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The NOW of Time and How It Impacts Physics

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Abstract This paper introduces the present moment, the NOW as it is called, into physics. Einstein thought the NOW could not be part of physics. Newton's definition of time, which he called mathematical time has defined a measure of time, but not time. It is used in all of physics, as well as all sciences, and civilization in general. Newton recognized that time appears to flow and thought the flow of time to be a universal constant independent of external influences. The common perception of the NOW of time does flow. Most conscious beings recognize time and space are different properties of Nature. So using this common belief as a clue, we introduce a new space called time-space, which is dependent upon external effects and controls the flow of time. Time-space is a two-dimensional space with only one unit, the second, but the physics of time-space is only one-dimensional and involves a periodic internal moving object, satisfying the philosophical notion that time and motion are intimately connected. Newton's flow of time is a universal constant, but Einstein's relativity, by assuming the speed of light to be constant, showed that the rate of time does depend on external influences when compared between different moving reference frames as well as different gravitational intensities. The NOW introduced here is thought to be an abstract quantity, consistent with Einstein's vision of I-time, as well as fields in general, having one property that is measurable, the period of the abstract moving object. The rate is constant within the solar system. Therefore, no changes are necessary to any of the physical theories. However, when applied to astrophysics and cosmology the altered rate has effects. This is demonstrated by applying the NOW rate to the rotation of the Andromeda galaxy and shows the rotation to be consistent with gravitation theories. Therefore, we conclude that galaxy rotation, which is the primary evidence for dark matter, dark matter does not exist. A broader conclusion is that the foundation of physics, as defined by Newton, is not correct.

Keywords NOW of Time, Flow of Time, Galactic Rotation, Dark Matter

1 Introduction

Modern physics provides our best understanding of the material universe and is based upon three main theories: Electrodynamics [1], both Classical and quantum, which describes light and its propagation, Special (SR)and General (GR) Relativity[2] which describes kinematics and gravitational properties, respectively, and quantum mechanics (QM)[3], which describes the micro-properties upon which all material aspects of the universe are built. All of these theories have as their foundation the physics of Newton[4] who defined the basic concepts of space and time. The successes of Newton's physics encouraged physicists to study the broader universe which in turn led to a field of Cosmology. Cosmology ran into its first major problem when our instruments evolved sufficiently to reveal the magnitude of the cosmos[5]. Cosmologists became aware of large islands of stars, called galaxies, scattered throughout the universe. Through quantum mechanics, and its success understanding atomic elements provided a means of measuring the velocities of distant objects. When measured it was found that these properties are not consistent with gravitation theories. The rotation velocity of the galaxies did not decrease with distance from the center, as gravitation theories predict, but remained constant with radial distance. Zwicky[6] observed this while studying nebulae, and he argued, that the fast rotation meant the stars would attain escape velocity and thus nebulae could not exist, so there must be more mass than observed. This

unseen mass became known as dark matter because it does not emit radiation and only interacts with gravitation. Rubin [7] studied numerous galaxies and found they all behave in the same way, exhibiting a flat rotation curve whereas gravitation expects rotation velocity to decline as the stars' positions move further from the galactic center. This has led to a century-long search for properties of dark matter. Dark matter could be dead stars, escaped planets, perhaps black holes, or maybe a new subatomic particle, but nothing has been found. There are also efforts to modify gravitation theory, to explain the unusual rotation. Modified Newtonian Dynamics, MOND developed by Milgrom[8] has been found to reproduce the flat rotation curve measured for all galaxies but requires an extra adjustable parameter. Gravitomagnetism by Ludwig[9] fits the rotation curves but fails to reproduce the luminosity profile, and the disk fails to give its mass distribution and total mass. At the present time, there has not been a satisfactory explanation of the dark matter.

This paper will take an approach, to my knowledge, not yet considered. The approach will look to the definition of time as the underlying cause for these discrepancies. With a modified definition of time, it is shown that the rotation of galaxies conform to gravitation theory, and does not require anything new to be added to the three main theories that are used to model physics and cosmology.

This paper is structured as follows: Section 2, the new structure of time will be defined, and how it is manifested and used. Section 3, time will be applied to the rotation of the Andromeda galaxy as a demonstration of the theory. Section 4, will discuss the meaning and metaphysics of this newly introduced time Section 5, will present our conclusions, and suggest a means to falsify this theory.

2 Existing definition of time

The development of time, as we currently know it, started with Galileo[10] who found ways to measure the swinging pendulum and the acceleration of balls rolling down an inclined plane. Newton[4] formalized these ideas as part of the foundation of his physics. Newton defined time as a mathematical time, a mathematical parameter designed to track the motion of objects through space, his time is measured with clocks. His Principia states:

> Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration: relative, apparent, and common time, is some sensible and external (whether accurate or unequable) measure of duration by the means of motion, which is commonly used instead of true time; such as an hour, a day, a month, a year.

Further, he thought time flows at some constant rate throughout the universe, which he did not define. Newton's mathematical time is a measure of time not a true definition of time, it is a mathematical parameter, a uniform sequence of numbers provided by some invented device, a clock calibrated by some external means that exhibits observable motion. SR and GR developed by Einstein[11] made major changes to how time is envisioned. These theories clearly show that the flow of time, as measured by the tick rate of clocks, is influenced by external effects, as opposed to Newton's fixed flow which is not influenced by anything external. These relativity theories use Newton's mathematical time, a clock-generated sequence of numbers, in all reference frames. Due to the constant speed of light, Einstein's tick rate of clocks at which mathematical time flows depends on external influences: relative speed and gravitational intensity, as observed in other "stationary reference frames". Minkowski[12] introduced a 4-dimensional construct, called space-time, where each point in space-time is constructed from "configuration space and mathematical time," where mathematical time is brought into alignment with the units of configuration space by multiplying by the speed of light. Space-time is looked upon as an address of events.

It will be argued that there is a fundamental change in the tick rate of clocks in all reference frames depending on where the reference frame and clock are located in the universe. This fundamental tick rate of clocks is dependent on external influences. The dilation of time described by relativity is superimposed on the fundamental rate. This fundamental rate does not alter the relativistic dilation of time each of the observer's measures, as the observers reunite. On the other hand, if the clock readings of each observer are communicated while at different locations then an error in calculations will be introduced. When the two reference frames are reunited the fundamental rate of time becomes the same and leaves no trace that it has been different, although the integrated time on the traveler's clock could indicate a difference.

2.1 New implementation of time

Most conscious beings "sense time" as the present moment, the NOW, as the flow of time, and recognize past time as memories that can be remembered but not relived, and thus cannot be changed. Furthermore, future time does not exist, it's only expectations of what might be. It is generally recognized that space and time are totally different properties of Nature; objects can stand still in space but not in time, or objects can move about at will in space but not in time. To implement the new time, we will construct it in its own "space" called time-space which is independent of configuration space and not linked with any other space. All properties of time are properties of time-space. Time-space can be used by configuration space but cannot use any properties of configuration space, because it only has one unit, "second". Configuration space has compound units that use seconds, such as meter per second, but time-space cannot accommodate compound units.

It is necessary to define time-space as having two dimensions. In physics, as we know it, clock time is one-dimensional and

has the units of a second. Higher-dimensional time-spaces have been studied, Bar[13] called it 2T physics, for two-dimensional time, Weinstein[14], studied higher dimensioned time spaces, and Popov[15] logically tested two-dimensional time. In higher dimensions, it is natural to assume there would be two or more different units of seconds; if so, it would allow the flow rate of time, that Newton introduced, to be measured directly, but as will be shown, multiple units of time, i.e., multiple different seconds, are not necessary.

In the implementation developed here, time-space requires two dimensions, but the physics of time in that space is one-dimensional requiring only one unit, the second, and other units that can be defined only by the second, such as frequency $second^{-1}$, as well as unitless constants. The NOW is an abstract entity. Abstract quantities, that can not be directly measured[16], such as fields can interact and influence time-space, for example, time-space can interact with bright objects. The NOW is defined as a circle in a two-dimensional time-space, hereafter called the time-circle. The radius of the time-circle is defined as the reciprocal of an angular frequency, i.e., ω^{-1}, so the circumference C of the time-circle has units of $second$ and is given by

$$C = 2\pi\frac{1}{\omega} = \frac{1}{\nu}. \tag{1}$$

On the circumference of the time-circle, we further imagine a point traveling continually around the circle, never beginning, never-ending, and independent of measurements. For discussion purposes, the point circulating on the time-circle will be called a "Chronon" and a complete circuit of the Chronon is one period τ from some arbitrary start point, which sets the boundary condition for a time in calculations. This is analogous to setting the clock in mathematical time to zero at the beginning of a calculation. When a time-circle is imagined at the beginning of a theory or observation since all points on the time circle are equally valid thus it makes no difference where the Chronon is imagined to be at the start of a calculation, however, that point defines the beginning and end of the period τ, throughout the remainder of the calculation.

The time-circle period τ is the minimum present moment, of the NOW. The rate that the Chronon moves along the circumference is a constant and is not influenced by anything external, as Newton thought for the flow rate of time. The Chronon, however, is not the flow rate of time. The rate of the Chronon is forever a constant and can not be measured, because the NOW is an abstract quantity. This is consistent with Einstein's concept, he was bothered by the NOW, as described by philosopher Rudolf Carnap[17]

> Einstein said the problem of the NOW worried him seriously. He explained that the experience of the NOW means something special for man, something essentially different from the past and the future but that this important difference does not and cannot occur within physics. That this experience cannot be grasped by science seemed to him a matter of painful but inevitable resignation. So he concluded "that there is something essential about the NOW which is just outside the realm of science.

To further paraphrase Einstein, "there exists for individuals an I-time or subjective time, this in itself is not measurable." The imagined I-time and the NOW developed here are the same in that they are not measurable[18]. The only measurable is the complete rotation of the Chronon on the time-circle, the period τ, and that links to mathematical time by controlling the fundamental tick rate of local clocks.

To clarify how I think of the NOW, two examples help.

Example 1: Imagine two people are communicating on the telephone. When the conversation begins the point on their respective time-circles, wherever the Chronon happens to be, defines the start and endpoint of the NOW period τ for each person, The NOW is then defined, and both parties acquire memories of the conversation. The NOW continues as long as the conversation continues, and if the two in communication are very far apart, the delays due to the speed of light are also in effect. When the conversation ends the NOW continues until the Chronon reaches the endpoint of its present period, then the entire conversation becomes past memories for both parties.

Example 2: NOW "recording" events that do not involve conscious beings. Imagine a comet impacting the earth, the "Earth's NOW" begins upon impact and continues uninterrupted as long as the debre of the collision continues to settle on the Earth. Years later conscious beings discover in the geologic record a thin layer of Iridium and notice no dinosaur fossils above the layer, thus providing evidence for the extinction of the dinosaurs. Past memory need not be conscious beings memory but ultimately will reside and influence conscious beings memory. Furthermore, a NOW, being an abstraction, can be associated with any physical entity, in this case, the entire Earth.

The NOW can be any length; however, the NOW can never be less than one period τ, since the Chronon position on the time-circle is not measurable, i.e., a fraction of a NOW period is not measurable. Therefore, there is a fundamental minimum of time that we called a Chronon period which is dependent on external effects, as will be shown below.

Newton thought the flow rate of time, here called ζ, is a fixed constant, he had no reason to believe otherwise. In this implementation the rate of time is dependent on a frequency, ω, since on the time-circle the Chronon moves at a constant rate, thus the period τ depends on the size of the time-circle. The question becomes, what frequency controls the time-circle? Nature has an infinite variety of frequencies, but all are intimately related to compound quantities in space-time, such as the speed of light, and momentum and, energy, they are not part of time-space.

There is one frequency in Nature that is removed from space-time quantities, it is the number of photon quanta, a unitless number, that flow from bright objects and has a unique frequency for each bright source. The number of photons is a multi-valued function of frequency, however, there is one point, or frequency, at which the number of photons is unique, that is the peak frequency of the Spectral Energy Distribution (SED), at a given temperature. Therefore, we argue, that the peak frequency of the SED determines the local flow rate, by changing the time duration of the circumference of the time-circle, measured in seconds. Since the rate of the Chronon is constant the period of the NOW changes, as a time-circle is bathed in the light of bright sources. In this implementation, the rate of the flow of time on Earth depends upon the SED for the surface temperature of the Sun. On Earth, the peak frequency of the SED of the Sun is 3.498×10^{14} Hz and the minimum physical period is 2.943×10^{-15} seconds.

It is not necessary to know the time rate on Earth, we can arbitrarily set it to *one* because all observations and experiments, and physical theories, are developed on earth and have a constant fundamental flow of time. However, when observing distant, or cosmological effects, the flow rate of time needs to be transformed to where the observations are being considered. To obtain this transformation consider the minimum measurable time which is the NOW's period. This will be taken as the smallest interval of time that is physically possible. Therefore on Earth any differential $dt_\odot$ can not be smaller than one NOW's period, and so $dt_\odot = \tau_\odot$. To understand how this is used consider a derivative with respect to time, or integral over time, they must be transformed to the location of interest, where the local NOW is located. Also in physical theories, the limit from $dt \to 0$ must be changed to $dt \to \tau$. Further, the time differential at different locations will be given by

$$dt = dt_\odot \frac{\tau}{\tau_\odot} \tag{2}$$

Where τ is the period of the NOW at the distant location of interest. The flow rate of time, ζ at the different locations, is referenced to Earth's fixed flow

$$\zeta = \frac{\nu}{\nu_\odot}. \tag{3}$$

Where $\nu = \tau^{-1}$ and is the peak frequency of a SED at the location under study and referenced to the SED peak frequency of the Sun. To determine the minimum duration τ at another location the circumference of the time-circle (1) is involved

$$\zeta \times \tau = C = \frac{1}{\nu}, \tag{4}$$

so that

$$\tau = \frac{\nu_\odot}{\nu^2}. \tag{5}$$

Then the transformation period τ becomes

$$\xi = \frac{\tau}{\tau_\odot} = (\frac{\nu_\odot}{\nu})^2. \tag{6}$$

When transforming derivatives with respect to time, the transformation is as follows

$$\frac{df}{dt} = \frac{df}{dt_\odot \xi} = \frac{df}{dt_\odot (\frac{\tau}{\tau_\odot})} = \frac{df}{dt_\odot} (\frac{\nu}{\nu_\odot})^2 \tag{7}$$

However, as discussed above, all physics is developed on Earth. Therefore, multiplying the transformation (6) to the time differentials effectively translates the time flow rate on Earth to the flow rate at the locations where the action is taking place. When the observed action occurs on Earth, $\xi = 1$ as can be seen from (6).

To clarify where the time circle is located in configuration space, for example, if we are measuring, or theorizing about the quarks inside a proton then the time circle is located in the proton. On the other hand, if our focus is on the rotation of galaxies the time circle is near the orbiting stars. Like the imagined multitude of clocks strung along the world line in SR and GR, the time-circle can be imagined wherever our work or our thoughts take us. Most importantly it is not a global NOW, it can be local to every point in configuration space. In time-space, NOW is the time duration that moves clocks, and is the proper time that defines Minkowski's space-time.

2.2 Locating a time-circle in space

To inquire about some time-circle at a specific distant location requires a theoretical model. The model provides the user a means to determine the brightness that affects the NOW. The NOW does not require the model, it simply responds to the brightness. The model uses astronomical magnitude calculations. If we use the model to obtain the brightness seen by a NOW at some given point in space, we use a distance, in configuration space, to determine the apparent magnitude at the location of the NOW, m_t so that

$$m_t = -2.5 Log_{10}(\frac{L_g}{4\pi d_g^2}) + constant, \tag{8}$$

Here L_g is the luminosity of that bright source, and the distance d_g is from the bright source to the NOW. In theory, the fundamental flow rate can be determined for any location in space-time. To do this the astronomical apparent magnitudes are employed, the magnitude m at the point of interest is given by the sum over all bright objects in the universe

$$m = -2.5 Log_{10}(\sum_i^\infty 10^{-0.4(m_i)}), \tag{9}$$

which generally will reduce to one or a few terms, in practice we choose a few of the closest bright objects. To get the apparent magnitude m_i for each source, they are compared to the apparent magnitude of the Sun

$$m_i - m_\odot = -2.5 Log_{10}(\frac{L_i}{L_\odot}(\frac{d_\odot}{d_i})^2). \tag{10}$$

Where L_i is the luminosity of the i^{th} distant bright object and d_i is the distance from the i^{th} bright object to the NOW of

interest. Then the magnitude m in (9), determines the peak frequency of the effective SED and thus the flow of time at that location. To get the result, the point of interest is compared to the Sun, the effective luminosity of the bright object affecting the NOW is determined

$$m - m_{\odot} = -2.5Log_{10}(\frac{L}{L_{\odot}}(\frac{d_{\odot}}{d})^2). \tag{11}$$

The distance $d_{\odot}$ is the distance from the Earth to the Sun, and d is the distance from the Earth to the location of the NOW, i.e., the luminosity that determines the rate of time is then given by

$$L = L_{\odot}(\frac{d}{d_{\odot}})^2 10^{-0.4(m-m_{\odot})}. \tag{12}$$

Then the temperature T of the effective SED represented by m is

$$L = 4\pi r_s^2 \sigma T^4. \tag{13}$$

Where the radius rs is the effective radius of a sphere that encloses the bright object, and σ is the Stefan-Boltzmann constant. The peak frequency of a SED is linearly proportional to the SED effective temperature, $\nu_{peak} = \kappa T$, where $\kappa = 5.8802 \times 10^{10} Hz/^{\circ}K$ so the transformation factor, (6) can be written in terms of temperature.

3 Galaxy rotation

Andromeda, our closest galactic neighbor, will be used as a demonstration of the effect of the NOW's impact on cosmological measurements. To study galactic rotation, we use de Vaucouleur's[19] photometry measurements of the B surface brightness along the semi-major axis of Andromeda and Rubin's[20] study of Andromeda's rotation velocities as a function of star distance from the center of the galaxy. These are given in Table 1, where columns 1 and 2 are from de Vaucouleurs table 5, and column 3 is Rubin's rotational velocity.

Table 1. Andromeda measured data.

R Kpc	σ_L $L_{\odot}/SAS$	V_{rot} km/sec
1	2	3
2.75	1360	196.3
5.5	615	248.8
8.25	530	264.5
11.0	270	261.1
16.5	70	239.2
22.0	20	228.0
27.5	5.5	230.0
30.0	− − −	230.0

3.1 Table 1 Title

De Vaucouleurs Position along the semi-major axis in kpc given in column1 and column 2 the brightness. Rubins rotational velocity in column 3.

We take the nuclear region as extending from the center to $8kpc$, and take the disk region to extend from $8kpc$ to $30kpc$. These boundary conditions for the start and end of the disk are determined by the peak velocity, in the fit to measured rotation data, seen in figure 2, and the limit of visible matter, about $30kpc$. This demonstration will be limited to the disk region since this disk region is where the gravitational predictions are expected to be the most pronounced. Rubin's disk region, ending at $27.5kpc$, is extended to $30Kpc$, using measurements by (Roberts, Whitehurst)[21], to prevent the polynomial fit of Rubin's rotation velocity V_{rot} data from diverging prematurely.

To apply this NOW theory to the galaxy rotation, a transformation factor, discussed in section 2, is applied to rotational V_{rot}. De Vaucouleurs measured the B surface brightness in each squared arcseconds (SAS) region along the semi-major axis, as a function of the distance from the galactic center in kpc, these are given in Table 1 columns 1 and 2 and expressed in units of solar units per SAS. Each unit's contribution to the luminosity is from the stars within the boundary of the SAS unit. The empty space in the unit contributes nothing to the luminosity, however, does contribute to the densities. To account for the space between stars in the SAS, the SAS is converted to pc^2. De Vaucourleurs provides the mass density in both SAS and pc^2. The mass densities σ_M and σ'_M given by De Vaucouleurs and included in Table 2 for both SAS and pc^2.

Thus it can be argued, that the ratio of the mass density accounts for the empty space in each unit. Therefore, the brightness conversion in Table 3 accounts for the empty space in the density calculations but contributes nothing to the luminosity. The conversion factor was obtained from (de Vaucouleurs[19], table 5 using columns 2, 3, 5, and 6) and shown in the first four columns in Table 2. The result, when averaged over all isophotes, given in column 5, yields the conversion, $9.24 \pm 0.48\ pc^2/SAS$. This I will argue distinguishes between the mass of the physical stars and the empty space in each SAS.

Table 2. Conversion of $SAS\ to\ pc^2$.

R Kpc	σ_M $M_{\odot}/SAS$	σ'_M $M_{\odot}/pc^2$	b/a	$b/a \times \sigma_M/\sigma'_M$ pc^2/SAS
1	2	3	4	5
2.75	19800.	982	0.46	9.27
5.5	13700.	492	0.34	9.33
8.25	9750.	248	0.26	10.02
11.0	4650.	130	0.26	9.30
16.5	2320.	77.1	0.29	10.19
22.0	1390.	44	0.30	9.32
27.5	700	29	0.30	7.24

3.2 Tables 2 Title

$kpc\,position, mass\,density\,per\,SAS,\ mass\,density\,per\,pc^2$ and ratio of minor to major axis, given in columns, 1,2,3,4 repectively, in column 5 he conversion pc^2/SAS.

Rubin[20] indicates a typical Strömgren sphere[22] in Andromeda, which is the spherical influence of a star, appears to be several seconds of arc in diameter. The temperature of the star is obtained from (13). with the radius of the Strömgren taken to be $r_s = 1.5pc$ as suggested by Rubin.

Luminosity and temperature from Photoelectric Photometry measurements of Andromeda Galaxy is obtained from de Vaucouleurs's, Table 5, and given in Table 3 in columns 1 and 2. These are the basic brightness data measured along the semi-major axes from the center of the galaxy. The luminosity and the transforming factor are in columns 3 and 4 respectively. Measured rotation velocity, V_{rot}, in column 3, in Table 1, is from Rubin's table 1, and the time flow corrected rotation velocity, U_{rot} is given in column 5 of Table 3. The entries for V_{rot} and U_{rot}, were obtained as discussed in the text.

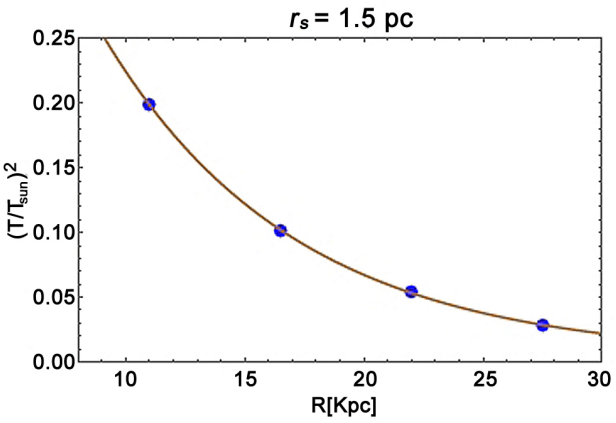

Figure 1. The transformation factor vs distance from the canter in Kpc

3.3 Figure 1

The transformation factor is given in Table 3 column 4 for each measured value. The disk portion of Andromeda is fit to an exponential $0.0035 + 0.7665e^{-0.1243R}$ which is utilized in converting Rubin's rotation velocities.

3.4 Tables 3 Title

$Kpc, Brightness/pc^2, Luminosity, transformation factor$, in columns, 1, 2, 3, 4, repectively. Column 5 transformed rotation velosities in Km/sec.

3.5 Figure 2

The black points are Rubins measured rotational velocities, and the open data points are the extension to the measured data

Table 3. Conversion of Rotation velocity.

R Kpc	σ_{L_{odot}/pc^2} $L_\odot/pc^2$	$Lum(10^{38})$ $watt$	$(T_\star/T_\odot)^2$	U_{rot} Km/sec
1	2	3	4	5
2.75	147.2	221.1	0.548	107.6
5.5	66.6	99.9	0.390	97.0
8.25	57.2	86.2	0.278	73.5
11.0	29.2	43.9	0.199	52.0
16.5	7.60	11.4	0.102	24.4
22.0	2.20	3.3	0.053	12.1
27.5	0.60	0.9	0.029	6.67
30.0	0.60	− − −	0.022	5.06

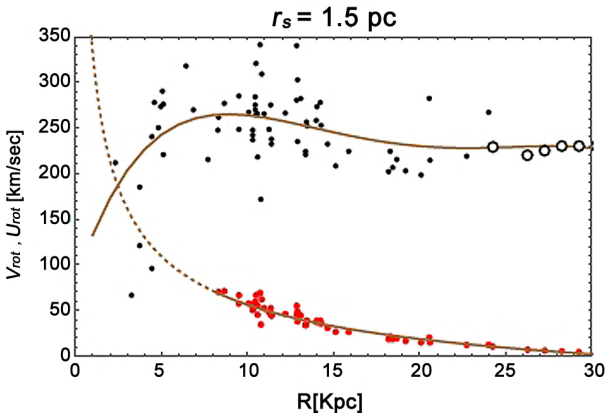

Figure 2. Measured V_{rot} Black, NOW corrected U_{rot}, Red.

as described in the text. The Red points are the transformed point using the exponential fit given in Figure 1.

The resulting calculations are given in Table 3, column 5, and shown in Figure 2 where the NOW corrected rotation velocities U_{rot} for the disk region are shown in red. The best fit to the NOW corrected rotation velocity is

$$U(r) = \frac{404.85}{\sqrt{r}} + constant. \tag{14}$$

The constant being -72.08 km/sec. The red points, in Figure 2 clearly show the correct gravitational behavior, and the magnitude of the corrected rotation velocities is determined by the value of r_s the Strömgren radius.

The black dots are the directly measured rotation velocity from Rubin's Table 1, and the open black circles are extended points discussed in the text. A 6th order polynomial makes the best fit to the measured data. The red dots are the point-for-point transformed rotation velocity as described in the text. The brown curves are the best fit for each population. As can be seen, the fitting function has the expected gravitational dependence $404.85/\sqrt{r} + constant$, where the constant is -72.08 km/sec.

3.6 Mass of Andromeda

The mass of Andromeda can be estimated from the corrected velocities given in Table 3. The nucleus is assumed to extend from the galaxy center to $8.25kpc$, where the fit to the measured points, black points, go through a maximum. The galaxy disk starts at the peak value, extending from $8.25kpc$ to $30.kpc$. The average nuclear-corrected rotation velocity is $\langle U_N \rangle = 92.7km/sec$ and average location in kpc located at $\langle r_N \rangle = 5.50kpc$. The average disk-corrected rotation velocity is $\langle U_D \rangle = 28.95km/sec$ and the average location at $\langle r_D \rangle = 19.21kpc$.

The mass of the nucleus is

$$M_N = \frac{\langle U_N \times 10^3 \rangle^2 (5.0 \times 3.08 \times 10^{19})}{2 \times 6.67 \times 10^{-11} \times 1.989 \times 10^{30}} = 5.49 \times 10^9 M_\odot \tag{15}$$

and the mass of the disk is

$$M_D = \frac{\langle U_D \times 10^3 \rangle^2 (19.2 \times 3.08 \times 10^{19})}{2 \times 6.67 \times 10^{-11} \times 1.989 \times 10^{30}} = 1.87 \times 10^9 M_\odot \tag{16}$$

The total mass of Andromeda is $M_{M31} = 7.36 \times 10^9 M_\odot$ with only visible matter, its value depends on the Strömgren radius that was adopted, from Rubin's[20] observation. Better measurements of the Strömgren will alter the galactic mass. The published estimate of Andromeda mass, including dark matter, is about $4. \times 10^{11} M_\odot$.

4 Discussion

In this paper we have introduced a new implementation of time that is closer to what conscious beings experience. This time is predicated on the present moment called the NOW, which then uses the Andromeda galaxy to demonstrate that galaxies rotate as expected from established gravitation theories. This, envisioned NOW, controls the flow of time, which Newton thought to be a constant in the universe, not influenced by anything external.

The time that Newton envisioned is a mathematical time, actually, a mathematical parameter that tracks the movements of objects in space and is measured with clocks. Einstein's Relativity theories use mathematical time in all reference frames, he did not believe the NOW could be part of physics, but he found that time flow, as a measure of the tick rate of clocks, did depend on external things, kinematics, and gravitational intensity. He accepted space-time, a construction of configuration space and mathematical time, introduced by Minkowski[12], which uses the speed of light to convert the time unit to space units.

The confusion between space and time can be minimized by introducing a new space, called time-space, which has only one unit, the second. The time-space controls the flow of time that is independent of observers, kinematics, and gravitation. The reason for this construction is the almost universal acceptance that space and time are independent properties of Nature. All known evidence suggests that we can move at will through space and revisit any point, whereas we can not move at will through time, and revisit any event, past or future, at least in the material universe described by physics. Put another way we can stand still in space but not in time. Einstein thought that the human conceived time, which he called I-time, is generated in the brain and not in the "real world". This paper looks upon this brain's sense of time as a clue to physical reality. Further, Nature offers us yet another clue, the evolution of the vision of land animals, seeing in the part of the electromagnetic spectrum we call visible light, that happens to be at the peak frequency of the SED of the Sun.

It can be argued that with the implementation of space-time one cannot revisit any point in space-time, a return to some previously visited point in configuration space does not have the same "address" since time continues to flow. Even in space-time, the flow of time is critical. The flow of time, independent of observers and compound units, has never been determined. it is argued that the flow of time is relative which eliminates the need to know the actual flow. We simply set the flow of time on Earth to a constant equal to unity, and defined the flow of time, at other places in the universe, relative to the flow on Earth. The NOW is further envisioned to be a local time and sets the fundamental rate at which clocks tick, and can be thought of as the time part of space-time. Thus space-time can be constructed as (configuration-space) and (time-space), as opposed to (configuration-space) and (mathematical-time). Furthermore, If another conscious being on some distant planet orbiting a distant star were to develop physical theories, and apply them cosmologically they will have to reference the temperature measured at the distant location to their star's temperature. This suggests that corrections might be needed in the Seti program for the search for intelligent life.

The NOW is envisioned in a 2-dimensional time-space but, only has one unit, the second, and any other quantity that can be constructed by the second alone, such as frequency. The NOW is envisioned as a "circle" in a 2-D time-space called a time-circle. The circumference of the time-circle has a measure of second and its radius is a frequency.

Further, since physics and philosophy believe that time and motion are explicitly connected, the time circle has its own motion, a point that moves on the "circumference" of the time circle, called a Chronon. The NOW is an abstract quantity; as Einstein thought personal time to be, he called it I-time. Therefore, the motion of the Chronon can not be measured, only one full period of the Chronon influences the tick of clocks. Since all points on a circle are equivalent by symmetry the start point is also the endpoint that defines the period is arbitrary but once selected must be adhered to during any explicit use of the NOW.

Since time-space is an abstract construction, it is reasonable that all abstract constructions can influence the NOW time. Maxwell's electric and magnetic fields, for example, became more accessible when the mechanical ether, he envisioned, was abandoned and the fields were thought of as abstract quantities[16]. Maxwell's abstract fields are not themselves measurable, only when combined among themselves or with other quantities do they participate in measurable physics. Time-space has similar qualities in the sense that it is abstract and outside of physics but produces real physical effects when Newton's concept of a fixed flow rate of time is abandoned, as demonstrated with galactic rotation.

5 Conclusion

Thus we conclude the mathematical-time Newton defined as the time part of the foundation of Physics, although works well locally, fails on the cosmological scale. He introduced the concept of the flow of time, thought it to be a universal constant independent of all external influences, and never addressed it further. Einstein found that the constant speed of light introduced an external influence on the flow of time, i.e., the rate at which clocks tick, but remained with mathematical time because he could not see how the NOW could fit into Physics. We find that introducing the NOW, as a local property of time, and relaxing the constant, universal flow of time, brings cosmological measurements in line with gravitation theories. The Andromeda galaxy rotation is used to demonstrate the effect the NOW and the flow of time has on cosmological measurements. This demonstration suggests, that if dark matter exists, it must be determined by effects other than, the high-speed rotation of galaxies, which is its primary evidence. The dependence of the flow rate of time on the peak frequency of light from SED, suggests a way to falsify this theory. With intense artificial light, perhaps, using a laser, the modulation of the time circle and its impact on a physical experiment could determine if this theory is valid, or not valid. In some respects, experiments of this kind have already been done, Parkhomov[23,24] using a specially designed telescope scans the sky, and shows changes in nuclear decay count rates when light from stars passes over the radioactive sample at the focus of the telescope.

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