2}\right)^2$

$\therefore A = \frac{16\pi G^2 M^2}{c^4}$ .... (9)

Equation (9) is for Schwarzschild black hole only.

The Schwarzschild black hole is shown in virtual image (1.1) below, in which the radius of that black hole is denoted by $'R'$ and the diffusively length of that black hole is denoted by $'L_d'$. It is also clear from the virtual image that the diffusively length of this black hole is twice the radius of that black hole.

Image (1.1)



Destructive black hole (Supermassive black hole).

The diffusively length of such a black hole is much more than twice the radius of that black hole.($L_d > 2R$)

Such black holes also absorb objects within their diffusively length by applying an accelerating force towards their center.

Suppose an object is located inside the diffusively length L_d of a black hole. And if the distance from that place to its diffusively length is L_1 then the difference of diffusively length for that object,

$\Delta L_d = L_d - L_1$

Thus,

The gravitational acceleration applied to this object by a black hole towards its center is obtained from the equation $\Delta L_d = \frac{c^2}{a}$,

From which,

$a = \frac{c^2}{\Delta L_d}$

$\therefore a = \frac{c^2}{(L_d - L_1)}$

The above equation shows that the closer an object is to a black hole, that is, to the inside of its diffusively length(L_d), the more gravitational acceleration will be applied to it by the center of the black hole.

Such black holes do not follow the equation for Schwarzschild radius.

Suppose an object is so close to a black hole that it is located on the surface of its event horizon, then the gravitational acceleration applied to it by the center of the black hole will be equal to the gravitational acceleration of that black hole.

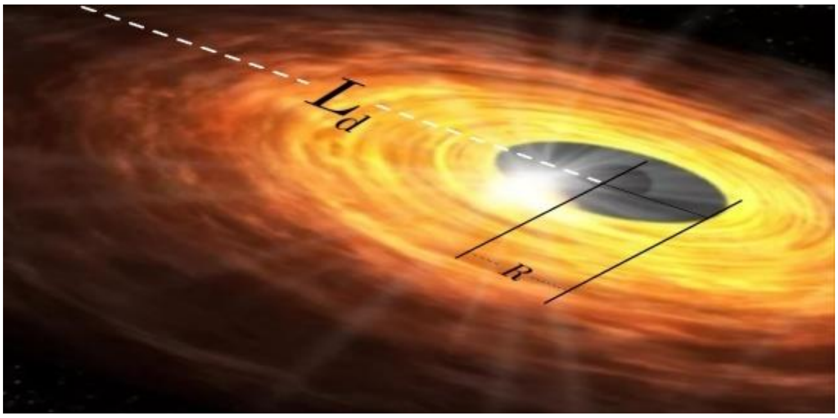
The radius of the destructive black hole can be given by the equation $R = {}^1\!/_c \sqrt{GML_d}$ we obtained earlier.

Thus the radius of any destructive black hole,

$R = {}^1\!/_c \sqrt{GML_d}$

The virtual image (1.2) below is of a Destructive black hole. It is clear from the virtual image that the diffusively length(L_d) of this black hole is more than twice the radius$(R)$of that black hole.

Image (1.2)



The area of a circular space in which this black hole absorbs objects from its center into a fixed circular space,

$A = \pi {L_d}^2$

Now from equation $L_d = \frac{c^2}{a}$,

$A = \pi \left(\frac{c^2}{a}\right)^2$

$\therefore A = \frac{\pi c^4}{a^2}$

Defects of Schwarzschild black hole

Figure (1.2)

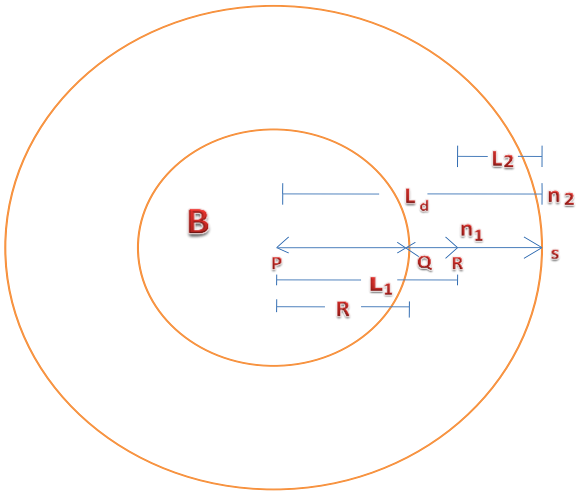


Figure (1. 2) corresponds to the Schwarzschild black hole, in which the Schwarzschild black hole is denoted by B. The radius of this black hole is $PQ = R$ as shown in the figure (1.2).As shown in the figure, the diffusively length of this black hole is $PS = L_d$. Which is twice the radius of this black hole($L_d = 2R$).

We know that Schwarzschild black holes apply gravitational acceleration to each object at its diffusively length in equal proportions from its center and that acceleration is equal to its own gravitational acceleration (gravitational acceleration of Schwarzschild black hole).

We know that every black hole follows the equation $L_d = \frac{c^2}{a}$.

As shown in Figure (1. 2), the object n_2 has an acceleration a_2 towards the center p from the diffusively length L_d, for which,

$c^2 = L_d a_2$.......................... (1)

Now suppose an object n_1 is inside the diffusively length of this black hole and its distance from the diffusively length of the black hole is L_2. It is clear from the figure that the difference in diffusively length for this object is,

$L_1 = L_d - L_2$

If the gravitational acceleration is applied by the center part of the black hole on the object n_1 is a_1, for which,

$c^2 = L_1 a_1$

$\therefore c^2 = (L_d - L_2)a_1$..................... (2)

We know that Schwarzschild black holes apply the same acceleration to every object located at the surface of their diffusively length and the object inside in it.

Hence $a_1 = a_2$.

Thus $a_1 = a_2$ will be in equation (2).

$\therefore c^2 = (L_d - L_2)a_2$ .... (3)

Comparing Equation (3) and Equation (1),

$L_d a_2 = (L_d - L_2)a_2$

$L_d = (L_d - L_2)$

We know that Schwarzschild black holes apply the same acceleration to every object located at the surface of their diffusively length and inside in it. So for them the difference in gravitational acceleration is zero. But from the result obtained here it is clear that the difference in diffusively length in the right side position is $(L_d - L_2)$.

Hence, $(L_d - L_2)a_1 < c^2$.

Means that,

$(L_d - L_2)a_1 \neq c^2$ namely $L_1 a_1 \neq c^2$

Thus in short any Schwarzschild black hole has an object inside its diffusively length i.e. if there is a diffusively length difference for them is ΔL_d, then,

$\Delta L_d a \neq c^2$

Thus for Schwarzschild black hole the equation $L_d = \frac{c^2}{a}$ is maintained for the object which is located at the surface of its diffusively length.

This does not happen in a destructive black hole. In a destructive black hole, the equation $L_d = \frac{c^2}{a}$ is maintained for any object located at the diffusively length of the black hole or inside the diffusively length of the black hole. This is because a destructive black hole exerts a different amount of acceleration on an object at a distance of its diffusively length and on the object inside it, and the applied acceleration is such that the equation $L_d = \frac{c^2}{a}$ is maintained.

Simple black-hole.

Now we will discuss another type of black hole. Suppose there is a black hole in the universe that only absorbs the objects on the surface of its event horizon by accelerating them towards its center, then the diffusively length $(L_d)$of such a black hole would be equal to the radius of that black hole.This is because these black holes cover only objects on the surface of its radius (event horizon). Such a black hole is called a Simple black hole.

Equation $R = {}^1/_c \sqrt{GML_d}$can be applied to all black holes.If the radius of a Simple black hole is R, then its radius from equation $R = {}^1/_c \sqrt{GML_d}$,

$$R = {}^1/_c \sqrt{GML_d} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (1)$$

As we have discussed, the diffusively length (L_d) of a Simple black hole is equal to its radius. I.e.$L_d = R$, thus putting $L_d = R$ in equation (1),

$$R = {}^1/_c \sqrt{GMR}$$

$$\therefore R^2 = \frac{GMR}{c^2}$$

$$R = \frac{GM}{c^2}\text{.............................}(2)$$

Equation (2)is the equation of radius of a Simple black hole.

If the radius of a Simple black hole is taken as R_1 and the radius of a Schwarzschild black hole is taken as R_2 and if their masses are same and its ratio is taken then,

$$\frac{R_1}{R_2} = \frac{\left({}^{GM}/_{c^2}\right)}{\left({}^{2GM}/_{c^2}\right)}$$

$$\therefore \frac{R_1}{R_2} = \frac{1}{2}$$

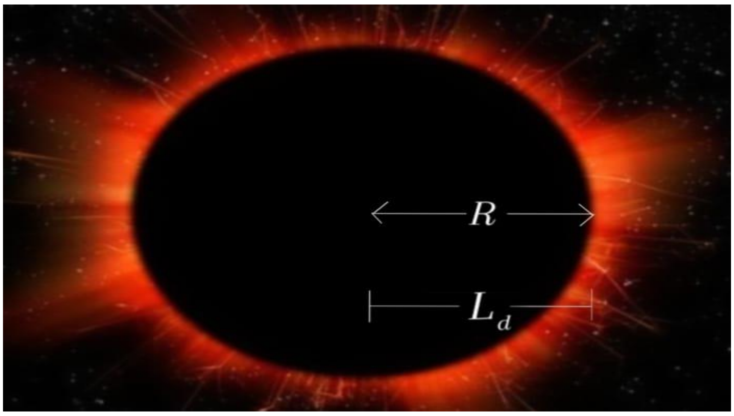
$$\therefore 2R_1 = R_2$$

$$\therefore R_1 = \frac{R_2}{2}$$

Thus, the results show that the radius of a Simple black hole is half that of a Schwarzschild black hole, i.e. a Simple black hole is smaller in size than a Schwarzschild black hole.

Virtual image(1.3) below shows a Simple black hole. Where its radius is denoted by R and its diffusively length is denoted by L_d. It is clear from the virtual image that the diffusively length of this Simple black hole is equal to its radius R.

Image (1.3)



n-factor of black holes.

The difference between the diffusively length and the radius of any black hole is called n factor.

Suppose the diffusively length of a black hole is n times greater than the radius of that black hole, then,

$L_d = nR$............................(1)

$\therefore n = \frac{L_d}{R}$.................................(2)

We have previously taken the ratio of $\left({L_d}/{R}\right)$ for Schwarzschild black hole. Whose value is 2. Putting this value in equation (2) gives $n = 2$ for Schwarzschild blackhole.

The diffusively length of a Simple black hole is equal to its radius. That is $L_d = R$ .Thus, putting this value in the equation (2) gives $n = 1$ for a Simple black hole.

$L_d > 2R$ for Destructive black holes. Thus, placing this value in equation 2 gives $n > 2$ for Destructive blackhole.

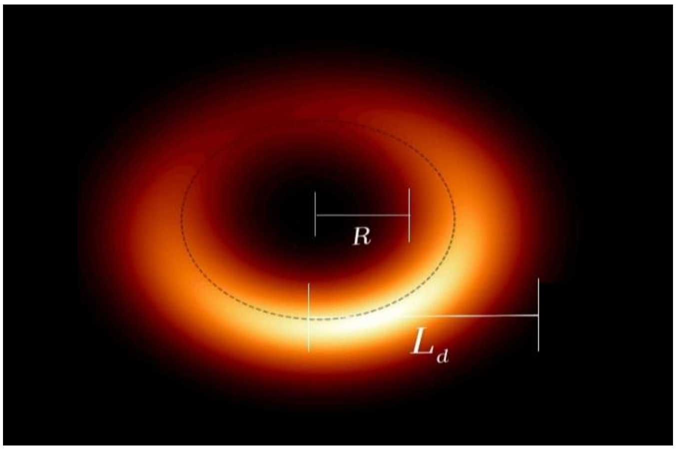
A simple black hole absorbs objects at only the surface of its radius, I. e the object near the event horizon by accelerating it towards its center. And since the event horizon is part of the Simple black hole, this acceleration is equal to its own gravitational acceleration.

But the Schwarzschild black hole absorbs objects not only at event horizon , but also absorbs the objects at its diffusively length by applying the same acceleration toward its center . And the applied acceleration is the same as the own gravitational acceleration of the Schwarzschild black hole. Which we've talked about this before. This can be clarified by the following image.

Image (1.4) is the original image of a Schwarzschild black hole. which its radius is R and its diffusively length is denoted by L_d.It can be seen from the image that the light is bent from the event horizon of the Schwarzschild black hole to its diffusively length. This is only possible if the Schwarzschild black hole accelerates uniformly from its event horizon to its diffusively length towards its center. And the applied acceleration is equal to its own gravitational acceleration of Schwarzschild black hole. And the diffusively length of a Schwarzschild black hole is twice its radius that we have already discussed before.

Classical physics cannot explain this. According to classical physics, the acceleration towards a planet decreases as the object moves farther away from the surface of the planet or any star etc.

Image (1.4)



We know that the radius of any black-hole is given by,

$R = {}^{1}/_{c}\sqrt{GML_d}$ ....(3)

Putting the value of Equation (1) into Equation (3),

$R = {}^{1}/_{c}\sqrt{GMnR}$

$\therefore R^2 = \frac{nGMR}{c^2}$

$\therefore R = \frac{nGM}{c^2}$.....................................(4)

It is clear from Equation (4) that the radius of any black hole depends not only on its mass but also depends on its n-factor value.

Each black hole has a Photosphere(Photon sphere) cover with the exception of a Simple black hole. Whose length is different for each black hole. The value of n-factor associated with any black hole also represents the value of Photosphere associated with any black hole.

Now, Putting the value of Equation (4) into Equation (1), We will get,

$L_d = \frac{n^2GM}{c^2}$ ....(5)

Now if the length of a Photosphere is denoted by L_{ph}then,

$L_{ph} = L_d - R$ ....(6)

Putting the value of Equation (5) and Equation (4) into Equation (6),

$$L_{ph} = \frac{n^2GM}{c^2} - \frac{nGM}{c^2}$$

$$\therefore L_{ph} = \frac{(n^2-n)GM}{c^2} \text{.........................(7)}$$

If we put the value of n=1 of Simple black-hole then we will get $L_{ph} = 0$ for Simple black-hole, Means that there's no Photosphere is associated with Simple black-hole.

If we put the value of n=2 of Schwarzschild black-hole, then we will get $L_{ph} = \left({2GM}/{c^2}\right)$for Schwarzschild black-hole. Which is equals to the radius of Schwarzschild black-hole, Means that $L_{ph} = R$.

If we put the value of n> 2 of Destructive black-hole, then we will get $L_{ph} = \frac{[(n^2-n)>2]GM}{c^2}$ for Destructive black-hole, Means that the length of Photosphere associated with Destructive black-hole is greater than the length of Photosphere associated with Schwarzschild black-hole.

The value of the n-factor associated with the Schwarzschild back hole also explains why the Schwarzschild black hole bends not only the light near its event horizon but also bent the light within its diffusively length L_d.

If an object has an orbital velocity $'v'$ near the surface of event horizon i.e. at a distance R(radius of the black hole) from the center of the Schwarzschild black hole i.e. around the surface of the Schwarzschild black hole, the centripetal acceleration applied by the center of the Schwarzschild black hole towards its center can be given by the following equation,

$$a = \frac{v^2}{R} \text{......................................(8)}$$

Where,

$R = The\ radius\ of\ the\ Schwarzschild\ black\ hole.$

$v = The\ orbital\ velocity\ of\ the\ object\ near\ the\ event\ horizon.$

Now, if an object is at a distance equal to its diffusively length L_d from the center of the black hole, then we know the acceleration applied to it by the center of the black hole towards its center,

$$a' = \frac{c^2}{L_d} \text{......................................(9)}$$

Where,

$c = Speed\ of\ light\ in\ vacuum = 3 \times 10^8\ m/s$.

$L_d = Diffusively\ length\ of\ the\ Schwarzschild\ black\ hole.$

If the diffusively length of a Schwarzschild black hole is n times greater than the radius of the Schwarzschild black hole, then $,L_d = nR$.Which we have already shown in Equation (1).

Putting the value of Equation (1) in Equation (9),

$a' = \frac{c^2}{nR}$...(10)

Taking the ratio of Equation (8) and Equation (10),

$\frac{a}{a'} = \frac{\left(v^2/_R\right)}{\left(c^2/_{nR}\right)}$....................................(11)

We know that a Schwarzschild black hole has the same acceleration towards objects from its center to its diffusively length L_d. i.e $a = a'$. Thus, equation (11) will be as follows.,

$\therefore \frac{v^2}{R} = \frac{c^2}{nR}$

$\therefore v^2 = \frac{c^2}{n}$

$\therefore v = c\sqrt{1/_n}$ ....(12)

If the mass of the Schwarzschild black hole is M and its radius is R then the orbital velocity of the object near the event horizon,

$v = \sqrt{\frac{GM}{R}}$..................................(13)

Where,

$M = Mass\ of\ the\ Schwarzschild\ black\ hole.$

$R = The\ radius\ of\ the\ Schwarzschild\ black\ hole.$

$G = The\ universal\ constant\ of\ gravitation = 6.67 \times 10^{-11}\ Nm^2/kg^2.$

If the mass of the black hole is M and its radius is R then the escape velocity of the object near the event horizon,

$v_{esc} = \sqrt{\frac{2GM}{R}}$.................................(14)

Where,

$M = Mass\ of\ the\ Schwarzschild\ black\ hole.$

$R = The\ radius\ of\ the\ Schwarzschild\ black\ hole.$

$G = The\ universal\ constant\ of\ gravitation = 6.67 \times 10^{-11}\ Nm^2/kg^2.$

Taking the ratio of Equation (13) and Equation (14),

$$\frac{v_{esc}}{v} = \frac{\sqrt{\frac{2GM}{R}}}{\sqrt{\frac{GM}{R}}}$$

$$\therefore \frac{v_{esc}}{v} = \sqrt{2}$$

$\therefore v_{esc} = \sqrt{2}v$ ....(15)

Putting the value of Equation (12) in Equation (15),

$v_{esc} = c\sqrt{2/n}$ ....(16)

Thus, we get two important Equations (12) and Equations (16). Equation (12) and Equation (16) are for Schwarzschild black holes only. Equation (12) and Equation (16) explain to us the important aspects associated with Schwarzschild black hole.

We know that the value of n - factor for a Schwarzschild black hole is 2. Where n - factor is the difference between its diffusively length and its radius.

If an object is located near the event horizon, then its diffusively length will be equal to its radius. I.e.$L_d = R$. And from equation (2) we get n = 1, if we put the value of n= 1 in equation (12) we get $v = c$, thus the orbital velocity of light near the event horizon is c. And if we put the value of n = 1 in the equation (16) we get the value of v_{esc} for light $\sqrt{2}\ c$, which is not possible. That means the light cannot escape from the event horizon.

We know that for a Schwarzschild black hole, the difference between diffusively length $L_d$and its radius R is 2 i.e. n = 2. If we put the value of n = 2 in Equation 16 we get the value of v_{esc} for light is equals to c. But this does not agree with the observation because if the value of v_{esc} for light at a distance of 2R is equal to c then the light itself would be free to escape from the distance of 2R because c is its own velocity of light.

If we take the value of n smaller than 2 and approximately equal to 1.85 and put this value in Equation 16, we get $v_{esc} > c$. That is, light is not able to be escape at a distance of 1.85 R from the center of the black hole. Because for this distance we get the value of $v_{esc} > c$. But light is able to escape at a distance of 2R because the value of v_{esc} at a distance of 2R is c.

Now, putting the value of n = 1.85 in Equation (4), we get the radius of the Schwarzschild black hole as follows,

$R = \frac{1.85GM}{c^2}$.......................................(17)

Now, putting the value of n = 1.85 in Equation (5), we get diffusively length of the Schwarzschild black hole as follows,

$L_d = \frac{3.42225GM}{c^2}$.....................................(18)

Now, putting the value of n = 1.85 in Equation (7), we get the length of the photosphere of the Schwarzschild black hole as follows,

$L_{ph} = \frac{1.5725GM}{c^2}$.................................(19)

Thus we made the necessary correction to the formula for the radius of a Schwarzschild black hole using the n- factor. We see that the difference between the diffusively length L_d and radius R for a Schwarzschild black hole is not 2 but 1.85. So the value of n-factor for a Schwarzschild black hole is 1.85.

Time formation of black-hole.

We know that when massive stars collapses, they result in a neutron star, a white dwarf star, or a black hole. We will look at the stars that result in a black holes after death. We know that at the end of a long time, when the gravitational force of a massive star begins to dominate itself, the star collapses.
When stars with such a large mass collapses, the mass of these broken stars concentrates in the center at a certain time interval. And in the end they result in a black hole. Intuitively, if the parts of a broken star are spread out in close space, it will take less time for them to concentrate, Thus, they will take less time to result in a black hole. and observations show that when a massive neutron star (~3 solar masses) collapses, it results in a black hole in less than 1 second. Thus the duration of a black hole formed by any star also depends on the mass of the star.

In short, the time it takes for a star to transform into a black hole after it collapses depends on the mass $'M'$ of that star and the length of the star's parts extending from its center to space after the collapses, i.e. the diffusively length $(L_d)$of the star.

Thus, the greater the mass$'M'$ of a broken star and the shorter the diffusively length (L_d) of the broken star, the less time it will take for the star to transform into a black hole.

The time it takes for a star to transform into a black hole after it collapses is called the star's 'Time formation of black hole'. Which we will denote by $'T_f'$.

Now we will theoretically get the equation $'T_f'$ of the time it takes for any star to become a black hole after it collapses.

(Figure 1.3)

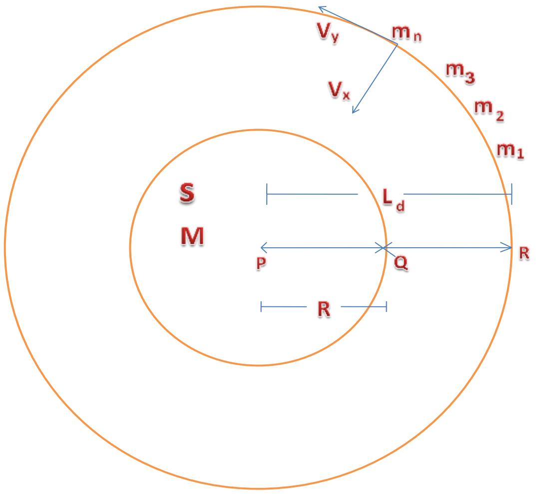


Figure (1.3) shows a single star that results in a black hole after it collapses. This star is denoted by $'S'$. The mass of this star is $'M'$ and its radius is $'R'$.

Suppose this star $'S'$ collapses, then its parts expanded into a space with a radius L_d (diffusively length). The masses of these broken parts are $m_1, m_2, m_3 \dots \dots \dots m_n$ as shown in Figure (1.3).

We know that every black hole follows the equation $L_d = {c^2}/{a}$. The star shown in Figure (1.3) here is going to result in a black hole.So we can apply the equation $L_d = {c^2}/{a}$ to star $'S'$. thus,

$$L_d = \frac{c^2}{a} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (1)$$

Where,

c= The velocity of light in a vacuum $=3 \times 10^8\ m/s$.

a= Acceleration applied to the broken parts by the center of the star 'P'.

As shown in Figure (1.3) , when this star $'S'$ collapses, the masses $(m_1, m_2, m_3 \dots \dots \dots m_n.)$ of the broken part of it expanded into a space with a radius L_d(diffusively length). There are two main types of velocities associated with these extended parts. V_x and V_y.

V_x =The velocity of the scattered parts from the diffusively length $L_d$towards the center P.

V_y =The orbital velocity of the extended parts on the circular orbit of the diffusively length L_d.

Theoretically, this star $'S'$ will result in a black hole when the parts of this broken star $'S'$, whose masses are $m_1, m_2, m_3 \dots \dots m_n$, are concentrated towards the center part P.

If the time it takes for the extended parts to reach the center part P from the diffusively length L_d is T and the velocity towards the center part P is V_x, Then,

$$L_d = V_x T \dots \dots \dots \dots \dots \dots \dots \dots (2)$$

Putting the value of Equation (2) in Equation (1),

$$V_x T = \frac{c^2}{a} \dots \dots \dots \dots \dots \dots \dots \dots . (3)$$

The value of $'T'$ in Equation (3) is T_f. This is because when the scattered parts of this star $'S'$ move towards the center P they will be concentrated and result in a black hole. Thus Equation (3) is written as follows.,

$$V_x T_f = \frac{c^2}{a}$$

$$\therefore V_x T_f a = c^2 \dots \dots \dots \dots \dots \dots \dots \dots (4)$$

If the extended parts of a star $'S'$ have an orbital velocity V_y at the diffusively length L_d, then according to Newton, the center part P has a centripetal acceleration $'a'$ on it. Where,

$$a = \frac{{V_y}^2}{L_d} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (5)$$

Putting the value of Equation (5) in Equation (4),

$$\frac{V_x \times {V_y}^2 \times T_f}{L_d} = c^2$$

$$\therefore L_d c^2 = V_x \times {V_y}^2 \times T_f$$

$$\therefore T_f = \frac{L_d c^2}{V_x \times {V_y}^2}$$

Taking $V_x = V_y$ for convenience,

$$T_f = \frac{L_d c^2}{{V_y}^3} \dots \dots \dots \dots \dots \dots \dots \dots \dots . . (6)$$

Now from Equation (5),

$${V_y}^2 = a L_d$$

$\therefore V_y = \sqrt{aL_d}$

$\therefore {V_y}^3 = \sqrt{a^3 {L_d}^3}$ ....(7)

If we assume that this broken star $'S'$ as a sphere, then the total gravitational acceleration(gravitational pull) of the broken parts of the star towards the center P can be given as follows,

$a = \frac{G(m_1+m_2+m_3+\cdots+m_n)}{{L_d}^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots..(8)$

Note here that the total mass of the broken parts is the mass $'M'$ of Star $'S'$. Because the broken parts are only part of the Star $'S'$.

Now in Equation (8),

$G =$ Universal constant of gravitation=$6.67 \times 10^{-11}\ Nm^2/kg^2$.

$(m_1 + m_2 + m_3 + \cdots + m_n) =$ The total mass of the broken part.

The total mass $m_1 + m_2 + m_3 + \cdots + m_n$ of the part of the broken star is the total mass $'M'$ of Star $'S'$. Hence Equation (8) is written as follows,

$a = \frac{GM}{{L_d}^2}$

$\therefore a^3 = \frac{G^3M^3}{{L_d}^6} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$

Putting the value of Equation (9) in Equation (7),

${V_y}^3 = \sqrt{\frac{G^3M^3}{{L_d}^6} \times {L_d}^3}$

$\therefore {V_y}^3 = \sqrt{\frac{G^3M^3}{{L_d}^3}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$

Putting the value of Equation (10) in Equation (6),

$T_f = \frac{L_d c^2}{\sqrt{\frac{G^3M^3}{{L_d}^3}}}$

$= \sqrt{\frac{c^4{L_d}^2}{G^3M^3/{L_d}^3}}$

$\therefore T_f = \sqrt{\frac{c^4{L_d}^5}{G^3M^3}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$

Equation (11) is the Equation for a “Time formation of black-hole”.

If a star is going to result in a black hole after it collapses and the mass $'M'$ of that star and its extended parts have a diffusively length L_d of how much long after the collapses if its value is known then the period in which the broken star will result in a black hole can be found using Equation (11).

To prove 'Time formation equation of black-hole' experimentally, we will take the help of a phenomenon called Hypernova explosion occurring in a single massive neutron star.

Hypernova is a explosion in which one massive neutron star collapses. Now we will see how Hypernova obey the time formation equation of black-hole.

It has been noted that the during the one Hypernova explosion a single neutron star collapses with a mass equal to 3 solar masses. After it collapses, the broken parts of this neutron star extend into space with a radius of about $3.5 \times 10^5\ m$. If this broken neutron star is going to result in a black hole, then we can estimate how long time will it take for result in a black hole using "Time formation equation of black hole?

Here, the mass of this neutron star is equivalent to 3 solar masses., 1 solar mass= mass of the sun= $2 \times 10^{30}\ kg$.

Thus the mass of this neutron star,

$M = 3 \times 2 \times 10^{30}\ kg = 6 \times 10^{30}\ kg.$, $L_d = 3.5 \times 10^5\ m$ is given.

Putting the above values in Equation $T_f = \sqrt{\frac{c^4 {L_d}^5}{G^3 M^3}}$,

$$T_f = \sqrt{\frac{(3\times10^8)^4\times(3.5\times10^5)^5}{(6.67\times10^{-11})^3\times(6\times10^{30})^3}}$$

$$= \sqrt{\frac{42.542\times10^{60}}{64.095\times10^{60}}}$$

$$= \sqrt{0.663}$$

$$\therefore T_f = 0.83\ s$$

Observations also confirmed that when a massive neutron star collapses with a mass equals to 3 solar masses it result in a black-hole in less than 1 second. The value of T_f we found here also confirmed this. Thus surprisingly this broken neutron star will result in a black hole in less than 1 second.

The relationship between the origin of the universe and the "Time formation equation of black-hole".

Our universe is made up of infinite number of galaxies. Different physicists have different opinions about the origin of the universe. Such as the Big Bang theory. Also according to some physicists the destruction of one universe leads to the origin of another universe. Thus, our universe is also the result of the end of one of the pre-associated universe, etc.

If we compare the equation for "Time formation of black-hole" in terms of the origin of the universe, it leads us to many remarkable results.

If the phenomenon of the formation of black holes and the formation of the universe are equated, then the equation for "Time formation of black-hole" can be applied equally to the formation of the universe.

We know that the origin of a black hole is the result of the breakdown of a pre-associated massive star or massive neutron star. Here we have equated the phenomenon of the origin of the universe and the black hole. That is, our universe is also the result of the destruction of some pre-associated massive celestial body.

At present, the lifespan of the origin of the universe is estimated to be about 13.8 billion years. Which is denoted by T_0. This value is obtained using the Hubble constant which is denoted by H_0. And its relation to T_0 is as follows,

$T_0 = \frac{1}{H_0}$................................(1)

Where,

$T_0 = The\ time\ of\ the\ origin\ of\ the\ universe.$

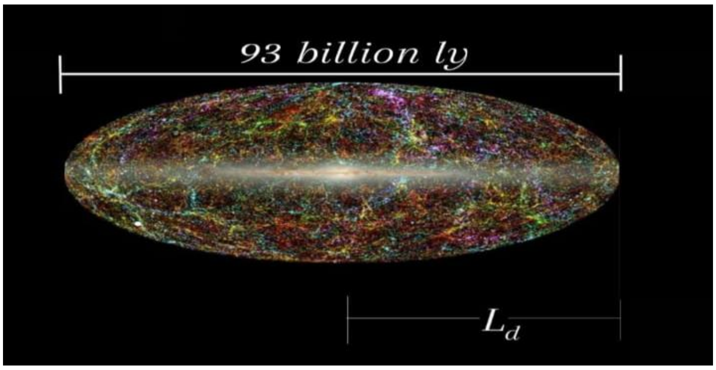
$H_0 = Hubble's\ constant = 2.3 \times 10^{-18} s^{-1}$.

If we consider the formation of the universe and the formation of black holes to be the same as we have discussed, then we can compare $T_0$with the equation of the time formation of black-hole. I . e T_f. thus,

$T_0 = T_f$....................................(2)

Shown below is a virtual image of the Observable universe. Where the length of the observable universe is about 93 billion ly (light year). Which is the diameter of the observable universe.

Image (1.5)



The radius of this observable universe is the diffusively length $L_d$of the observable universe. Where,

$$L_d = \frac{Length\ of\ the\ observable\ universe}{2}$$

$$\therefore L_d = \frac{93}{2} = 46.5\ billion\ ly$$

$$\therefore L_d = 46.5 \times 10^9 \times 9.461 \times 10^{15} = 4.4 \times 10^{26}\ m.$$

We know that if a star that is going to result in a black hole has a mass M, so its mass M will remain the same even when it results in a black hole. Here we have equated the phenomenon of the creation of a black hole and the universe, that is, if the mass of the observable universe which is formed from the massive celestial body is M, then the mass of the observable universe will also be M.

Now applying the equation for the "Time formation of black hole" to the observable universe,

$$T_f = \sqrt{\frac{c^4 {L_d}^5}{G^3 M^3}} \quad \text{.................................(3)}$$

Where,

$T_f = The\ time\ of\ the\ origin\ of\ the\ universe.$

$c = Speed\ of\ light\ in\ a\ vacuum = 3 \times 10^8\ m/s.$

$G = Universal\ constant\ of\ gravitation = 6.67 \times 10^{-11}\ Nm^2/Kg^2.$

$M = Mass\ of\ the\ observable\ universe.$

$L_d = Diffusively\ length\ of\ the\ observable\ universe.$

Now, Putting the value of Equation (1) and Equation (3) into Equation (2),

$$\frac{1}{H_0} = \sqrt{\frac{c^4 {L_d}^5}{G^3 M^3}}$$

$$\therefore \frac{1}{{H_o}^2} = \frac{c^4 {L_d}^5}{G^3 M^3}$$

$$\therefore M^3 = \frac{c^4 {L_d}^5 {H_o}^2}{G^3} \quad \text{....................................(4)}$$

Now putting the known values of c, L_d, H_0 and G in Equation (4),

$$M^3 = \frac{(3\times10^8)^4 \times (4.4\times10^{26})^5 \times (2.3\times10^{-18})^2}{(6.67\times10^{-11})^3}$$

$$= \frac{706.58\times10^{129}}{296.74\times10^{-33}}$$

$\therefore M^3 = 2.381 \times 10^{162}\ Kg^3$

$\therefore M \cong 1.34 \times 10^{54} kg.$

Thus the value of the mass of the observable universe is about$1.34 \times 10^{54}\ kg$.Which corresponds to a value in the range of its mass. It is also seen from Equation 4 that,

$M^3 \propto\ {L_d}^5$

Our observable universe grows over time and covers masses within it. Due to which its mass is increasing. The result $M^3 \propto\ {L_d}^5$ also confirms this.Because the value of L_d increases as the observable universe expands. And as the value of L_d increases, so the value of M also increasing according to Equation 4.

The radius of the observable universe is given by the following equation,

$R = cT_0$

Where,

R= The radius of the observable universe.

T_0 = Age of the observable universe.

c= Speed of the light in vacuum=$3 \times 10^8\ \ m/s$.

The value of this radius of the observable universe is about 3.3846 times smaller than the radius $4.4 \times 10^{26}\ m$ we used earlier. Here we have taken the radius of the observable universe as the diffusively length L_d of the observable universe. means,

$L_d = cT_0$

$\therefore {L_d}^5 = c^5{T_0}^5$.......................................(5)

Now it is clear from Equation (2) that $T_f = T_0$. Thus, Equation (3) can also be written as follows,

$T_0 = \sqrt{\frac{c^4{L_d}^5}{G^3M^3}}$

$\therefore {T_0}^2 = \frac{c^4{L_d}^5}{G^3M^3}$.......................................(6)

Putting the value of Equation (5) in Equation (6),

${T_0}^2 = \frac{c^4 \times c^5{T_0}^5}{G^3M^3}$

$\therefore c^9{T_0}^3 = G^3M^3$

$\therefore M^3 = \frac{c^9{T_0}^3}{G^3}$

$\therefore M = \frac{c^3 T_0}{G}$ ....(7)

Putting the value of Equation (1) in Equation (7) we get the famous equation for the mass of the observable universe as follows,

$M = \frac{c^3}{GH_0}$.................................(8)

Now putting the known values of c, H_0 and G in Equation (8),

$$M = \frac{(3\times10^8)^3}{6.67\times10^{-11}\times2.3\times10^{-18}}$$

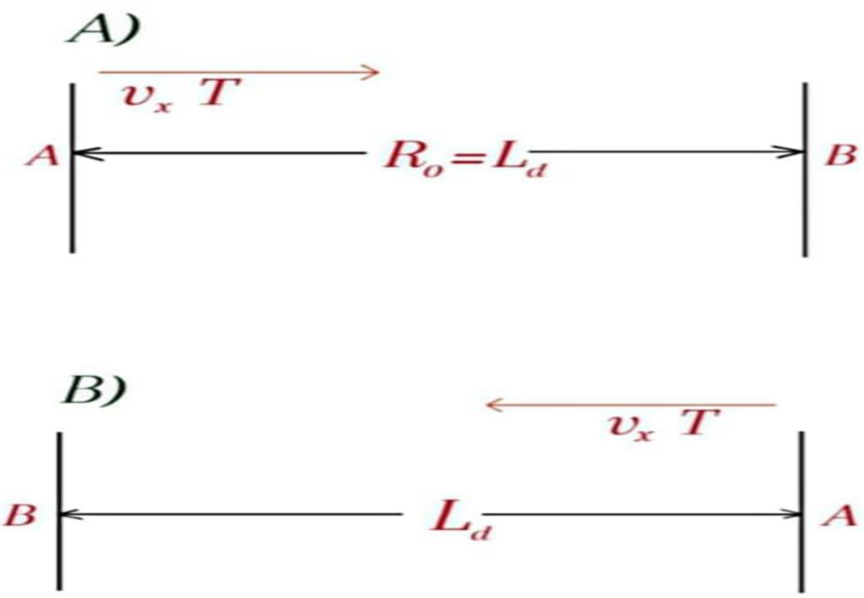
$\therefore M \cong 1.76 \times 10^{53}\ Kg.$

Thus if the radius of the observable universe is $4.4 \times 10^{26}\ m$ then we get the mass $1.34 \times 10^{54}\ Kg$ of the observable universe. And if the radius of the observable universe is cT_0 i.e$1.3 \times 10^{26}\ m$ then we get the mass $1.76 \times 10^{53}\ Kg$ of the observable universe.

From the results we obtained here, it is clear that the formation of the universe is similar to the formation of black holes .But there is a one difference between the formation of black holes and the formation of the universe. The difference is that when a massive star or neutron star collapses it then concentrates and then results in a black hole. Whereas the universe is the result of the breakdown of a concentric point (singularity) with a huge masses.

We will understand this matter with the help of figure (A) and figure (B) given below.

Figure (A) & (B)



Here the figure (A) is associated with the formation of the universe. While the figure (B) is associated with the formation of black hole. To understand the formation of the universe we will first understand figure (B).

Suppose B is the center of a massive star as shown in figure (B). After this star collapses it becomes a black hole. When this star collapses, then these parts of the collapsed star spread out from the center B of the star to A i.e. space of radius L_d (diffusively length of the star). Then these broken parts are concentrated towards the center B. As shown in figure (B), these broken parts are concentrated at a distance L_d i.e. from A with a velocity v_x towards the center B. If the total time taken by the broken parts to concentrate from A to center B is T, then $L_d = v_x T$. Here $T = T_f$ i.e. the time taken by the collapsing star to become a black hole, because when the scattered parts of this star move towards the centre B, they will be concentrated and result in a black hole.

The creation of the universe is done in the opposite direction. Let us now turn our attention to the figure (A) associated with the creation of the universe.

In figure (A), A represents the singularity of the universe whose mass is the mass of the universe itself. When this singularity undergoes a massive explosion (Big Bang), these broken parts spread out from the center A to B i.e. space with a radius of R_0.

Here R_0 is the radius of the observable universe. Here we have taken R_0 as the diffusively length (L_d) of the observable universe, which is taken according to the definition of diffusively length. We have seen earlier in the definition of diffusively length that when any object accelerates another objects from its center to a fixed distance towards its center, then that fixed distance is called diffusively length of that object. Also, when an object breaks down, the parts of the broken object spread out from its center to a fixed distance. This fixed distance is also called the diffusively length of that object. This statement is true in the case of the observable universe. After the explosion of the Singularity (Big Bang explosion), numerous broken parts of the singularity spread out into space with a radius of R_0. Here R_0 is fixed distance. Because the broken parts are propagated only up to a distance R_0. For this reason we have taken the radius R_0 of the observable universe as the diffusively length (L_d) of the observable universe.

If these broken parts are moving from center A (singularity) to B with a velocity v_x and the total time taken to reach from center A to B is T, then $v_x T = R_0 = L_d$.

Here T represents the time of formation of the observable universe i.e. Age T_0 of the observable universe, because the size of the observable universe is not constant for any given period of time because the observable universe is continuously expanding at a velocity equal to v_x so that its radius R_0 increases and so the time T taken to expand also increases.

In short, here T represents the time taken from the explosion of the singularity to the formation of the observable universe with a radius equal to R_0, means it defines Age T_0 of the observable universe.

Here, when we applied the equation of 'Time formation of black hole' in the context of the observable universe, we got the results associated with the observable universe which shows that the formation of the universe and the black hole is almost the same. There is only one difference, which we have already discussed.

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