Time Dark Matter Geometrical Model and Newton's Law Recovery

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ABSTRACT

Recently, a new geometrical model was proposed to solve the problem of "time". Moreover, the proposed model offers a solution for the dark matter enigma. In this work, we explain how Newton's law of rotation is an immediate consequence of the proposed "time" model. Furthermore, a more general formula is required for the acceleration of a particle to be more accurate. This explains our need for the Einstein theory of gravitation.

Keywords: Time, dark matter, velocity, acceleration

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INTRODUCTION

The majority of the energy stuff in the cosmos cannot be regular matter, which was one of the fascinating scientific discoveries of the 20th century. It is another type of matter that interacts with classical matter through its gravitational effect. Scientists have called this new stuff "Dark matter" (DM). The type and physical properties of DM are enigmatic (Young 2017). We cannot see DM, but we can know it is there by its gravitational impact on seen matter.

In previous work (Kallel-Jallouli 2018; 2021a,b,c), Saoussan Kallel proposed the existence of invisible unusual stuff, named "Zaman", responsible for the variations of "time" by its rotational motion (Kallel-Jallouli, 2023a,b). The proposed model led to the formation of rings, or multiple images of the same object, then, to the self-evident conclusion that "Zaman" exists, and it solves the DM enigma. In this work, using the new definition of "time", we shall explain how to recover Newton's law of rotation. Let us begin by recalling the new geometrical model.

THE "ZAMAN" GEOMETRICAL MODEL

2.1 Introduction

The concept of time is complex. For many decades, the difficulty of giving a complete account of "time" remained unresolved (DeWitt 1967; Earman 1987; Isham 1993; Kuchăr 1999; Merali 2013; Rovelli 1991; Smolin 2014; Wheeler 1968). Most scientists just see time as what clocks measure, so we may as well disregard it (Barbour 2001; Magueijo and Smolin 2019; Smolin 2001). The problem of "time" remained unsolved until the new revolutionary idea proposed by Pr. kallel in 2018 (Kallel-Jallouli 2018). She believed time is not simply a question of order of events (Rovelli 2018), or a real or complex variable. She succeeded, using the Dark Matter strong lensing effect, to demonstrate the existence of an unusual kind of unseen staff called “Zaman” responsible for the variations of “time” by its spin (Kallel-Jallouli 2021).

The idea proposed in the new theory is very interesting and helps scientists obtain a better understanding of our physical universe. We shall see how, using the new physical perception of “time”, things are more rigorous.

2.2 A new geometrical model

2.2.1 Definition of U-day (Kallel-Jallouli 2018, 2021, 202)

U will be a spinning sphere (generally called “universe” or “halo”), automatically filled with “Zaman”. Assume U has a solid body rotation and that, in comparison to its non-rotating (inertial) state U_I, it takes T units of clock-time, for U, to complete one rotation in the positive direction about its axis. If the rotational speed of U is constant and repeatable, then T is the length of the U-day. One U-day is equal to one full rotation of U in the positive direction around its axis. The U-day's length is determined using a chosen clock (habitually expressed in seconds). Evidently, the clock is an instrument used just to fix the length T of the physical U-day.

2.2.2 Definition of U-time inside U

Let us choose the spherical coordinate system (r,θ,φ), given by figure 1

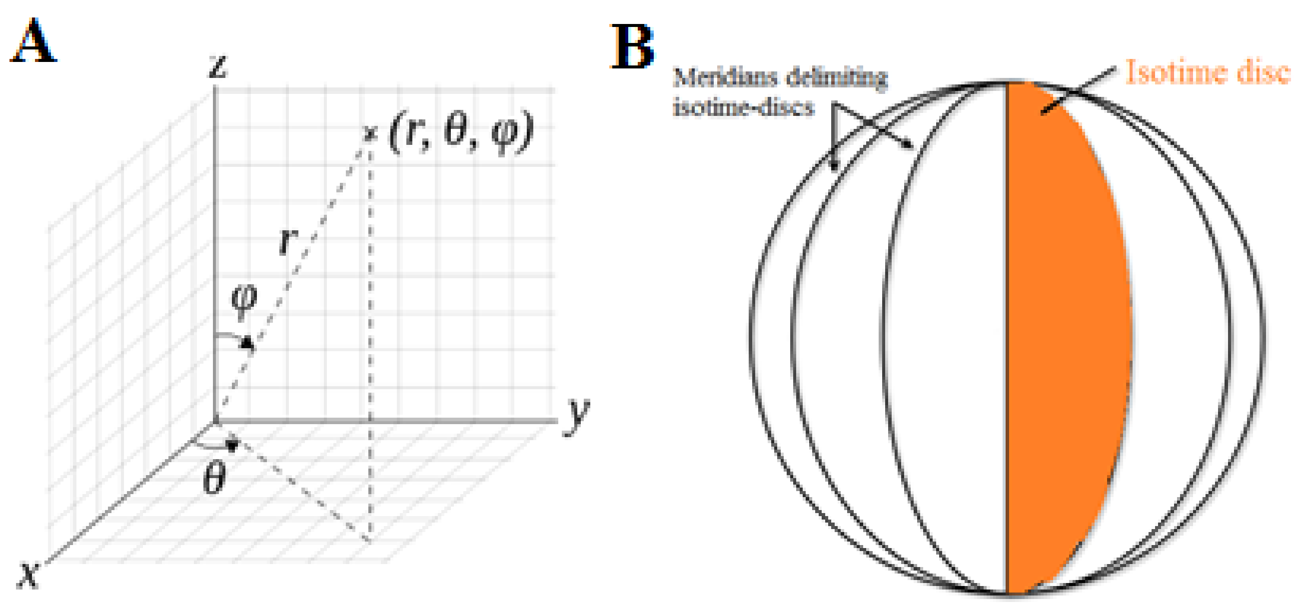

Figure 1. A. Spherical Coordinates. B. Isotime-discs (Kallel-Jallouli 2021)

U-time will be the same for a solid body rotation over each semidisc limited by the axis of rotation and a meridian (figure 1).

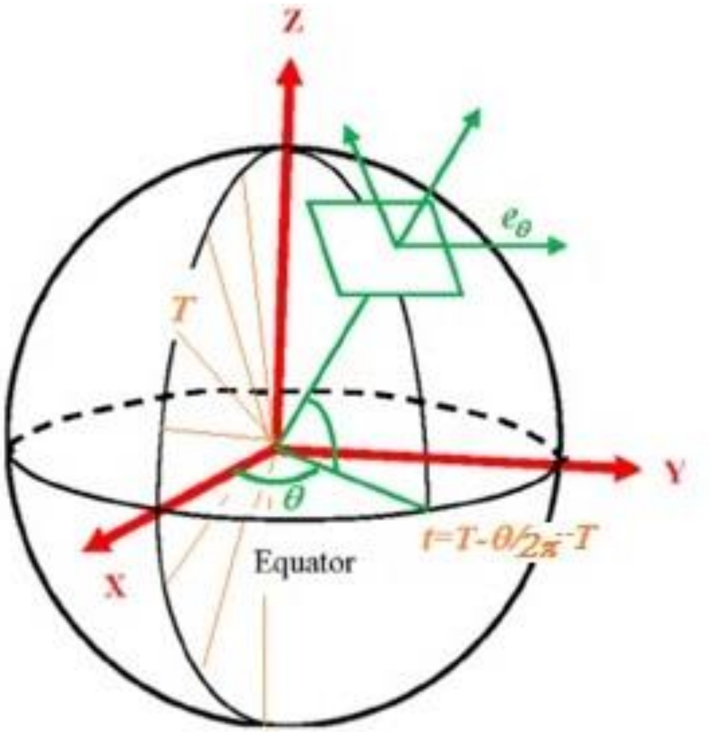

Figure 2. U-time inside U

Let us select the isotime-disc enclosed in the plane (Oxz) as the semidisc of U-time 0 ($t_U \equiv 0$). It is called the U-prime meridian (figure 2). Any certain point P in U_I with coordinates (r, θ, φ) concurrently indicates the space position (r, θ, φ) and the U-time variation in relation to the U-prime meridian, provided for the first day by (Kallel-Jallouli 2021b,c,d):

$t_U = T - \frac{T}{2\pi}\theta$ (from 0 to T). (2.1)

This is how internal U-time varies, in one U-day. For the n^{th} day, U-time is provided by:

$t_U = nT - \frac{T}{2\pi}\theta$ (between (n-1)T and nT). (2.2)

The value of U-time inside U_I is t_U

2.2.3 U-time difference between two points inside the U_I.

The following formula is used to determine the U-time difference between two sites inside of U for the same day based on the difference in longitude:

$$\Delta t_U = -\frac{T}{2\pi}\Delta\theta \qquad (2.3)$$

2.2.4 A particular example: the classical time

When T=24 hours, then

$$t_c = 24h - 24h\frac{\theta}{2\pi} = 24h - \theta \quad (2.5)$$

The classical variation of time is the variation of U-time:

$$\Delta t_c = -\Delta\theta \quad (2.6)$$

Remarks.

1. In this classical case,

* 360 degrees corresponds to one U-day of length 24 hours

* 180 degrees corresponds to half a U-day of length 12 hours

* 15 degrees corresponds to 1 hour

Let us call this "universe", the classical "universe", and the corresponding U-time, the classical time.

2. if $T > 24$ hours, then $\Delta t_U > \Delta t_c$, and U-time is stretched, with respect to the classical time. If $T < 24$ hours, then $\Delta t_U < \Delta t_c$ and U-time is shrunken with respect to the classical time.

Actual physical rules inside of U must be based on U-time, which is tied to the actual spin of U, rather than clock time, which has no physical relation with the U-spin.

NEWTON'S LAWS FOR ROTATION

3.1 U-celerity

Let 's consider a spinning spherical halo U_0 with rigid body rotation, with constant angular velocity Ω_0 (remember that angular velocity is related to the length of the U_0-day by : $\Omega_0 = \frac{2\pi}{T_0}$), about a fixed axis (z-axis) passing through its centre O, relative to its nonrotating inertial frame of reference. According to Newton's first law of rotation, U_0 will continue to rotate at the same angular velocity unless it experiences an external torque. If a tracer particle P is placed inside U_0, at a distance r from the origin, then it follows circular orbits around the central axis with tangential velocity given by Newton's law of rotation:

$$\mathbf{V_{0N}}(\mathbf{r}) = \mathbf{\Omega_0} \times \mathbf{r} \quad (3.1)$$

Now, we seek to retreeve this formula using our revised concept of U-time.:

Theorem 1

The U_0-velocity of P given by (using our new definition of U_0-time):

$$\mathbf{V}_0(P) = \mathbf{V}_{U_0}(P) = \frac{d\mathbf{r}}{dt_{U_0}} \quad (3.2)$$

satisfies the relation:

$$\mathbf{V_0}(\mathrm{P}) = \mathbf{\Omega_0} \times \mathbf{r} \quad (3.3)$$

Proof

P will rotate in a circle of fixed radius ($r\sin\varphi$). This circle has the U_0-axis of rotation as the axis. Note that if the particle completes one revolution, θ will not become zero again, but 2π rad, corresponding to one U_0-day. Consider the particle to be at point P_i, which corresponds to angular position θ_i, at U_0-time t_i. Once a U_0-time Δt_{U_0} passed, the particle changed to point P_f, which represents the angular position θ_f, at U_0-time t_f. Its angular displacement given by $\Delta\theta = \theta_f - \theta_i$ is positive for counterclockwise rotation (increasing θ). The U_0-time it takes for the particle to pass from P_i to P_f must be based on the difference in "time" between the two points, so, using relation (2.4), we must have:

$$\Delta t_{U_0} = t_f - \left(t_i - \frac{T_0}{2\pi}\Delta\theta\right) = t_f - t_i + \left(\frac{T_0}{2\pi}\Delta\theta\right)$$

When $t_f - t_i \to 0$, $\Delta t_{U_0} \to \frac{T_0}{2\pi}d\theta$, and we obtain:

$$dt_{U_0} = \frac{T_0}{2\pi}d\theta \quad (3.4)$$

By definition (3.2) of the U_0 −radial velocity of a particle P inside U_0,

$$\mathbf{V_0} = \mathbf{V}_{U_0} = \frac{d\mathbf{OP}}{dt_{U_0}}$$

Using relation (3.4), we can write, with O' the projection of P on the z-axis:

$$\frac{d\mathbf{OP}}{dt_{U_0}} = \frac{2\pi}{T_0}\frac{d\mathbf{OP}}{d\theta} = \frac{2\pi}{T_0}\frac{d(\mathbf{OO'} + \mathbf{O'P})}{d\theta} = \frac{2\pi}{T_0}\left(\frac{d\mathbf{OO'}}{d\theta} + \frac{d\mathbf{O'P}}{d\theta}\right) = \frac{2\pi}{T_0}\frac{d\begin{pmatrix} O'P\cos\theta \\ O'P\sin\theta \\ 0 \end{pmatrix}}{d\theta} = \frac{2\pi}{T_0}O'P\begin{pmatrix} -\sin\theta \\ \cos\theta \\ 0 \end{pmatrix}$$
$$= \frac{2\pi}{T_0}O'P\mathbf{e_\theta} = \mathbf{\Omega_0} \times \mathbf{r}$$

Finally, we can deduce:

$$\mathbf{V}_{0N}(\mathbf{r}) = \mathbf{V}_{U_0}(\mathbf{r}) \quad (3.5)$$

This means the equality between the known Newton's tangential velocity $\mathbf{V}_{0N}$ given by (3.1), and the U_0-velocity $\mathbf{V}_{U_0}$ given by (3.2) (based on U_0-spin) of a test particle living inside U_0.

3.2 U-acceleration

For the test particle P, Newton's acceleration using U_c-time is given by:

$$\boldsymbol{a_N} = \frac{d\boldsymbol{V_0}}{dt_c}(\boldsymbol{r}) = \frac{d}{dt_c}(\boldsymbol{\Omega_0} \times \boldsymbol{r}) = \frac{d\boldsymbol{\Omega_0}}{dt_c} \times \boldsymbol{r} + \boldsymbol{\Omega_0} \times \frac{d\boldsymbol{r}}{dt_c}$$

By applying relation (3.1), we obtain

$$\boldsymbol{a_N} = \frac{d\boldsymbol{\Omega_0}}{dt_c} \times \boldsymbol{r} + \boldsymbol{\Omega_0} \times (\boldsymbol{\Omega_0} \times \boldsymbol{r}) \quad (3.6)$$

The tangential component:

$$\boldsymbol{a_{Nt}} = \frac{d\boldsymbol{\Omega_0}}{dt_c} \times \boldsymbol{r} \quad (3.7)$$

The radial component:

$$\boldsymbol{a_{Nr}} = \boldsymbol{\Omega_0} \times (\boldsymbol{\Omega_0} \times \boldsymbol{r}) \quad (3.8)$$

Let us denote: $dt_0 \equiv dt_{U_0}$. If the spherical halo U_0 rotates with constant angular velocity Ω_0, then, based on our new definition of U_0-time, a tracer particle P will have an U_0- acceleration defined by:

$$\boldsymbol{a_0}(\boldsymbol{r}) = \frac{d^2\boldsymbol{r}}{dt_0{}^2} = \frac{d\boldsymbol{V_0}}{dt_0} = \frac{d}{dt_0}(\boldsymbol{\Omega_0} \times \boldsymbol{r}) = \frac{d\boldsymbol{\Omega_0}}{dt_0} \times \boldsymbol{r} + \boldsymbol{\Omega_0} \times \frac{d\boldsymbol{r}}{dt_0}$$

Since, for constant angular velocity, we have $\frac{d\boldsymbol{\Omega_0}}{dt_0} = 0$, then we conclude that

$$\boldsymbol{a_0}(\boldsymbol{r}) = \boldsymbol{\Omega_0} \times (\boldsymbol{\Omega_0} \times \boldsymbol{r}) \quad (3.9)$$

We find the same relation (3.8) of the radial acceleration given by Newton's law.

If Ω_0 varies with time, then, U_0-time inside U_0 varies. We will have

Theorem 2

The U_0-acceleration of a test particle P inside U_0 defined by

$$\boldsymbol{a_0}(\boldsymbol{r}) = \boldsymbol{a}_{U_0}(\boldsymbol{r}) = \frac{d^2\boldsymbol{r}}{dt_0{}^2} \quad (3.10)$$

satisfies:

$$\boldsymbol{a_0}(\boldsymbol{r}) = \frac{T_c}{T_{U_0}}\frac{d\boldsymbol{\Omega_0}}{dt_c} \times \boldsymbol{r} + \boldsymbol{\Omega_0} \times (\boldsymbol{\Omega_0} \times \boldsymbol{r}) \quad (3.11)$$

In the particular case $T_{U_0} = T_c$, we obtain the equality between the U_0-acceleration and Newtonian's acceleration:

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$$\boldsymbol{a_0}(\boldsymbol{r}) = \boldsymbol{a_N}(\boldsymbol{r})$$

Proof

Using our U_0-time definition, U_0-acceleration is given by:

$$\boldsymbol{a_0}(\boldsymbol{r}) = \frac{d}{dt_0}\boldsymbol{\Omega_0} \times \boldsymbol{r} = \left(\frac{d}{dt_0}\boldsymbol{\Omega_0}\right) \times \boldsymbol{r} + \boldsymbol{\Omega_0} \times \frac{d\boldsymbol{r}}{dt_0}$$

Using (3.3), we get

$$\boldsymbol{a_0}(\boldsymbol{r}) = \left(\frac{d}{dt_0}\boldsymbol{\Omega_0}\right) \times \boldsymbol{r} + \boldsymbol{\Omega_0} \times (\boldsymbol{\Omega_0} \times \boldsymbol{r}) \quad (3.12)$$

This is the same formula (3.6) given by Newton, where the clock time t_c is replaced by the new physical U_0-time t_{U_0}. However, we do not have equality of the two quantities (3.6) and (3.12). More precisely, using (3.4), we obtain the immediate relation

$$dt_c = \frac{T_c}{T_0} dt_0 = \frac{\Omega_0}{\Omega_c} dt_0 \qquad (3.13)$$

Formula (3.12) can then be written as:

$$\boldsymbol{a_0}(\boldsymbol{r}) = \frac{\Omega_0}{\Omega_c}\frac{d\boldsymbol{\Omega_0}}{dt_c} \times \boldsymbol{r} + \boldsymbol{\Omega_0} \times (\boldsymbol{\Omega_0} \times \boldsymbol{r}) \qquad (3.14)$$

Or equivalently, the relation (3.11).

Here, this U_0-acceleration (3.14) is a generalization of the approximation formula (3.6) given by Newton. However, we do not have equality of the U_0-acceleration with the Newtonian acceleration, in the case $\Omega_c \neq \Omega_0$.

CONCLUSION

Finally, the tangential velocity formula (3.3) applies inside any “halo”, without the need to care about U-time inside U (or U spin). Using any time definition leads to the same formula (3.3). So, the choice of “international atomic Time” TAI (or classical time, as measured by the atomic clocks) by the International Commission of Time, which itself was part of the International Astronomical Union (IAU), in 1967, could be explained. Contrariwise, if we need to apply the U_0-acceleration formula (3.12), it is very important to know the U_0-spin, since the first term of our formula (3.11) (3.14) depends clearly on the length T of the U_0-day (or U_0-spin).

The tangential U_0-acceleration

$$\boldsymbol{a_{0t}}(\boldsymbol{r}) = \frac{T_c}{T_{U_0}}\frac{d\boldsymbol{\Omega_0}}{dt_c} \times \boldsymbol{r} \qquad (4.1)$$

depends on the length T_{U_0} of the day. Its modulus is greater for a shorter length of the day. Since we live inside a "halo" with an increasing length of the day (Gross 2007), Newtonian's classical acceleration formula, based on classical clock time, is no longer accurate. We have an increasing term "T_{U_0}" that will have very interesting impacts on physical, geological, and astronomical sciences.

The tangential force created by this tangential acceleration, on a particle of mass m, will be given by:

$$\boldsymbol{F_t} = m\frac{T_c}{T_{U_0}}\frac{d\boldsymbol{\Omega_0}}{dt_c} \times \boldsymbol{r} \qquad (4.2)$$

For an increasing rate of rotation $\boldsymbol{\Omega_0}$, this tangential force will push ahead any particle moving inside a spinning "halo" in the positive direction ($\boldsymbol{\Omega_0}$ and the z-axis have the same orientation). The particle will then spiral outward. In the case $\boldsymbol{\Omega_0}$ is decreasing, corresponding to an increasing length of the U_0-day, this force will try to push back any test particle. The particle will spiral inward. This will have very interesting applications, especially in physics and astronomy.

Finally, if we hope to obtain accurate laws of nature that can apply at all levels and do not change either when the length of the day changes, we must use in our laws the physical U-time (U-days) related to the spin of U, and not the classical clock time, with no physical relation. Variations in U-time can be measured through longitudinal variations (3.4). A chosen clock serves only to determine the length T of the U-day. If $T \approx 24$ hours, then, in the "halo" U, our Newtonian classical laws apply. If $T \not\approx 24$ hours, we just have to use the generalized relation (3.11) for acceleration. We have just to understand that the physical "time" (U-time) inside a "halo" has a feeble chance to coincide with classical time. Therefore, Newtonian's acceleration has a feeble chance to be accurate. Our need for the Einstein theory of gravity becomes then understandable. Farther the particle is from the axis of rotation of U_0, the greater the error. The heavier the particle is, the greater the error.

The relation (4.2) can also be written as:

$$\mathbf{F_t} = \mathrm{m}\Omega_\mathrm{c}\frac{\mathrm{d}\ln\Omega_0}{\mathrm{dt_c}}\hat{\mathbf{z}} \times \mathbf{r} \qquad (4.3)$$

For a light particle, not far from the axis of rotation, (4.3) can be neglected provided that $\frac{\mathrm{d}\ln\Omega_0}{\mathrm{dt_c}}$ is small enough. Newtonian's theory remains then a good approximation. Finally, we want to mention that the U solid body rotation is a very special case. The more general differential rotation case will be studied elsewhere [Kallel-Jallouli 2024a,b].

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COMPETING INTERESTS

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