RELATIVISTIC ACCELERATION AND PREDICTING CHANGE IN DARK MATTER

Abstract:

Since the discovery of dark matter, it is one of the biggest mysteries in the field of astrophysics. This paper explains Dark Matter as a result of the relativistic variation of acceleration with velocity. This theory is also applicable to galaxies that lack Dark Matter. This theory can also be used to predict the change in dark matter.

Keywords:

- With increase in velocity, acceleration observed is comparatively lesser than that when observed at rest.
- Astronomers calculate the mass of a Body only considering the relative acceleration and not the absolute one. Thus we obtain a lesser value of mass than the actual one and the missing mass is dubbed as Dark Matter.
- Ghost galaxies have their relativistic acceleration almost equal to absolute acceleration.
- Dark Matter is mass left uncalculated.
- By predicting the velocity and direction of galaxies at different point of time, we can predict the amount of dark matter and the change in dark matter with time.

Introduction:

In 1905, Einstein for the first time in human history suggested that the fundamental quantities like length, mass, time are not absolute but relative quantities. From LIGO's observation of gravitational waves and the first image of a Black hole, it is evident that Einstein's Theory of relativity governs the universe.

Dark Matter is a hypothetical form of matter which constitutes around 85 % of matter in the universe. It was discovered when astronomers found that the gravitational pull of supermassive black holes at the center of the galaxy was not enough to hold up all the stars it contained. There seemed to be an additional gravitational pull due to an unknown phenomenon which interacts with normal matter only through gravity. A recent theory unifies dark matter and dark energy as the result of a hypothetical substance called dark fluid filling all the universe.

Author: Sayad Pervez .B - Chennai-43

Email ID : pervez2504@gmail.com

My theory explains dark matter as a phenomena arising due to the relativistic variation of acceleration across various inertial frames of reference.

Derivation:

Consider two frames of reference S and S'. Let the frame S be at rest and the frame S' be moving along the positive X-axis with a uniform velocity ' v '. Let ' A ' and ' B ' be two bodies of equal mass ' m ' separated from each other by a distance ' d '. ' A ' and ' B ' exert a gravitational force on each other and the acceleration produced is given by the equation (1).

acceleration = G m / r^2 ---------------(1) ;

Where G is the universal gravitational constant and r is the distance between two bodies.

In S frame,

r = d ;

From (1),

a_0 = G m / d^2 ---------------(2)

Where a_0 is the absolute acceleration observed from a stationary frame of reference.

In S' frame,

From Einstein's theory of relativity, the distance of seperation appears to be contracted (length contraction)

$$r=\frac{d}{\sqrt{1-\frac{v^2}{c^2}}} \quad \text{---------------(3)}$$

Substituting (3) in (1), we get

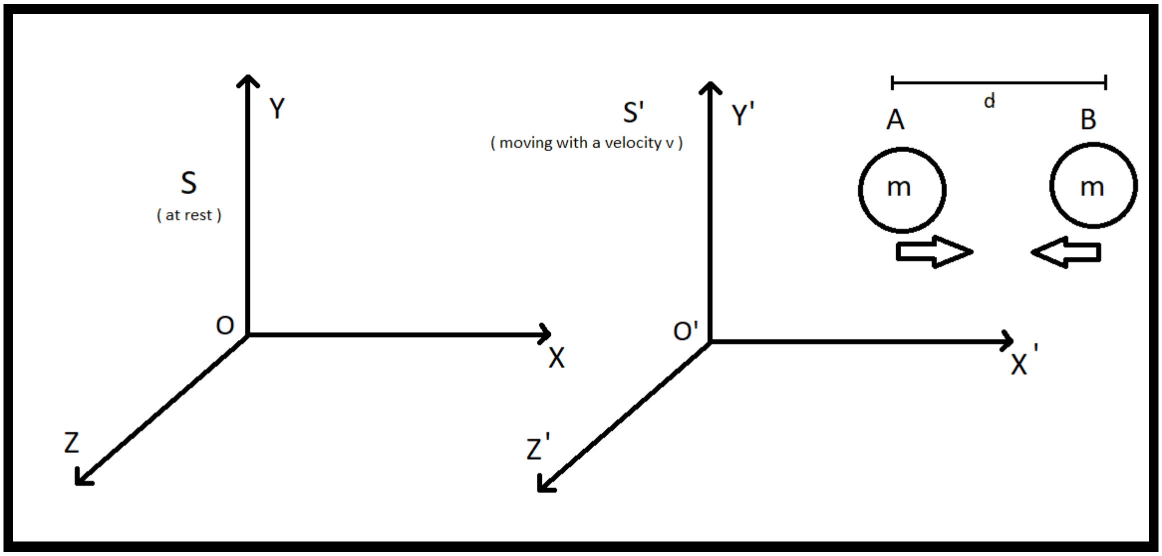
$$a=\frac{Gm}{d^2}\times(1-\frac{v^2}{c^2})$$

$$a\times\frac{c^2}{c^2-v^2}=\frac{Gm}{d^2} \quad \text{---------------(4)}$$

From (2),

$$a\times\frac{c^2}{c^2-v^2}=a_0 \quad \text{---------------(5);} \quad a=a_0\times\frac{c^2-v^2}{c^2} \quad \text{---------------(6)}$$

PICTURE 1



Here ' a ' represents acceleration as observed from an inertial frame of reference moving with a velocity ' v '.

It is evident from the equations that the acceleration of a body as observed from a moving frame of reference is less than that of the actual acceleration. (i.e) $a < a_0$.

Effect on stars in a galaxy:

Consider a star revolving a blackhole. Here acceleration is directed towards the blackhole. Thus when observed from a frame of reference which is relativity at rest, we observe the actual acceleration due to gravity, $a_{0.}$ From a frame of reference moving relative to the system, the observed acceleration is comparatively lesser and is given by the equation (6). The mass of blackhole in the center of a galaxy is measured by studying the time period of stars as well as the distance from the Blackhole.

$$T=2\pi\times\sqrt{\frac{R}{a}} \text{ ---------------(7)}$$

from which acceleration can be derived as

$$a=4\pi^2\times\frac{R}{T^2} \text{ ---------------(8)}$$

Conventional methods that do not take into consideration the relative velocity, give the relativistic acceleration and not the absolute one. Thus when mass is calculated using (8), we get a value less than that of the absolute mass of the required blackhole or the star taken into consideration.

$$m=\frac{a\times r^2}{G} \quad \text{---------------(9)}$$

Thus, the remaining mass of the blackhole which we failed to calculate using the conventional formulae was dubbed as "Dark Matter".So to find the actual mass of the blackhole, equation (8) has to be used to find the relativistic acceleration after which when substituted in (5) gives the absolute acceleration a_0 of the blackhole. After substituting a_0 in (9), actual mass of the blackhole can be calculated.

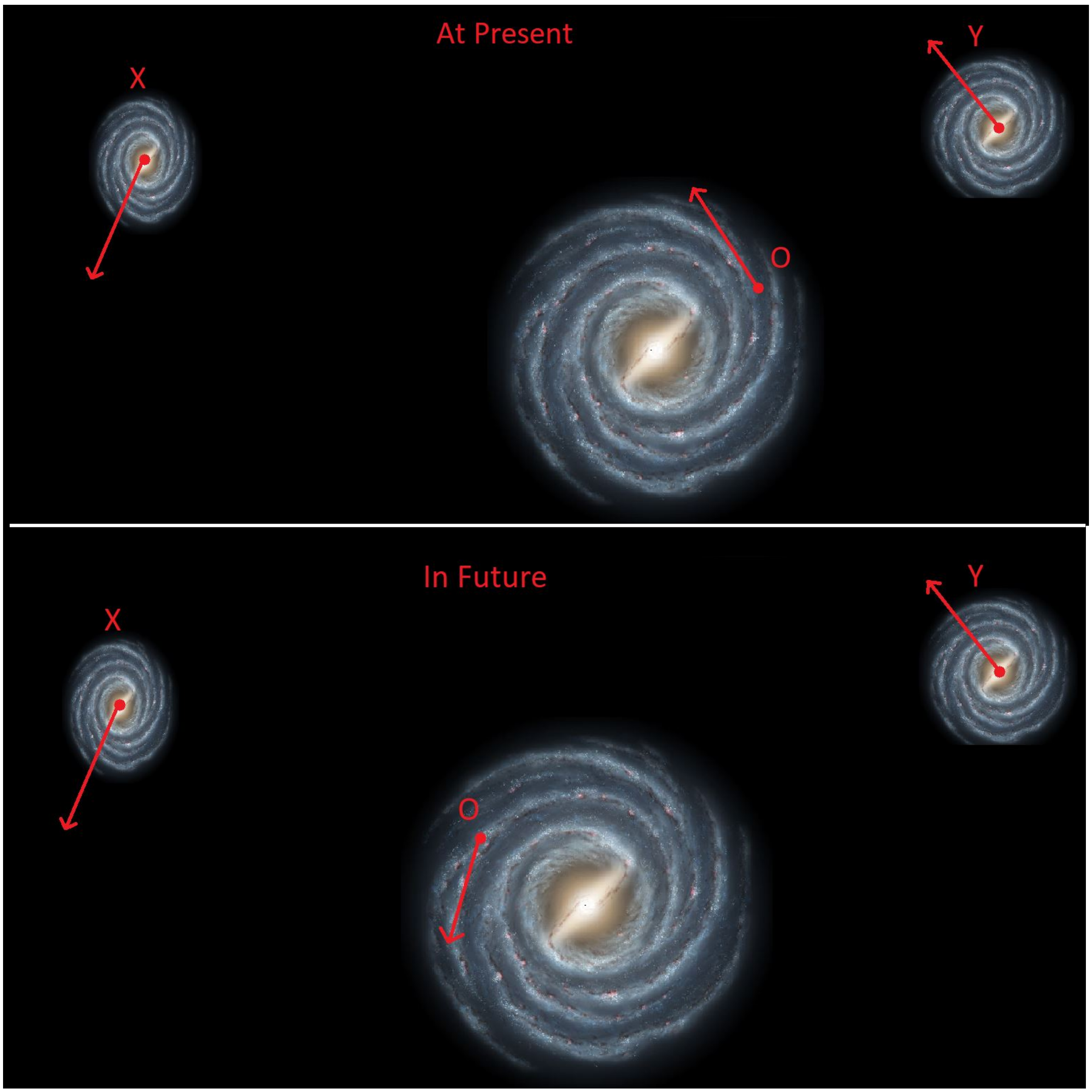
Galaxies without Dark Matter:

A recent study published by "The Astrophysical Journal Letters" claims a significant discovery of two galaxies nicknamed as DF2 and DF4 without Dark Matter also known as Ghost Galaxies. This questioned the existence of Dark Matter. From (6), relativistic acceleration is equal to absolute acceleration ($a = a_0$) when the relative velocity is zero. Thus the observed acceleration is equal to the absolute acceleration resulting in no error in mass of the Supermassive blackholes at the center of the galaxy and hence these galaxies appear to lack Dark Matter.

Prediction:

It is because both the direction and velocity of our solar system around our galaxy is equal to that of ghost galaxies like DF2 and DF4, the observed acceleration is almost equal to the absolute acceleration resulting in the absence of dark matter. With time when the direction of our star system changes, there will be a change in the relative velocity between galaxies. This would result in the increase of Dark Matter in the ghost galaxies(present ones) and decreasing amount of Dark Matter in other galaxies whose relative velocity decreases, when calculated using the conventional methods.(refer PICTURE 2). Also by predicting the relative velocity(and direction), we would be able to predict dark matter (mass left uncalculated) at any point of time.

Pictures:



Picture_2

Picture 2 explains how the perception of dark matter would change if we still use the conventional method of using relativistic acceleration to calculate the mass of blackholes. At present Y is a ghost galaxy lacking dark matter since we are able to measure the absolute acceleration of the blackhole (lesser value of relative velocity) and X is any normal galaxy with Dark Matter since it's velocity vector is directed in a different direction.

In future, when our star system moves out to a different part of our galaxy, it's velocity vector gets directed parallel to the direction of X. Thus at this point of time, X appears to be a galaxy with no dark matter and Y which was previously a ghost galaxy appears to have gained a lot of dark matter owing to the difference in direction. This is one of the predictions of my theory.

Summary:

Thus according to this theory,

- The acceleration of a body appears to decrease with increase in velocity.
- The acceleration of a body when observed from a frame of reference relatively at rest is referred to as absolute velocity ' a_0 '.
- The acceleration of a body when observed from a frame of reference moving relative to the body is denoted by ' a '.
- When relative velocity is zero, $a = a_0$.
- For relative velocity other than zero, observed acceleration is given by the formula: $a=a_0\times\frac{c^2-v^2}{c^2}$
- Calculating the mass of stars or blackholes with conventional methods would give a lesser value of mass and hence this missing mass was dubbed as "Dark Matter".
- When we calculate the mass of stars or blackholes using the absolute acceleration, we get it's actual mass
- Ghost galaxies without dark matter is due to lesser values of relative velocity due to which ' a ' is approximately equal to ' a_0 ' and the mass of the galaxy agrees with the orbit of stars around it.
- Thus Dark Matter is mass left uncalculated.
- This theory predicts that when we use the conventional method (without using a_0 for calculating the mass of stars), the dark matter in DF2 and DF4 would

decrease and the dark matter in the galaxies with velocity vector equal and parallel to our star system would increase.

- By predicting the velocity and direction of galaxies at different point of time, we can predict the amount of dark matter(mass left uncalculated) and the change in dark matter with time.