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Theories Affected by Time Flow

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Abstract The purpose of this paper is to investigate the impact of the NOW theory of time, introduced by Longo, titled: "The NOW of time and how it impacts physics." If found to be valid, it alters all aspects of physical theories because of the foundation of time, as defined by Newton. First, we start with Electrodynamics because it is the primary theory critical to Astronomy, Astrophysics, and Cosmology for the study of the universe. In this paper, it is found that when the NOW of time is applied, the speed of light is not a universal constant throughout the entire universe but is dependent on local brightness that varies throughout the universe. Next, we show that Quantum Mechanics is altered. This alters Redshift calculations and interpretations. It is the next theory in line of importance due to the theories of atomic structure and its connection with a redshift that allows the dynamics of cosmological objects to be studied. We find that atoms radiate at different frequencies in distant locations than they do on earth. This provides a possible interpretation other than the usual Doppler effect. Furthermore, it alters the scale when considering the expansion of space. Finally, it also alters Special and General Relativity primarily due to the alteration of the speed of light. Thus, we conclude that Newton's foundation of physics needs to be revisited.

Keywords Effect of NOW, Electrodynamics, Quantum Mechanics, Special, General Relativities, RedShift

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1 Introduction

Our present understanding of the material universe is obtained by building models using the main theories: Newtonian classical theory [1], Electrodynamics (ED)[2,3,4], Quantum Mechanics (QM)[5], and Special (SR) and General (GR) Relativity[6,7]. These theories are well established and experimentally verified locally in the solar system. All these theories are built on the foundation of space and time defined by Newton, who thought that space is an empty void within which all activities reside. He thought that time, which he called mathematical time, flowed at a constant rate throughout the universe and was independent of all external influences. Einstein's SR and GR introduced the universal constant speed of light and found that the mathematical time of Newton, measured by clocks, depended on kinematics and gravitational intensity experienced and witnessed by observers in other reference frames. Using these theories in cosmology at large distances from the solar system produces concepts that, in some cases, do not fit well with the theories used. In a recent paper[8], it was suggested that time, part of the foundation of our physics, defined by Newton, may be the problem and offered a solution to dark matter. Another unexplained phenomenon is the rhythmic behavior of radio active decay[9] and a suggested solution[10] is that the definition of space defined by Newton as the foundation of physics may also need to be revisited.

Einstein found that Newton's mathematical time was modified due to the speed of light, assuming it to be a universal constant for all observers. He was unable to reconcile the NOW, the present moment, into physics. In a recent work[8] it was found that the NOW can be included in physics and was demonstrated, using the Andromeda galaxy, by showing the flat rotation curve is not real; thus, the need for dark matter becomes questionable. That work suggests that the flow of time, determined by the NOW, is a needed change to the foundation of physics. This short paper, except the premise of the NOW time theory[8], assumes it to be correct, then studies how it modifies all the main theories [1,2,3,4,5,6,7]. These modifications will modify measured results of the cosmos and, therefore, the conclusions of how the universe behaves.

This paper first looks at Maxwell's electrodynamic equations in section 2.1, since all information from distant locations depends on information propagation and involves the speed of light. Section 2.2 Schrodinger's equation of quantum mechanics is shown to be modified by the NOW, which modifies the energy of atomic elements, which in the present paradigm are thought to be immutable. Section 2.3 looks at the redshifts produced by atomic elements. Section 2.4 and Section 2.5 look at the effect of SR and GR, respectively, which are modified due to the speed of light. Section 2.6 looks at the cosmological redshift and the expansion of space. Section 3 provides our conclusions.

2 Implemention

The NOW theory[8] affects the flow of time by affecting the minimum physical time that can exist; thus, changes are made through the differentials of time $dt_\odot$, the subscript $\odot$ denotes quantities measured in the solar system, and subscripts denoted by $\star$ are quantities at distant locations. These subscript designations are not needed when physics is applied locally, because the flow of time is constant in the reference frame of the solar system. When observations are made on other stars and galaxies, the flow of time is not the same as it is in the solar system, so the measurements must be transformed to the distant location as discussed in[8]. Theories that are commonly used in astronomical, astrophysical, and cosmological observations are described in the following subsections.

2.1 Classical Electrodynamics

Consider Maxwell's equation in free space.

$$\nabla \cdot \boldsymbol{E} = 0 \tag{1}$$

$$\nabla \cdot \boldsymbol{H} = 0 \tag{2}$$

$$\nabla \times \boldsymbol{E} = -\mu_0 \frac{\partial \boldsymbol{H}}{\partial t} \tag{3}$$

$$\nabla \times \boldsymbol{H} = \epsilon_0 \frac{\partial \boldsymbol{E}}{\partial t} \tag{4}$$

Both Faraday's law and Ampere's law involve time derivatives. Therefore according to[8] the flow of time will influence them. The two equations which have derivatives with respect to time are affected by the NOW. These equations are transformed to the distant location and given by

$$\nabla \cdot \boldsymbol{E} = 0 \tag{5}$$

$$\nabla \cdot \boldsymbol{H} = 0 \tag{6}$$

$$\nabla \times \boldsymbol{E} = -\mu_0 \frac{\partial \boldsymbol{H}}{\partial t} (\frac{T_\star}{T_\odot})^2 \tag{7}$$

$$\nabla \times \boldsymbol{H} = \epsilon_0 \frac{\partial \boldsymbol{E}}{\partial t} (\frac{T_\star}{T_\odot})^2 \tag{8}$$

If the fields $\boldsymbol{E}$ and $\boldsymbol{H}$ are assumed to be abstract quantities as discussed in[4]. Once the fields are established by the differential equation they can not be altered until they undergo another interaction, i.e., $\boldsymbol{E}$ and $\boldsymbol{H}$ can not be measured until they are brought into the measurable universe by combining them in some way, such as $\boldsymbol{E}^2$ to determine energy. The transformation being part of the measurable universe can only be applied to physically measurable quantities. Therefore, the transformations are applied to the physical constants ϵ_0 and μ_0, in Eq 7 and Eq 8, not the fields. Therefore, we get

$$\epsilon_{0\star} \Rightarrow \epsilon_{0\odot} (\frac{T_\star}{T_\odot})^2 \tag{9}$$

$$\mu_{0\star} \Rightarrow \mu_{0\odot} (\frac{T_\star}{T_\odot})^2. \tag{10}$$

It then follows that the speed of light at the distant location $c_\star$ is modified from the value measured in the solar system

$$c_\star = \frac{1}{\sqrt{\epsilon_{0\odot}\mu_{0\odot}(\frac{T_\star}{T_\odot})^4}} \tag{11}$$

$$c_\star = c_\odot (\frac{T_\odot}{T_\star})^2. \tag{12}$$

With the introduction of the NOW of time, the speed of light is not a universal constant. It depends on the local flow of time and can change continuously along the timeline in space-time, depending on the universal brightness that exists at each point.

2.2 Quantum Mechanics and the Energy of Atomic Elements

The wave function in Schrodinger's equation[5] is time-dependent and given by

$$H\Psi(\boldsymbol{x}, t_\odot) = i\hbar \frac{\partial \Psi(\boldsymbol{x}, t_\odot)}{\partial t_\odot}. \tag{13}$$

Where H is the Hamiltonian of the system and $\Psi(\boldsymbol{x}, t_\odot)$ is the wavefunction as function of space vectors $\boldsymbol{x}$ and mathematical time $t_\odot$, and $\hbar = h/2\pi$ is the reduced Planck constant.
The time dependence can be removed by defining $\Psi(\boldsymbol{x}, t_\odot) = \phi(\boldsymbol{x})\psi(t_\odot)$
Then EQ 13 becomes two equations

$$H\phi(\boldsymbol{x}) = E_\odot \phi(\boldsymbol{x}) \tag{14}$$

$$i\hbar \frac{\partial \psi(t_\odot)}{\partial t_\odot} = E_\odot \psi(t_\odot) \tag{15}$$

When an atomic system at a distant location is observed, the time derivative is transformed to the location yielding

$$\frac{\partial \psi(t_\odot)}{\partial t_\star} \Rightarrow \frac{\partial \psi(t_\odot)}{\partial t_\odot} (\frac{T_\star)}{T_\odot})^2 \tag{16}$$

As noted above since the wave function is a probability amplitude field, it is an abstract quantity[4,10] the transformation must be applied to measurable quantities therefore, the energy is transformed. The energy levels of atomic elements[5,11] at the distant location are

$$E_{\star,n} = E_{\odot,n} (\frac{T_\star}{T_\odot})^2 = -\frac{\mu \, {Z_n}^2 e^4}{2\,\hbar^2 n^2} (\frac{T_\star}{T_\odot})^2 \tag{17}$$

Where μ is the reduced mass.

2.3 RedSift due to Atomic Elements

A redShift is an important tool for studying the universe. If the quantum energy levels are different at distant locations, the RedShift will also be different. When spectral lines are observed and measured, the observed frequency or wavelength is evaluated against the emission of the line observed on Earth, which is usually called the rest-frame frequency or wavelength. This interprets everything as Doppler, and other possible measurable effects will be missed. This works okay, when measuring known Doppler effects but will miss possible discordant effects. The NOW theory[8] provides a means to distinguish possible discordant effects from Doppler effects.

Suppose, momentarily, the expansion of space is neglected, see Section 2.6 for space expansion discussion, then the light emitted at a distant location will reach the detector on Earth, assumed without modification. The observed frequency $\nu_{\odot\ obs}$ is really the emitted frequency $\nu_\star$ at the distant location and is compared to the emission of the same emission line measured on Earth.
The transition from state m to state n using Eq 17 is

$$E_{\star,m,n} = -\frac{\mu\, {Z_n}^2 e^4}{2\,\hbar^2}(\frac{1}{m^2} - \frac{1}{n^2})(\frac{T_\star}{T_\odot})^2, \tag{18}$$

and the frequency of the emitted photon at the distant location is

$$\nu_{\star,m,n} = \frac{E_{\star,m,n}}{\hbar}. \tag{19}$$

Therefore, the redshift z for the spectral line from $m\ to\ n$ is

$$z = \frac{\nu_{\star,m,n} - \nu_{\odot\ obs}}{\nu_{\odot\ obs}}, \tag{20}$$

and $\nu_{\odot\ obs}$ is the frequency of the same spectral emission line on Earth, this gives

$$z + 1 = \frac{\nu_{\star,m,n}}{\nu_{\odot,m,n}} \tag{21}$$

The emission frequencies must be at the location where the action is taking place. Therefore, the emission frequency is at a distant location, but the observed frequency is measured on Earth, so it is not transformed. From Eq 18 and Eq 19, the emission frequency for a particular emission line is

$$\nu_{\star\ emit} = \frac{E_\star}{h}(\frac{T_\star}{T_\odot})^2 \tag{22}$$

Therefore, an identified emission line is the reciprocal of the transformation factor

$$z + 1 = (\frac{T_\star}{T_\odot})^2. \tag{23}$$

The redshift can be independently measured if a series of the spectral lines are observed, or the line can be identified, then Eq 23 would provide the transformation factor and the effective local temperature. If the Doppler effect also applies, then the transformation factor can not be directly obtained without knowing the relative velocity

$$z + 1 = (\frac{T_\star}{T_\odot})^2.\sqrt{(1 + v_\parallel/c)(1 - v_\parallel/c)}. \tag{24}$$

2.4 Special Relativity

The NOW will affect the Lorentz equation[7] in Special relativity and General relativity since relative velocity and the speed of light are involved in both. In Special relativity, the gamma factor becomes

$$\gamma_\star = \frac{1}{\sqrt{1 - \frac{v_\odot^2}{c_\odot^2}(\frac{T_\star}{T_\odot})^4}} \tag{25}$$

Where the velocity $v_\odot$ is measured from Earth but is physically occurring at a distant location. The Lorentz transformations viewed near a distant star become

$$X_\star = \frac{1}{\sqrt{1 - \frac{v_\odot^2}{c_\odot^2}(\frac{T_\star}{T_\odot})^4}}(X_\odot - v_\odot(\frac{T_\star}{T_\odot})^2 t_\odot) \tag{26}$$

$$t_\star = \frac{1}{\sqrt{1 - \frac{v_\odot^2}{c_\odot^2}(\frac{T_\star}{T_\odot})^4}}(t_\odot - \frac{X_\odot v_\odot}{(c_\odot)^2}(\frac{T_\star}{T_\odot})^6). \tag{27}$$

Where $X_\odot$ is the space coordinate measured on Earth and $X_\star$ is at the distant location, similarly $t_\odot$ is Newton's mathematical time measured from the Sun's system, and $t_\star$ is Newton's mathematical time in the star's system.

2.5 General Relativity

The line element[7], when the speed of light is explicitly shown in the time term is unchanged at all distances. This happens because the correction to the speed of light comes from the permittivity and permeability, shown in section 2.1, which inverts the transformation for the speed of light. Furthermore, time used in general relativity is Newton's mathematical time measured by clocks, therefore,

$$ds^2 = g_{(r,r)}dr^2 + g_{(\theta,\theta)}d\theta^2 + g_(\phi,\phi)d\phi^2 + g_{(t,t)}{c_\odot}^2 {dt_\odot}^2(\frac{T_\odot}{T_\star})^8 \tag{28}$$

If the line element is written as the proper time $d\tau^2$ then the time flow is visible in the line element

$$d{\tau_\star}^2 = ({dt_\odot}^2 - \frac{g_{(r,r)}dr^2}{c_\odot^2} - (\frac{g_{(\theta,\theta)}d\theta^2}{c_\odot^2} + \frac{g_{(\phi,\phi)}d\phi^2}{c_\odot^2}))(\frac{T_\star}{T_\odot})^4. \tag{29}$$

Consider, for example the Schwarzschild solution

$$g_{(r,r)} = (1 - \frac{2GM}{rc_\odot^2}(\frac{T_\star}{T_\odot})^4)^{-1} \quad (30)$$

$$g_{(t,t)} = (1 - \frac{2GM}{rc_\odot^2}(\frac{T_\star}{T_\odot})^4) \quad (31)$$

$$g_{(\theta,\theta)} = \frac{r^2}{c_\odot^2}(\frac{T_\star}{T_\odot})^4 \quad (32)$$

$$g_{(\phi,\phi)} = \frac{r^2 sin^2(\theta)}{c_\odot^2}(\frac{T_\star}{T_\odot})^4. \quad (33)$$

The metric tensors are corrected for the speed of light.

2.6 Cosmological RedSift

To examine the expansion of space, the Robertson-Walker metric[10] is used

$$d\tau^2 = dt^2 - \frac{a^2}{c^2}(\frac{dr^2}{1-kr^2}). \quad (34)$$

Where a is the scale factor. The observer is at, $r = 0$ and at clock time $t = t_{now}$, observing the crest of light waves, emitted at $r = R$ and $t = t_{then}$. This calculation assumes the expansion is only along the radial direction, and for light $d\tau = 0$. To trace the wave crest, Integrating Eq 34 which yields[7]

$$0 = c^2 \int_{t_{then}}^{t_{now}} \frac{dt}{a} - \int_R^0 (\frac{dr^2}{1-kr^2}). \quad (35)$$

When the light was emitted

$$t = t_{then} + \frac{\lambda_{then}}{c_{then}} \quad (36)$$

and the next wave crest seen by the observer is

$$t = t_{now} + \frac{\lambda_{now}}{c_{now}} \quad (37)$$

$$0 = c^2 \int_{t_{then}+\frac{\lambda_{then}}{c_{then}}}^{t_{now}+\frac{\lambda_{now}}{c_{now}}} \frac{dt}{a} - \int_R^0 (\frac{dr^2}{1-kr^2}). \quad (38)$$

Combining Eq 35 and Eq 38 gives

$$\int_{t_{then}}^{t_{now}} \frac{dt}{a} = \int_{t_{then}+\frac{\lambda_{then}}{c_{then}}}^{t_{now}+\frac{\lambda_{now}}{c_{now}}} \frac{dt}{a}. \quad (39)$$

The result allowing for the correct speed of light gives

$$\frac{\lambda_{now}}{\lambda_{then}} = \frac{c_{now}}{c_{then}}\frac{a_{now}}{a_{then}}, \quad (40)$$

where

$$c_{now} = c_\odot(\frac{T_\odot}{T_{now}})^2, \quad (41)$$

and

$$c_{then} = c_\odot(\frac{T_\odot}{T_{then}})^2, \quad (42)$$

$$\frac{\lambda_{now}}{\lambda_{then}} = (\frac{T_{then}}{T_{now}})^2 \frac{a_{now}}{a_{then}}, \quad (43)$$

therefore

$$z + 1 = \frac{a_{now}}{a_{then}}(\frac{T_{then}}{T_{now}})^2. \quad (44)$$

3 Conclusions

This work determines how the NOW theory of time[5] will affect the main theories used in our effort to understand the universe. Any theory that contains time differentials or derivatives with respect to time is corrected to the location where they occur. The most important result is the removal of the speed of light from the status of a universal constant. It is dependent on the peak frequency of local brightness and thus shows to be dependent on the flow rate of time. Quantum Mechanics is also affected since the Schrodinger equation involves a derivative with respect to time. Furthermore, the wave function, like the electric and magnetic fields in Maxwell's equations, are abstract quantities; the correction factor does not affect them but affects mathematically measurable quantities, in this case, the quantum energy. These alterations affect the redshift, both due to atomic element observations and cosmological observations. Finally, the introduction of the NOW of time[5] alters all astronomical, astrophysical, and cosmological calculations and interpretations. Lastly, the NOW theory of time suggests that mathematical limits cannot extend all the way to zero when applied to physics; this may have effects on perturbation calculations by eliminating unwanted infinities.

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