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Finite Relativism and Dark Matter Disproof

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The mathematical representation of General Relativity uses a four dimensional reference frame to position in time and space an object and tells us time is a linear variable that can have both a negative and positive value. This therefore implies time becomes itself a dimension and causes the theory opening doors to ideas such as: singularity, wormhole, dark matter, cosmic acceleration faster than *c* and so on.

In this paper a new mathematical model is being suggested which is based on the current laws of dynamics. The theory is objective and superimposes low-scaled GPS gravitational time dilation precision, Mercury's perihelion precession, particle accelerator momentums, up to the disproof on the needfulness of the ambient dark matter, natural faster-than-*c* galactic expansion prediction and can consequently be used to determine the ultimate scale of the Universe.

1 Finite Relativism

Finite Relativism (FR) defines a new representation of the actual tested formulas derived from General Relativity (GR). Where it differs from it is how time is defined and will help understand the implications previously stated.

Indeed in contrast to GR where space is ultimately variable to keep the speed of light constant, FR considers time to be variable and therefore the space can be represented with the standard Cartesian coordinate system. No effective results deriving from General Relativity are in violation.

FR postulates time dilation is directly proportional to its energy, where the former will be later shown to be sufficient in describing universal phenomena:

1. The kinetic energy of body relative to its maxima induces dilation of time
2. A gravitational time dilation is the direct cause of the superposed gravitational potentials

Which will lead to the consequent precepts:

1. Mass density cannot exceed ~ 4 x 10^{26} kg / m^3
2. The speed of light and the gravitational time dilation are correlative

1.1 Black hole radius

A black hole is a region in space where all matter and energies, including light, cannot escape from its gravitational well. The Schwarzschild radius defines the event-horizon where the gravitational pull exceeds the escape velocity of the speed of light. This is given by:

$$r_s = \frac{2GM}{c^2} \tag{1}$$

Given that Schwarzschild radius derives from GR formulation, FR will need its own definition. Satisfyingly, this can easily be found by reckoning the location where the gravitational acceleration overtakes the escape velocity given by the constancy of the speed of light:

$$\frac{1}{2}mv^2 = \frac{GMm}{r_b} \tag{2}$$

By solving the equation with the maximum escape velocity a photon can have, where the mass is of non-importance we get:

$$r_b = \frac{2GM}{c^2} \tag{3}$$

Despite the fact the resulting equation is exactly the same as the Schwarzschild radius, we will use a different notation forasmuch as its origin differs.

1.2 Mass density

First if we take for example the theoretical scenario where a photon falls down into a black hole. The photon will red shift, will slow down and will eventually come to an apparent halt about the event horizon of the black hole.

The statement is perfectly valid but its conclusion is controversial. In this scenario and according to GR the photon itself will never notice any problem, which is also true. But according to GR the proton will eventually fall down into the event horizon and either crash into some black star, a singularity or a wormhole.

FR predicts that the photon will never cross the event horizon at all because time is not considered to be a dimension, but a limit. Therefore if the apparent speed of the photon is nearly zero, then it must be nearly zero.

Finally if all mass can never pass the event horizon then there is obviously a maximum density the black hole can take. We can easily find that density based on the event horizon:

$$r_b = \frac{2G\rho_0}{c^2} \tag{4}$$

Hence the maximum mass we can include in a unit of volume is:

$$\rho_0 = \frac{c^2 \times \sqrt[3]{\frac{3}{4\pi}}}{2G} \tag{5}$$

$$\rho_0 = 4.1825892 \times 10^{26} \frac{kg}{m^3} \tag{6}$$

1.3 Time dilation reengineered

We can represent time dilation using simpler techniques by interpolating dilation. Indeed if we rationalize the kinetic energy gained by the object in motion according to the maximum one it can experience at the speed of light then:

$$p_v = \frac{\frac{1}{2} m v^2}{\frac{1}{2} m c^2} \quad \textbf{(7)}$$

Since the time dilation percentage is the exact opposite of the speed ratio then:

$$p_t = 1 - p_v \quad \textbf{(8)}$$

We consequently define general time dilation in direct relation to the proportion as follows:

$$t_o = \frac{t_f}{1 - \frac{v^2}{c^2}} \quad \textbf{(9)}$$

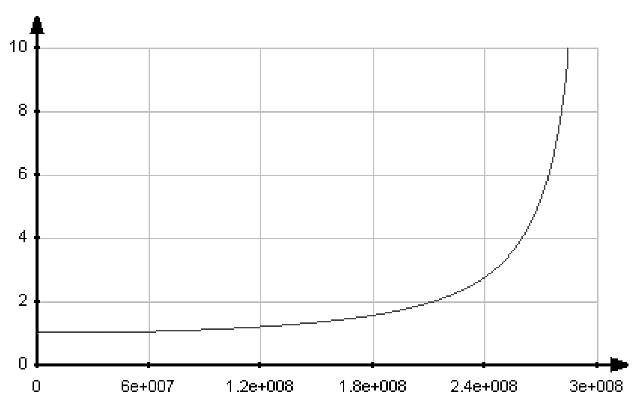

Figure 1 – Time Dilation Factor vs. Speed (m/s)

1.4 Gravitational time contraction

In contrast to kinetic time dilation, gravitational time contraction will be used interdependently with the non-trivial ambient gravity field of the observer, or fractionalized.

1.4.1 Outside a sphere

Since an inertial body being subject to a specific gravitational force is responsible for gravitational time dilation and that gravity is a superposable force, we will translate the same conditions of all gravitational potentials into the sum of all surrounding fields of an observed clock and the observer:

$$t_o = -\frac{\Phi(r)}{\Phi(r_o)} \times t_f \quad \textbf{(10)}$$

$$t_o = \frac{\sum_{i=1}^{n} \frac{m_i}{|r_i - r|}}{\sum_{i=1}^{n} \frac{m_i}{|r_i - r_o|}} \times t_f \quad \textbf{(11)}$$

Where:

- r is the location of the observed clock
- r_i is the location of the center of mass i
- r_o is the location of the observer (typically 0)
- m_i is the mass i
- t_o is the observed time of two events from the clock
- t_f is the coordinate time between two events relative to the clock

By juxtaposing the same spherical mass with its external gravitational time dilation factor and internal counterpart we have the following, for a spherical mass of 20 *meters* in radius:

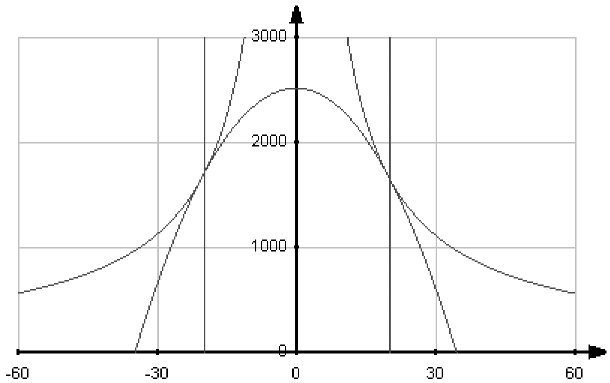

Figure 2 – Inner & Outer Gravitational Time Dilation Factors vs. Radius (m)

1.5 Dynamic universe of 2 galaxies

In fact if we consider the galaxies to be moving away from each other then the gravitational field will in turn be constantly changing. This means the traveling galaxy will affect its own speed.

1.5.1 Dynamic speed contraction

By putting this in context and estimating the speed contraction when a galaxy itself is traveling away with constant inertia from a more massive one where gravitational forces have no effect, we will have an entire galaxy of a lesser mass that will dynamically alter the gravity field itself. Modifying the ambient gravity field according to our theory will modify the speed in regards of the galaxy in motion. Hence the moving galaxy will affect its own speed. Let's estimate the speed of a less massive moving galaxy than the leftmost one, in one instant:

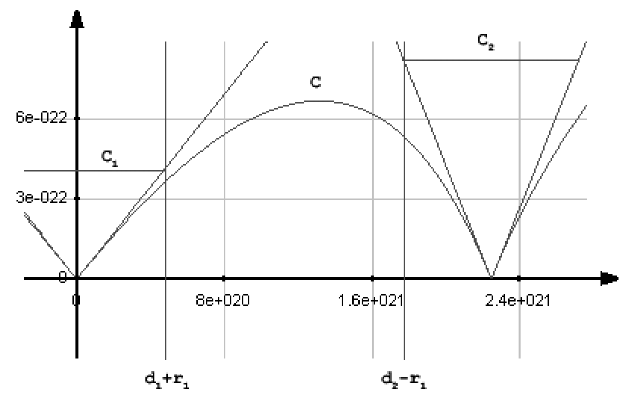

Figure 3 – Dynamic Speed Contraction Factor vs. Distance (m)

Where:

- $m_1 = 1.1535736{\times}10^{42}\ kg$ (mass of leftmost galaxy)
- $m_2 = 5.767868{\times}10^{41}\ kg$ (mass of rightmost galaxy)
- $d_1 = 0\ m$ (position of leftmost galaxy)
- $d_2 = 2{\times}10^{21}\ m$ (position of leftmost galaxy)
- $r_1 = r_2 = 4.7305{\times}10^{20}\ m$ (radius of both galaxies)
- C_1: speed contraction of leftmost galaxy
- C_2: speed contraction of rightmost galaxy
- C: interactive speed contraction

With the above declarations we can attain the following relative speed as seen from the edge of the leftmost galaxy:

$$v_o = \frac{\mathrm{f}(2\times10^{21}m - 4.7305\times10^{20}m)}{\mathrm{f}(4.7305\times10^{20}m)} \times v_f \quad \textbf{(12)}$$

$$v_o = 142.61539\% \times v_f \quad \textbf{(13)}$$

This means the galaxy will be seen traveling 3 times faster than its local inertia from the edge of our galaxy. Now by moving the galaxy further away from us by

$2.5 \times 10^{20}\ m$ we will quickly see the different apparent speed it will carry:

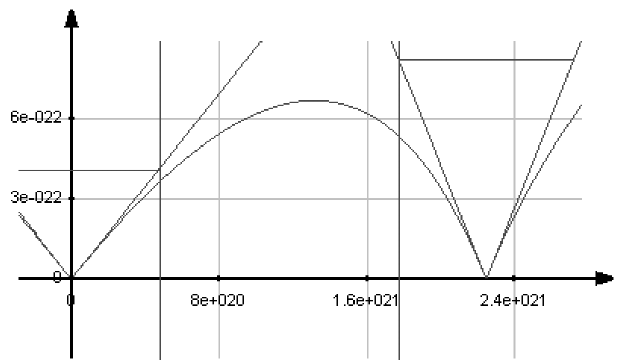

Figure 4 – Dynamic Speed Contraction Factor vs. Distance (m)

$$v_o = \frac{f(2.25 \times 10^{21} m - 4.7305 \times 10^{20} m)}{f(4.7305 \times 10^{20} m)} \times v_f \quad \textbf{(14)}$$

$$v_o = 147.88381\% \times v_f \quad \textbf{(15)}$$

We already see here an acceleration in the perceived speed of the moving galaxy by 5.26842% for a distance of $2.5 \times 10^{20}\ m$ away from its original position. To better estimate the perceived speed of the galaxy according to a variable position we will use Equation (17) where the speed sample taken from the gravity field will always be on the innermost radius of the galaxy. What changes here is the position of the traveling galaxy, which is variable:

$$v_o = \frac{v_f}{\frac{m_1}{|x - d_1|} + \frac{m_2}{|r_2|}} \quad \textbf{(16)}$$

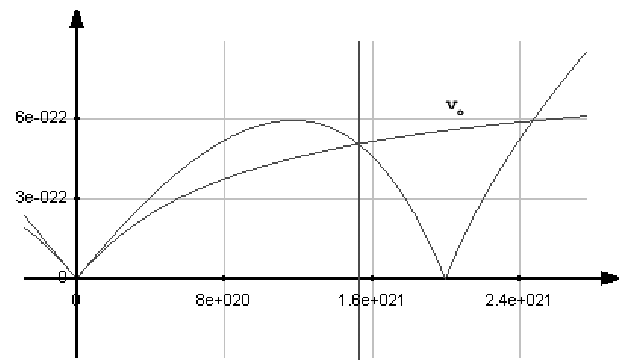

Figure 5 – Dynamic Speed Contraction Factor vs. Distance (m)

Irrevocably the speed of the nomadic galaxy with an initial inertia will be greatly enhanced the farther it gets away from us. There is absolutely no repulsive force necessary to accomplish this behavior.

Furthermore this concept will obviously to even greater scales such as cluster of galaxies, superclusters and even greater probable groups of superclusters. The discussion on knowing how large the Universe is not conclusive enough unless possible reverse engineering is used to map the measurements to approximate the direction of the galaxies and therefore the center of the Universe if a Big Bang is really responsible for its creation.

1.5.2 Dynamic acceleration

In our estimates we are taking into account only 2 galaxies. Once again this drift can be applied to greater scales in more important amplitudes but they will still follow the same course. This course can be estimated as such:

$$a_o = a_f \times \frac{m_1}{\left[\frac{m_1}{|x-d_1|}+\frac{m_2}{|r_2|}\right]^2 x^2} \tag{17}$$

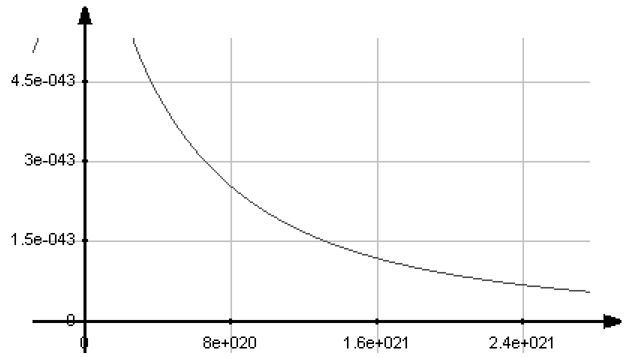

Figure 6 – Dynamic Acceleration Factor vs. Distance (m)

This graph summarizes how gigantic masses will interact with each other. The acceleration is not constant in short distances in contrast with the Hubble's Law but will eventually tend to be this way for very long distances.

2 IMPLICATIONS

Herein are enumerated all consequences FR will lead to and highlights important differences from its cousin GR. No precise mathematical proof is being made in this matter; only logical observation, deductions and estimates are necessary to disjoint many hypotheses.

At this level only complex computer research can be proposed to simulate a modeling of the Universe under this umbrella in order to match its behavior with measurements such as the constant of the Hubble's Law. Potentially, simulators can also be used to reverse time and estimate an early Universe according to the current velocities of the superclusters, solve the scaling factor of the observed Universe which will lead to an estimation of the real volume of the Universe and solve local focal points of gravitational lenses .

2.1 GPS

The gravitational time dilation is actively subjecting the GPS system and needs to be considered in its corrections. The observed relativistic effects or both the kinetic and gravitational time dilations contribute in adding around 38 *nanoseconds* to the satellite's clock everyday, which in turn orbits the Earth with an altitude of 20200 *km*.

2.1.1 General Relativity

By examining what GR suggests in terms of gravitational time dilation, we can account its importance in function of the altitude of the satellite according to the following equation:

$$t_o = \frac{\sqrt{1-\frac{2Gm}{|i|c^2}}}{\sqrt{1-\frac{2Gm}{(x+|i|)c^2}}} \times t_f \tag{18}$$

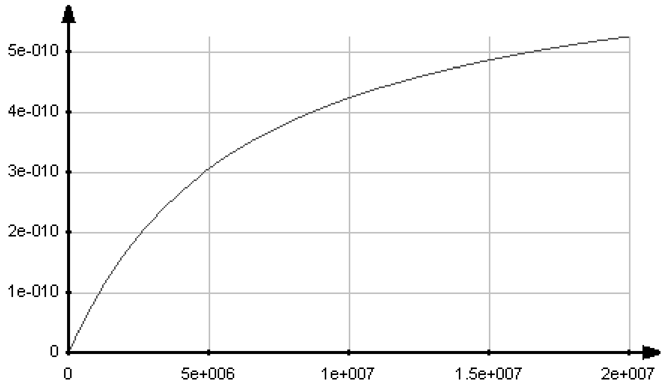

Figure 7 – GR Gravitational Time Dilation Factor ($\times 10^{-1}$-1) vs. Altitude (m)

$$t_o = 99.99999994714\% \times t_f \quad \textbf{(19)}$$

2.1.2 Finite Relativism

In contrast with GR, to get the anticipated gravitational time dilation factor of any artificial satellite in proximity with the Earth, we first need isolating the most influential gravitational masses surrounding our probe. That will be the Earth itself, the Sun and the Milky Way. Consequently the simplified summation of the juxtaposed gravitational acceleration amplitudes for a satellite with an altitude of 20,200,000 *m* will give us a gravitational time dilation factor of:

$$t_o = \frac{\frac{m}{|x-i|} + \frac{n}{|x-j|} + h}{\frac{m}{|i|} + \frac{n}{|j|} + h} \times t_f \quad \textbf{(20)}$$

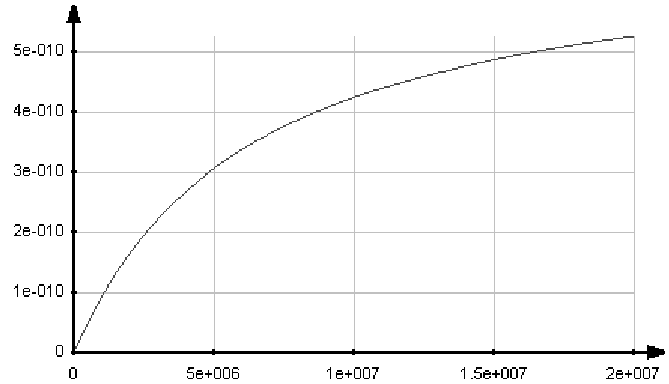

Figure 8 – FR Gravitational Time Dilation Factor ($\times 10^{-1}$-1) vs. Altitude (m)

$$t_o = 99.99999994714\% \times t_f \quad \textbf{(21)}$$

Where:

- $m = 5.9736 \times 10^{24}$ *kg* (Earth mass)
- $n = 1.98892 \times 10^{30}$ *kg* (Sun mass)
- $i = -6371000$ *m* (position of center of Earth)
- $j = 1.49597870691 \times 10^{11}$ *m* (position of Sun)
- $h = 1.3450632 \times 10^{27}$ *kg/m* (Milky Way scaling factor)

The precision of FR is relative to the number of masses included in its formulation, and amazingly is very sensible to the influence of large ones such as the local galaxy when high precision is required. This is because the norm or amplitude of each determinant is directly proportional to the body's mass and inversely to the distance.

The scaling factor represents the contribution of the local galaxy and is based on observations in order to match the effects. Deeper analyses of this factor constitute more complex calculations of mass distribution regarding the host galaxy.

2.1.3 Comparison

Given the fact FR was using an unaccountable constant to hold similar trends the observations are following, there is no clear distinction between the two theories up to this point. But if we observe the behavior of both theories at even higher altitudes, the predictions will diverge from each other:

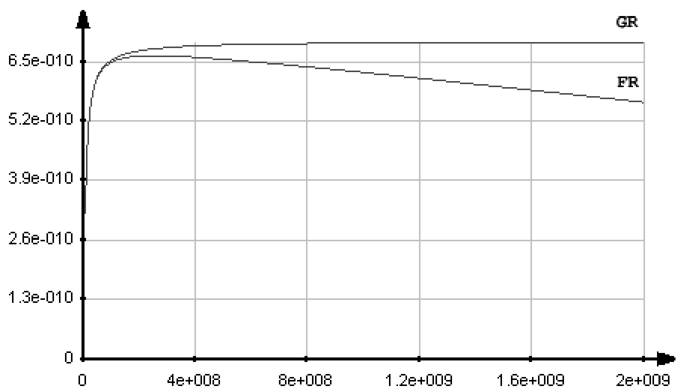

Figure 9 – GR & FR Gravitational Time Dilation Factors ($\times 10^{-1}$-1) vs. Altitude (m)

As seen on the first row, for the popular Hafele and Keating Experiment altitude involved and predictions surpassing geostationary satellites this means:

Altitude (m)	*GR (%)*	*FR (%)*
8,900	99.99999999990300	99.99999999990281
20,200,000	99.99999994714	99.99999994714
100,000,000	99.99999993463	99.99999993512
1,000,000,000	99.99999993090	99.99999993738

This also expresses a differing decreased expectation on the FR gravitational time dilation for a satellite or space probe at high altitudes or simply out of orbit, considering it is in direct line between the Earth and the Sun. If the probe is on the dark side of the planet, the opposite effect of speedups will be true.

2.2 Natural FTL

One of the most practical and interesting goals of any research area in this field is to reach exoplanets. Unfortunately since GR disallows any probe or ship traveling faster than 3×10^8 *m/s* we reach an impasse because one of the closest star named Alpha Centauri is about 4.3650765 *light years* or 4.01345081×10^{16} *meters* away from us. This means light rays will take 4.36507646 *years* to overtake that distance according to GR. The following section explores consequences of FR on both interstellar and intergalactic message transmission.

2.2.1 Alpha Centauri

In order to estimate the time it would take in conformance to FR, we will follow the henceforth equation that takes into account the adjoining most massive entity, or the influence of the Milky Way with a scaling factor. Once again the scaling factor represents the average influence of all surrounding stars:

$$t = \int \frac{\sum_{i=1}^{n} \frac{m_i}{|x - d_i|}}{\sum_{i=1}^{n} \frac{m_i}{|d_i|}} \times \frac{1}{c} dx \quad \textbf{(22)}$$

By renaming m_1, m_2 with m, m respectively, d_1, d_2 with i, j, consequently using a constant scaling factor of h representing $m_3/|x-d_3|$ and simplifying the entire equation we have:

$$t = \frac{m\log(|x-i|) + m\log(|x-j|) + hx}{\frac{m}{|i|} + \frac{m}{|j|} + h} \times \frac{1}{c} \quad \textbf{(23)}$$

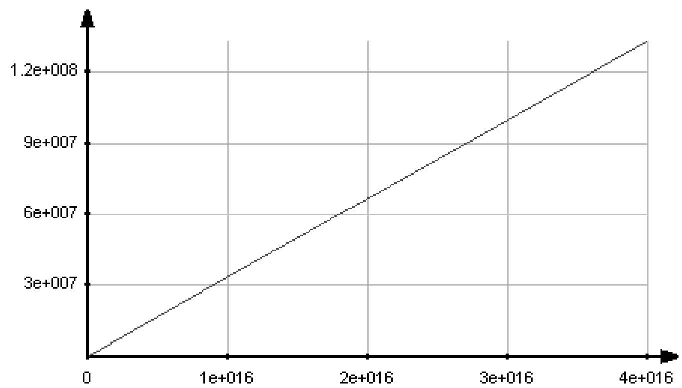

Figure 10 – Time (s) vs. Distance (m)

$$t = 4.3650764 \; years \qquad (24)$$

Where:

- $m = 1.98892 \times 10^{30}$ *kg* (Sun & Alpha Centauri mass)
- $i = -149597870691$ *m* (position of Sun)
- $j = 4.1297265 \times 10^{16}$ *m* (position of Alpha Centauri)
- $h = 1.3450632 \times 10^{27}$ *kg/m* (Milky Way scaling factor)

Given that the observer is at position 0 *m*, we get an increase in speed of 100.0000009883% relative to GR's predictions, which is not tremendous but the experiment remains at a very low interstellar scale.

2.2.2 Andromeda

On the other hand by computing the nearest galaxy of about the same size called Andromeda and forasmuch as the hosting Virgo cluster affecting both gravity fields of the Milky Way and Andromeda equally, we will get:

$$t = \frac{m\log(|x-i|) + m\log(|x-j|) + hx}{\frac{m}{|i|} + \frac{m}{|j|} + h} \times \frac{1}{c} \qquad (25)$$

$$t = 2.5007882 \times 10^{6} \; years \qquad (26)$$

Where:

- $m = 1.1535736 \times 10^{42}$ *kg* (Milky Way & Andromeda mass)
- $i = -2.45986 \times 10^{20}$ *m* (position of center of Milky Way)
- $j = 2.403094 \times 10^{22}$ *m* (position of center of Andromeda)
- $h = 5 \times 10^{23}$ *kg/m* (Virgo scaling factor)

Relative to GR, which predicts 2.5140531×10^{6} *years*, we have a velocity boost of 100.53043%. We are using a scaling factor from the Virgo cluster that is estimated in section 2.3.2, based on the observed galactic rotation curves.

We can foretell from these calculations galaxies will be subject to a speed bound much greater than 3×10^{8} *m/s* and that the more distant they are, the greater it will be relative to our galaxy. This is consistent with observations of distant galaxies outside the Hubble's sphere, where they all surpass the speed limit of 3×10^{8} *m/s*.

2.3 Dark Matter

Dark matter was proposed in 1933 by a Swiss astrophysicist named Fritz Zwicky. This idea is supposed to replace the missing matter necessary to withhold all tangential galaxies within their cluster traveling much higher than the necessary escape velocity. Dark matter explains also the same scenario at lower scales where tangential stars should technically easily escape the attraction towards to center of their galaxy. Unfortunately after many attempts of unfolding the nature of dark matter, no conclusive discovery can be revealed.

In contrast, by using FR as a mathematical representation we will find much different conclusions. Indeed, the stars and galaxies rotating around their galaxy and cluster respectively will be subject to time contraction. This means the bodies will be seen to travel much faster than the anticipated Newtonian speed. There is therefore no need for any dark matter to increase the gravity strength necessary to keep the tangential objects in an uninterrupted cycle.

2.3.1 Newton's law of gravitational force

Let's take a closer by comparing the two scenarios using approximate measurements but with correct tangents. First let's explore the necessary velocity our Sun needs having in order to maintain its orbit around the center of the Milky Way. This is a very simplified model that disregards gravity of surrounding stars and wave effects of spiral arms:

$$v = \sqrt{\frac{Gm}{x}} \quad \textbf{(27)}$$

Where:

- $m = 1.1535736 \times 10^{42}\ kg$

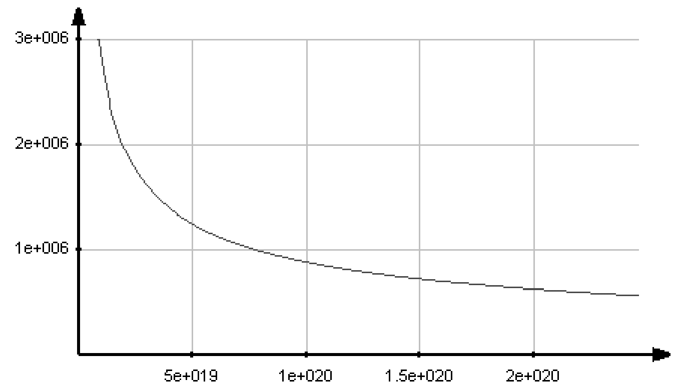

Figure 11 – Orbital Velocity (rad/s) vs. Radius (m)

The previous graph gives us the velocity proportional to its radius we should expect to see when stars are rotating a galaxy. This is known to be not true and here arrived the theory of the dark matter to augment the general mass of the galaxy.

2.3.2 Finite Relativism

In the other hand, if we add time contraction effects to the stars orbiting the galaxy we will get very different results. Let's imagine our neighbor Andromeda has exactly the same properties as the Milky Way, in order to simplify our measurements, and we are observing it from our solar system. In these conditions an approximation of the observed speed of the rotating stars of Andromeda as seen from our position can be given by the following according to FR:

$$v = \sqrt{\frac{Gm}{x}} \Bigg/ \left[\frac{m}{x} + h \Big/ \frac{m}{r} + h\right] \quad \textbf{(28)}$$

Where:

- $m = 1.1535736 \times 10^{42}$ *kg*
- $r = 2.45986 \times 10^{20}$ *m*
- $h = 5 \times 10^{23}$ *kg/m*

We have arbitrarily adjusted the scaling factor *h* of the Virgo cluster properly to show the effects on the subjected Milky Way galaxy:

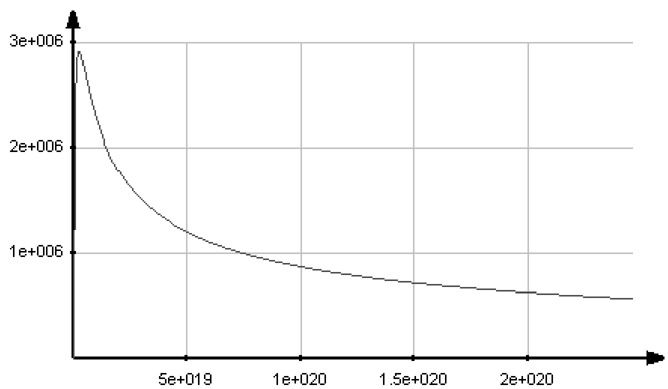

Figure 12 – Orbital Velocity (rad/s) vs. Radius (m)

We clearly see the observed velocity of the stars in Andromeda with different radius than our own Sun in the Milky Way ($r_o \neq r$). The graph curve is consistent with what is currently observed with distant galaxies, from the exception of its contracted form because of its non-distributed and centralized mass.

ACKNOWLEDGMENTS

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