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A Theoretical Analysis of the Acceleration and the Angular Momentum of the Universe

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Abstract

The loss of Baryonic Matter through Black Holes from our spatial 3-D Universe into its 4th dimension as Dark Matter, is used along with the Conservation of Angular Momentum Principle to prove theoretically the accelerated expansion of the 3-D Universe, as has already been confirmed experimentally being awarded the 2011 Nobel Prize in Physics. Theoretical calculations can estimate further to indicate the true nature of the acceleration; that the outward acceleration is due to the rotation of the Universe caused by Dark Energy from the Void, that the acceleration is non-linear, initially increasing from zero for the short period of about a Million years at a constant rate, and then leveling off non-linearly over extended time before the outward acceleration begins to decrease in a non-linear fashion until it is matched by the gravitational attraction of the matter content of 4D Space and the virtual matter in 3-D Vacuum Space. m = m(4D) + m(Virtual). The rotation of our 3D Universe will become constant once all 3D matter has entered 4D space. As the 3-D Universe tries to expand further it will be pulled inward by its gravitational attraction and will then keep on oscillating about a final radius r_f while it also keeps on oscillating at right angles to the radius r_f around final angular velocity ω_f, until it becomes part of the 4-D Universe. The constant value of the Angular Momentum of our Universe is $L = 0.5mr_f^2\omega_f$.

Keywords

3-D Baryonic Matter, 3-D Virtual Matter, 4-D Dark Matter, Non-Linear Acceleration, Final Radius, Final Angular Velocity, Conservation of Angular Momentum Principle

1. Introduction

This paper is a continuation of the two published papers in the References based

on the effect the Conservation of Angular Momentum Principle has on the accelerated expansion of the Universe and that is the reason no other publications were used as part of the References. While the 2011 Nobel Prize specifies that our Universe is accelerating outwards, this paper indicates that the acceleration starts by being linear, then becomes non-linear for most part, as it starts from zero and ends its outward motion when acceleration reaches the value of Gm/r_f^2 due to the inward pull of gravity, explains the physical reasons for its non-linearity, as too the reasons for the Universe's final radius r_f and final angular velocity ω_f. Because of its rotation our 3-D Universe goes from a spherical to an elliptical to a disk shape. The Moment of Inertia of the Universe I increases systematically from $0.4mr^2$ to $0.5mr^2$ in steps as it changes its shape from a sphere to a disk, much like the disk shapes the galaxies of our Universe have currently taken. This slow increase in I causes a slow decrease in ω to keep the Angular Momentum $L = I\omega$ a constant and occurs while ω is still in its increasing phase. It is the reason for the outward acceleration changing its shape from initially being linear to finally becoming non-linear.

2. Main Text

We have already established graphically that the outward acceleration of our 3-D Universe is not a constant, but continues to accelerate non-linearly, the acceleration increasing at a constant linear rate of 10^{-2} m/s^2 per million year for the first million year, and then beginning to increase non-linearly until the acceleration stops increasing in the positive direction at a value of about 0.035 m/s^2 which is an extrapolation of the current experimental data and its theoretical calculations [1]. Once all 3-D matter has been removed from our 3-D Universe by its Black Holes the outward acceleration will begin to decrease in a non-linear fashion until it is brought to a stop at the constant value of Gm/r_f^2 when our Universe stops expanding in size as the accelerated expansion due to the rotation of the 3-D Universe is halted by the gravitational inward pull of the Universe.

Quasars formed earlier in time were more active in our 3-D Universe as indicated by data from radio telescopes because there was more 3-D Baryonic matter during the early development stage of our 3-D Universe to produce active Black Holes. Our 3-D Universe will be bereft of all Baryonic Matter before it becomes part of the 4-D Universe.

As matter goes into 4-D space through the Black Holes of our 3-D spatial Universe, the matter in our 3-D Universe is being continuously depleted. The Conservation of Angular Momentum $L = I\omega$ indicates that as the Moment of Inertia $I = mr^2$ decreases because m decreases faster than r^2 increases, thereby the angular velocity ω increases, leading to an increasing angular acceleration $\propto$ of the Universe which will continue to add to the centrifugal acceleration, flinging galaxies outwards with greater force, thereby causing the accelerated expansion $\bar{a}$ of the 3-D Universe.

Since the ratio of Dark Matter to Baryonic Matter is currently estimated to be

about 5 or 5.25 to 1, this implies that our 3-D Universe has advanced toward about 84% completion of its fourth dimension, and hence only 16% of the original mass our Universe started with currently exists in our 3-D Universe. Our 3-D Universe will keep on expanding until all its original mass has been sent into 4-D Space. Once all 3-D matter has entered 4-D Space the final radius r_f and the final angular velocity ω_f of 3-D space will be held a constant by m(4D) and m(Virtual); m(4D) is the matter sent into 4D space which is evidenced by the rotational curve of galaxies as shown in Figure 1 due to 4D Dark Matter, and m(Virtual) are Virtual particles that exist in our 3-D Vacuum Space. Virtual particles are mainly electron positron pairs that are continuously created by high frequency gamma ray photons and exist for a short period of time as they annihilate each other. Since m = m(4D) + m(Virtual) r^2 continues to increase, thereby reversing the effect m has on the Moment of Inertia I and the angular velocity ω. Since the Moment of Inertia I now increases, ω decreases to keep the Angular Momentum $L = I\omega$ a constant, leading to a decreasing angular acceleration $\propto$ of the Universe, until it reaches a constant value. With m, a constant, $r^2\omega$ must remain a constant and therefore ω will continue to decrease as $1/r^2$ to keep L, a constant. When the inward gravitational acceleration due to m equals the outward centrifugal acceleration due to ω, there is no net acceleration a_{Net} of the system which occurs when $\omega_f = \sqrt{Gm/r_f^3}$. At that point the Universe will stop expanding because it will be pulled back inward as it continues to oscillate about the equilibrium point r_f. This final radius r_f of the 3-D Universe is given by $r_f = \left\{Gm/\omega_f^2\right\}^{1/3}$. The outward acceleration $\bar{a}$ will end when its value equals Gm/r_f^2. For a disk-shaped Universe the Angular Momentum $L = 0.5mr_f^2\omega_f = \sqrt{Gm^3r_f/4}$ where m = m(4D) + m(Virtual). Our Universe cannot stop its rotational motion because if it did, then $\omega \to 0$, would imply $L = I\omega \to 0$, thereby violating the Conservation of Angular Momentum Principle. This also implies from the formula for ω_f that the final radius r_f of the Universe must remain finite.

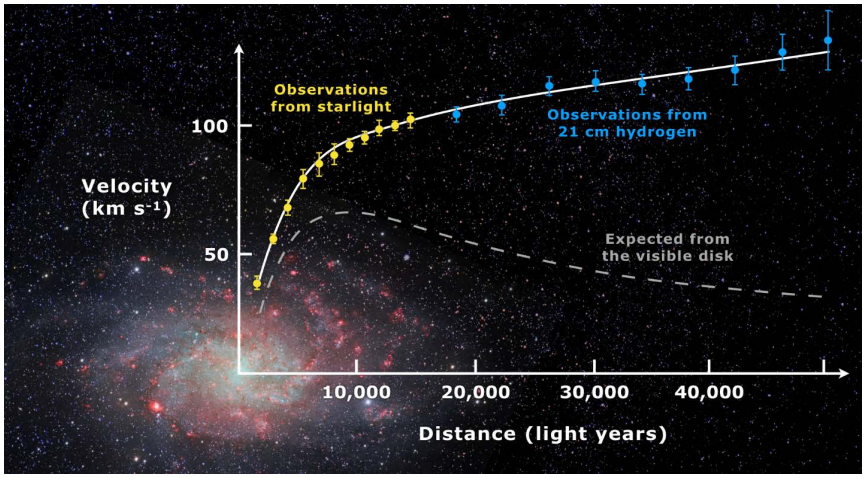

Figure 1. The rotational curve of galaxies due to Dark Matter in the 4-D Space of our 3-D Universe.

Eventually, 3-D Vacuum Space will form the surface of 4-D space filled with 4-D matter, just as 2-D space forms the surface of 3-D space filled with 3-D matter, just as on a smaller scale the surface area of a solid 3-D sphere is a hollow 2-D sphere, and the surface area of a solid 3-D cube are six 2-D plane surfaces. The same effect occurs in all the other 3-D Universes in our Multiverse since all the 3-D Universes must deposit their matter in their 4-D dimensions in the same manner so that four 3-D Universes with their 4-D dimensional parts can come together simultaneously to complete the formation of each of the 4-D Universes of our Multiverse [2].

There are two possibilities that exist for the loss of mass m from our 3-D Universe into its 4-D dimension to keep the Angular Momentum L, a constant, and the effect each possibility has on the outward acceleration $\bar{a}$ and the angular acceleration $\propto$ of our 3-D Universe is stated below:

1) The acceleration due to the inward pull of gravity becomes weaker compared to the outward acceleration as matter is removed from the 3-D Universe. m decreases faster than r^2 increases, in which case I decreases, while ω and $\propto$ increase, and $\bar{a}$ increases as long as $\bar{a} = r\omega^2$ increases, as has been confirmed experimentally along with a graph of its theoretical calculations.

2) The acceleration due to the inward pull of gravity begins to become stronger compared to the outward acceleration when no more Baryonic matter can be removed from the 3-D Universe. What remains is m = m(4D) + m(Virtual), which remains a constant while r^2 increases, in which case I increases, while ω and $\propto$ decrease and $\bar{a}$ decreases as long as $\bar{a} = r\omega^2$ decreases. For constant m since ω decreases as $1/r^2$, $\bar{a} = r\omega^2$ will decrease as $1/r^3$ and will continue to get smaller in value as r becomes larger.

When ω reaches the constant value of $\omega_f = \sqrt{Gm/r_f^3}$, a_{Net} the net acceleration and $\propto$ the angular acceleration become zero because for $\propto$, ω is now a constant. Since $a_{Net} = r_f\omega_f^2 - Gm/r_f^2 = 0$ where gravitational attraction cancels centrifugal expansion, for $r < r_f$, a_{Net} is positive while for $r > r_f$, a_{Net} is negative. For $\omega > \omega_f$ or $r < r_f$, $\propto = (\omega - \omega_f)/\Delta t$ is positive while for $\omega < \omega_f$ or $r > r_f$, $\propto = (\omega - \omega_f)/\Delta t$ is negative. Both $\propto$ and a_{Net} become positive and negative simultaneously as $\propto$ and a_{Net} both oscillate at right angles to each other around their respective equilibrium positions ω_f and r_f. The 3-D Universe will continue oscillating around ω_f with zero angular acceleration at the center and with maximum positive and negative angular acceleration at the two end points of its oscillation; and our Universe will also oscillate about its final radius r_f with zero net acceleration at the center and with maximum positive and negative net acceleration at the two end points of its oscillation.

3. Conclusions

A rotating Universe cannot be isotropic or homogeneous because it has a preferred direction which is centered at the axis of rotation. Since the Cosmological Principle which requires the Universe to be both isotropic and homogeneous is not valid at all other points, we cannot use the same space-time equations for dif-

ferent parts of the Universe, as is currently being done.

The rotational curve of Galaxies tells us that Galaxies have an Angular Momentum which translates to the Angular Momentum of our 3-D Universe. The current theories of Cosmology ignore the rotation of our Universe to keep the validity of the Cosmological Principle intact which implies that the Angular Momentum of our Universe is zero, thereby refuting the basic laws of Physics and the experiments of the accelerated expansion of the Universe for which a Nobel Prize in Physics has been awarded.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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