Relative Universe

A special theory of gravitation

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Abstract: Gravitation is relative density of space time caused by mass of object. There are three aspects on gravitation. First related to object. Gravitation can cause changes in velocity and direction of object. Second related to photon, gravitation can change direction and frequency of photon. Third related to difference in the result of observation. Different observers on the same object observation can yield different result. Gravitation cause difference in time period of event, difference in length of object, and difference in mass or energy of object

1. INTRODUCTION

According to Newtonian mechanics, gravitation is force of every object attract every other object. The value of gravitational force directly proportional to the product of their mass and inversely proportional to the square of the distance between them.

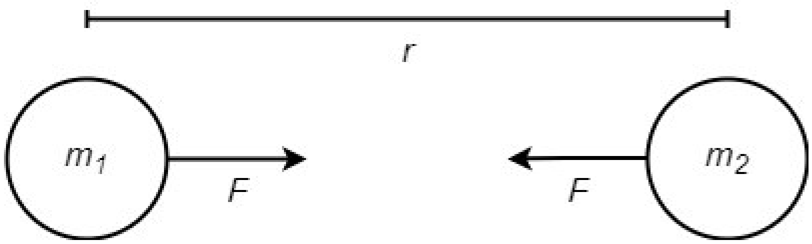

Figure1

F is force, G is gravitational constant , m_1, m_2 are mass of objects, and r is distance between two objects.

$$F = G\frac{m_1 m_2}{r^2}$$

2. POTENTIAL ENERGY AND KINETIC ENERGY

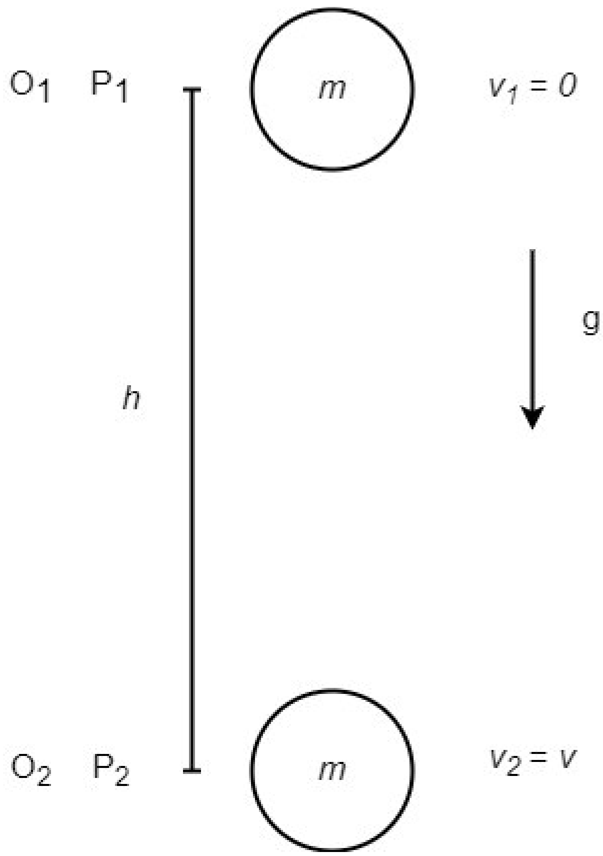

Figure 2

O_1 is Observer1, O_2 is Observer2 P_1, P_2 are position 1 and 2 of observers and object. *m*, is mass of object, *V* is velocity of object, and *h* is height between P_1 and P_2. Object with mass *m* is dropped at position P_1. Initial velocity *V* is $V_1 = 0$. Object then free fall to Position P_2. At P_2 velocity of object is $V_2 = V$

Object has potential and kinetic energy. Potential energy is energy held by on object because it is at a height. Kinetic energy is form of energy held because of its motion.

$E_p = mgh$

E_p is Potential energy, *m* is mass of object, *g* is gravitation and *h* is height of object.

$E_k = \frac{1}{2}mv^2$

E_k is Kinetic energy, *m* is mass of object *v* is velocity of object.

When an object is dropped from a height there is change in energy from potential energy to kinetic energy.

When position of object is at P_1 $E_p = mgh$ and $E_k = 0$ because $V = 0$.

At position of object is at P_2 $E_p = 0$ because $h = 0$ and $E_k = \frac{1}{2}mv^2$.

Total energy, potential energy add kinetic energy is constant. There is only changes in forms of energy.

$$mgh_1 + \frac{1}{2}mv_1^2 = mgh_2 + \frac{1}{2}mv_2^2$$

3. DIFFERENCE IN TOTAL ENERGY BECAUSE OF DIFFERENCE IN POSITION OF OBSERVER

According to Einstein's special theory of relativity mass equal to energy, $E = mc^2$, where E is energy of object, m is mass of object, and c is speed of light. Total energy of object consists of rest mass energy and kinetic energy. When speed of object is much less than speed of light than Newton equation for kinetic energy $E_k = \frac{1}{2}mv^2$ is still valid.

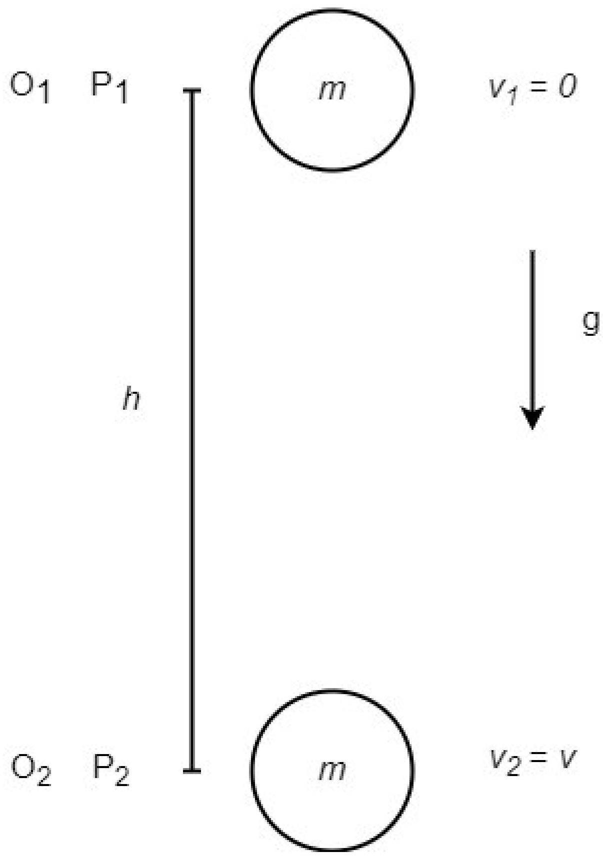

Figure 3

See figure 3

Observer 1 is at position P_1. Observer 2 at position P_2.

From the view point of Observer 1 when position of object is at P_1

$h = 0$ and $v = 0$

so

$E_r = mc^2$, E_r is rest energy

$E_p = mgh$, because $h = 0$ then $E_p = 0$, E_p is potential energy

$E_k = \frac{1}{2}mv^2$, because $v = 0$ then $E_k = 0$

total energy $= mc^2 + mgh + \frac{1}{2}mv^2 = mc^2$ or $E_t = E_r$

When position of object is at P2

$h = -h$ and $v = v$

$E_r = mc^2$

$E_p = -mgh$,

$E_k = \frac{1}{2}mv^2$

total energy = $mc^2 - mgh + \frac{1}{2}mv^2 = mc^2$ or $E_t = E_r$

because $mgh = \frac{1}{2}mv^2$

From the view point of Observer 2 when position of object is at P_1

$h = h$ and $v = 0$

$E_p = mgh$,

$E_k = \frac{1}{2}mv^2$ $E_k = 0$ because $v = 0$

And total energy = $mc^2 + mgh + \frac{1}{2}mv^2 = mc^2 + mgh$ or $E_t = E_r + E_p$

Because $v = 0$.

When position of object is at P_2

$h = 0$ and $v = v$

$E_p = mgh$, $E_p = 0$

and $E_k = \frac{1}{2}mv^2$

and total energy = $mc^2 + mgh + \frac{1}{2}mv^2 = mc^2 + \frac{1}{2}mv^2$

Because $h= 0$

Or total energy $E_t = E_r + E_k$

or total energy $E_t = E_r + E_p$

because $mgh = \frac{1}{2}mv^2$

Observer	Total energy		Difference in total energy
	Position Object at P_1	Position Object at P_2	
O_1	$E_t = E_r$	$E_t = E_r + E_k - E_p = E_r$	No
O_2	$E_t = E_r + E_p$	$E_t = E_r + E_k$ or $E_t = E_r + E_p$ Because $E_k = E_p$	No
Difference in total energy	Yes	Yes	

Table 1

We can see that the cause of difference of total energy is position of the observer, not the position of object

4. LIGHT AND GRAVITATION

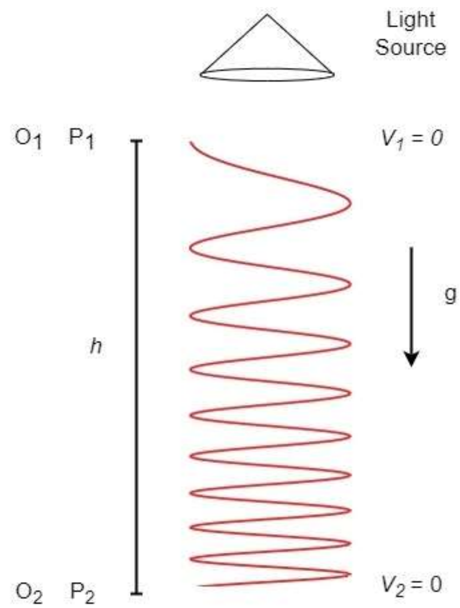

Figure 4

When light is directed from position P_1 to P_2 then there is change in frequency of light. Observer O_2 at position P_2 will detect the frequency of light higher than the frequency detected by Observer O_1 at position P_1

From the viewpoint of Observer O_1 at position P_1

$v = v_1$

$T_1 = \frac{1}{v_1}$

$\lambda_1 = \frac{c}{v_1}$

$E_1 = hv_1$

From the viewpoint of Observer O_2 at position P_2

$v = v_2$

$T_2 = \frac{1}{v_2}$

$\lambda_2 = \frac{c}{v_2}$

$E_2 = hv_2$

$v_1 < v_2$, $\lambda_1 > \lambda_2$, $T_1 > T_2$, and $E_1 < E_2$

v is light frequency.

h is Planck constant

λ is light wavelength

T is wave period of light

Compared to Observer 1 at position 1 Observer 2 at position 2 get time is slower, length is shorter and energy is higher.

Observer	Wavelength	Frequency	Period	Energy
O_1	λ_1	v_1	T_1	$E_1 = hv_1$
O_2	λ_2	v_2	T_2	$E_2 = hv_2$
Comparison	$\lambda_1 > \lambda_2$	$v_1 < v_2$	$T_1 > T_2$	$E_1 < E_2$

Table 2

Note that the light observed by Observer1 and Observer2 is the same light and the same source. The difference in wavelength, frequency and period are because of difference in position of observers.

5. GRAVITATION AS RELATIVE DENSITY OF SPACE TIME

There are three aspects on gravitation. First related to object. Gravitation can cause changes in velocity and direction of object. Second related to photon, gravitation can change direction and frequency of photon. Third related to difference in the result of observation. Different observers on the same object observation can yield different result. Gravitation cause difference in time period of event, difference in length of object, and difference in mass or energy of object.

From section 3 and 4 we see that there are difference in total energy of object and difference in wavelength, frequency, period, and energy of photon. The differences are because of difference in position of observers. I introduce gravitation d as relative density of space time. Value of d is ratio of total energy of an object observed from different position. The value of d is relative. Closer the position of observer to a high mass object then higher the value d. Figure 8 is visualisation of relative density of space time d. Darker the colour means higher the value of relative density of space time d. Closer the position to the high mass object darker the colour.

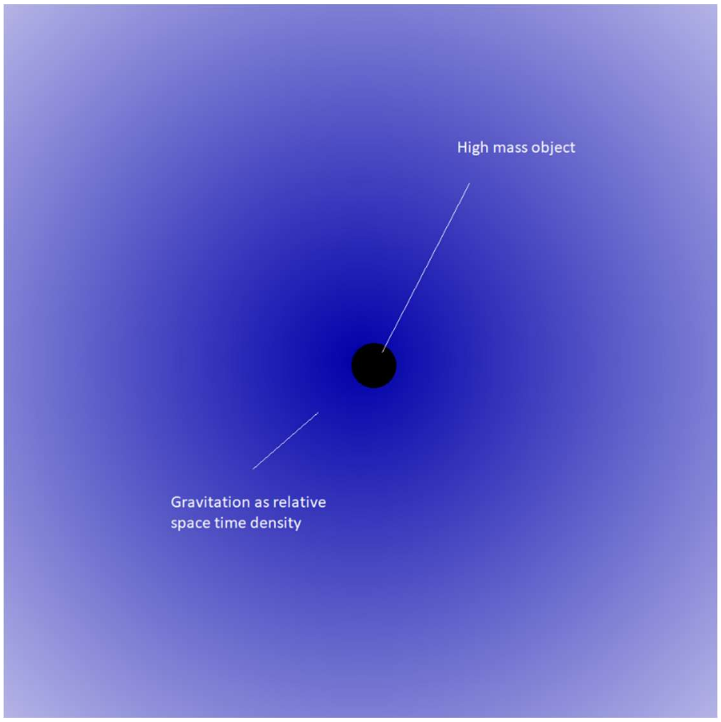

Figure 5

$$d_{relative\ at\ position\ 1\ to\ position\ 2} = \frac{1}{d_{relative\ at\ position\ 2\ to\ position\ 1}}$$

Or $d_{12} = \frac{1}{d_{21}}$

And $d_{21} = \frac{1}{d_{12}}$

And $d_{11} = d_{22} = 1$

$0 < d < \infty$

Let observer 1 at position 1 and observer 2 at position 2 and d as relative total energy

$$d_{12} = \frac{E_{total\ observed\ by\ observer\ 1}}{E_{total\ observerd\ by\ observer\ 2}}$$

Or $d_{12} = \frac{E_{t1}}{E_{t2}}$

And because mass equal to energy, $E = mc^2$

$$d_{12} = \frac{m_1}{m_2}$$

d as relative time interval

$$d_{12} = \frac{t_{time\ interval\ observerd\ by\ observer\ 2}}{t_{time\ interval\ observed\ by\ observer\ 1}}$$

Or $d_{12} = \frac{t_2}{t_1}$

d as relative length

$$d_{12} = \frac{l_{length\ of\ object\ observed\ by\ observer\ 2}}{l_{lengt\ \ of\ object\ observer\ by\ observer\ 1}}$$

Or $d_{12} = \frac{l_2}{l_1}$

6. RELATIVE DENSITY OF SPACE TIME FROM MERCURY PLANET TO EARTH.

Relative density d of space time from Mercury planet to Earth is

$$d_{mercury\ ear} = \frac{E_{total\ observed\ by\ observer\ from\ Mercury\ Planet}}{E_{total\ observerd\ by\ observer\ from\ Eart}}$$

or

$$d_{me} = \frac{E_{tm}}{E_{te}}$$

$E_{te} = mc^2$

$E_{tm} = mc^2 + E_{p\ (from\ earth\ to\ mercury)}$

$$E_p = \int_{rm}^{re} \frac{GMm}{r^2} dr$$

$$E_p = -\frac{GMm}{r} \Big|_{r_m}^{r_e}$$

$$E_p = -\left(\frac{GMm}{r_e} - \frac{GMm}{r_m}\right)$$

$$E_p = \frac{GMm}{r_m} - \frac{GMm}{r_e}$$

$$E_p = GMm\left(\frac{1}{r_m} - \frac{1}{r_e}\right)$$

$$E_p = GMm\left(\frac{r_e - r_m}{r_e r_m}\right)$$

$$d_{me} = \frac{E_{tm}}{E_{te}}$$

$$d_{me} = \frac{E_{te} + E_p}{E_{te}}$$

$$d_{me} = \frac{mc^2 + GMm\left(\frac{r_e - r_m}{r_e r_m}\right)}{mc^2}$$

$$d_{me} = \frac{c^2 + GM\left(\frac{r_e - r_m}{r_e r_m}\right)}{c^2}$$

$$d_{me} = 1 + \frac{GM(r_e - r_m)}{r_e r_m c^2}$$

G = 6.67384 x $10^{-11} m^3 kg^{-1} s^{-2}$

M = 1.98847 x 10^{30} kg

r_m = 5.74 x 10^{10} m or 0.574x10^{11} m

r_e = 1.496 x10^{11} m or 14.496 x10^{10} m

c = 3x 10^8 ms^{-1}

$$d_{me} = 1 + \frac{6.67384 \text{ x } 10^{-11}\ 1.98847 \text{ x } 10^{30}(1.496 \text{ x}10^{11} - 0.574 \text{ x } 10^{11})}{1.496 \text{ x}10^{11}\text{x } 5.74 \text{ x}10^{10} \text{ x } 9 \text{ x } 10^{16}}$$

$$d_{me} = 1 + \frac{12.2356136 \text{ x } 10^{30}}{77.28336 \text{ x}10^{37}}$$

$$d_{me} = 1 + 1.58321 \text{ x } 10^{-8}$$

Object of observations	Result from Earth	Calculation from Mercury	Calculation result from Mercury
Mass of the sun	1.98847 x 10^{30}kg	$(1 + 1.58321 \text{ x } 10^{-8})$ x 1.98847 x 10^{30}	1.98847 x 10^{30}kg + 3.14817 x 10^{22}kg

Distance from mercury to the sun	5.79×10^{10}m	$\frac{5.79 \times 10^{10}}{1+1.58321 \times 10^{-8}}$	5.79×10^{10}.m – 366 m
Diameter of the sun	1.3927×10^{9}.m	$\frac{1.3927 \times 10^{9}}{1+1.58321 \times 10^{-8}}$	1.3927×10^{9}.m - 22.05 m
Average rotating the sun on axis	27 days = 2.3328×10^{6}s	$\frac{2.3328 \times 10^{6}}{1+1.58321 \times 10^{-8}}$	27 days – 0.036 s
Mass of the universe	1.73×10^{53}kg	$(1+1.58321 \times 10^{-8}) \times 1.73 \times 10^{53}$	1.73×10^{53}kg + 2.739×10^{45}kg
Diameter of the universe	93.016×10^{9} light years	$\frac{93.016 \times 10^{9}}{1+1.58321 \times 10^{-8}}$	93.016×10^{9} light years – 1472.64 light years

Table 3

7. RELATIVE UNIVERSE

From table 3 we can conclude that observation of mass, length, and rotation period of an object differ between from earth and from mercury. There are so many places in the universe. Value of relative density of space time are different from one place to another places so mass, length, and period of an object differ between them. The result is there are no absolute value of mass, length, and period of time of object in the universe. There are only relative value of mass, length, and period of time. Value mass and diameter of universe are relative value observed from earth, there are so many places outside earth with relative value of d lower than 1, as location far from star at the edge of aur galaxy, or value of d much larger than 1 as at location at the neutron star.

8. LOCALISATION PRINCIPLE

Observer O_1 and Observer O_2 at different Position, O_1 at Position P_1 and O_2 at Position P_2. Relative density $d_{1\,2}\neq 1$. They are observed same object. Carbon-12 atomic mass, quartz crystal vibration, and hydrogen atom Bohr radius.:

Observer1 result:

Carbon-12 atomic mass = 12 amu (atomic mass unit)

Quartz crystal vibrate at 32768 times each second

Hydrogen Bohr radius = 1.00054 Å (Ångström)

Observer2 result:

Carbon-12 atomic mass = 12 amu

Quartz crystal vibrate at 32768 times each second

Hydrogen Bohr radius = 1.00054 Å

Both Observer1 and observer2 have the same result when they observe object at the same position with the object.

But if observer1 observes object at position2 the results are

Carbon-12 atomic mass = $d_{1\,2}$x 12 amu

Quartz crystal vibrate at $d_{1\,2}$ x 32768 times each second

Hydrogen Bohr radius = $\frac{1}{d_{21}}$ x 1.00054 Å

9. PSEUDO MOVEMENT

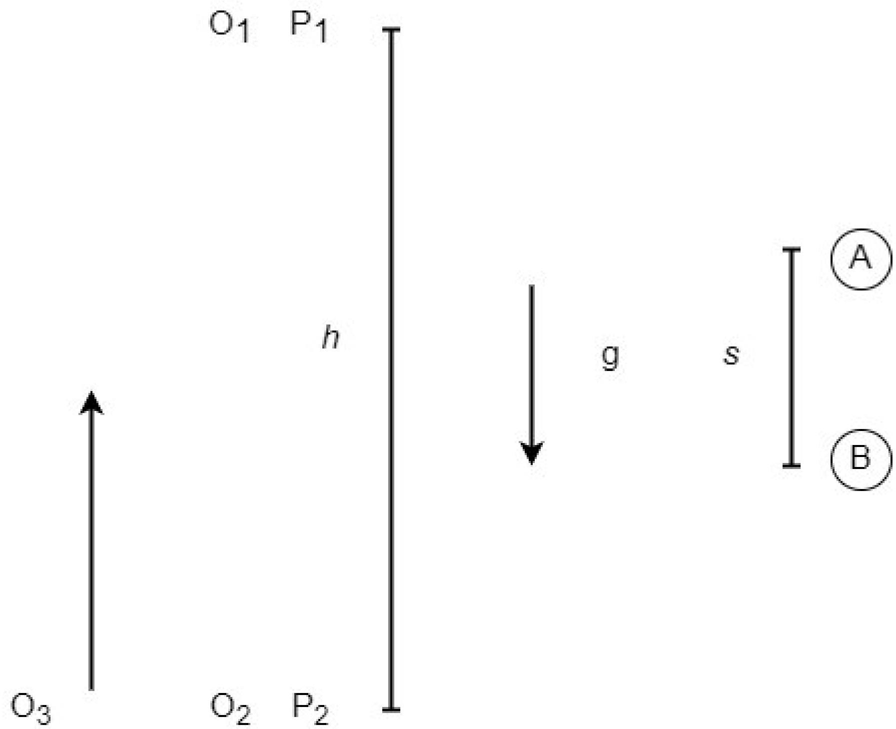

Figure 6

Observer1 stay still at position P_1, observer2 stay still at position P_2 and observer3 move from position P_2 to position P_1. Object A and object B is not move.

Observer 1 sees distance from A to B is S_1

Observer 2 sees distance from A to B is $S_2 = \frac{1}{d_{21}}\ S_1$

$S_1 > S_2$, $\Delta S = S_1 - S_2$

When observer3 at position P_2 he saw distance of A to B is S_2. When Observer 3 arrives at Position P_1 he saw distance of A to B is S_1 then observer 3 sees the pseudo movement between A to B as ΔS.

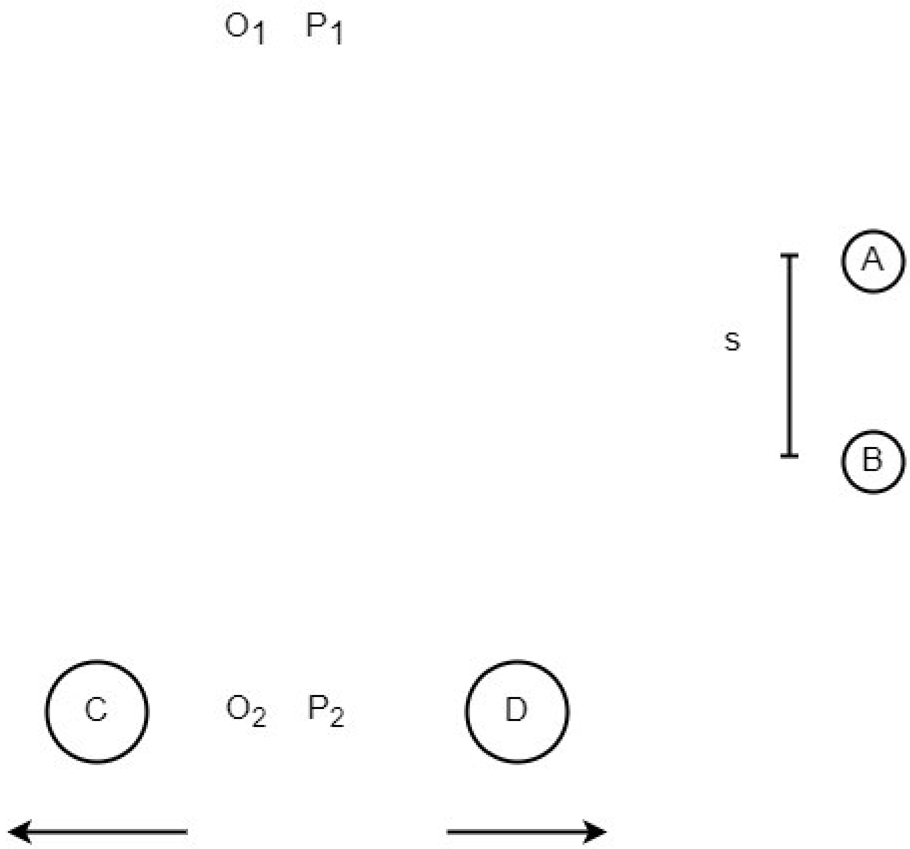

Figure 7

Observer O_1 stay still at position P_1, observer O_2 stay still at position P_2. Object A and object B is not move. There are two object C and D move away from O2.

From viewpoint of Observer O_1

Because there is no change about gravitation at Observer O_1 then there is no change in relative density

$$d_{after\ before} = d_{ab} = 1$$

$$S_{1aft} = \frac{1}{d_{ab}} S_{1before}$$

$$S_{1aft} = S_{1befo}$$

S_{1befo} = distance of object A and object B before object C and object D move away from observer O_2.

S_{1afte} = distance of object A and object B after object C and object D move away from observer O_2.

From viewpoint of Observer O_2

Because change in distance of object C and D to P_2 then relative density at position P_2 change.

$$d_{after\ before} = d_{ab} < 1$$

$$S_{2after} = \frac{1}{d_{ab}} S_{2before}$$

$S_{2afte} \ > \ S_{2before}$

$\Delta S_2 = S_{2aft} \ \ - S_{2befo}$

$S_{2before}$ = distance of object A and object B before object C and object D move away from observer O_2.

S_{2af} = distance of object A and object B after object C and object D move away from observer O_2.

Observer O_2 saw there is pseudo movement with value ΔS_2. Different with result from Observer O_1 that there is no change in distance of object A and object B

10. EXPANDING UNIVERSE

Since the big bang, our universe is continue expanding. Every galaxies move away each other. According to section 9 relative density caused by object move away from observer $d_{after\ before} = \ d_{ab} < 1$.

$d_{ab} < 1$ cause pseudo movement.

$v_o = v_r + v_p$

v_o = Velocity of expanding universe seen by observer.

v_r = Real velocity of expanding universe.

v_p = Pseudo velocity of expanding <u>universe.</u>

Pseudo movement is part of total velocity of expanding universe seen by observer. Pseudo movement make total velocity of expanding faster than it should.

REFERENCES

[1.] Crowell, Benjamin, Mechanics, Light and Matter Fullerton, California, (2019).

[2.] Einstein, Albert, Relativity the special and general theory, Henry Holt and Company, New York, (1920)