9b - **Propagation of light across large distances.** (Reduced version)

A paper that treats the subject with more detail might be of interest for those readers familiar with the description of the aether and of gravity done by the model. It can be downloaded at https://www.eterinica.net/EVE9/Eve9.pdf).

Abstract

Hubble's law can be explained, without invoking an expanding Universe, as the consequence of a slow gradual *increase* in time of the speeds of all the bound material bodies (electrons in atoms, planets, stars...) of the Universe. Such increase includes orbiting speeds and frequencies of vibration of the bound bodies. The increase of those speeds and frequencies is observed when measured by *an Ideal Clock* used for the description.
The rotation curves of galaxies can be explained with the same paradigms without invoking the existence of dark matter.

Consider an Ideal Observer (IO), that from “outside of the physical world” is capable to observe instantly any event happening in the physical world. (An "event" is, in this context, a specific distribution of the locations of *all* the particles of the Universe). This Ideal Observer has an Ideal Clock with which he labels all the events (assigning to “each” of them a time reading of his clock).
According to the Ideal Clock, on which will be based the description, the material clocks of the physical world (e.g. the atomic clocks) are seen to increase along time, slowly but constantly, their tick rate. These material clocks will be called Official Clocks.
The readings of the Ideal Clock will be called the Ideal time and the observer using that clock (he only needs one) will be called the Ideal Observer (IO)
The readings of the Official Clocks will be called the Official time and an observer measuring time with his material clocks will be called the Official Observer (OO).
It must also be remembered that the model claims that it is possible (and desirable) to make a consistent description of Physics postulating an "absolute time" and therefore, in what follows, the reader should not get tangled with the Special Theory of Relativity.

It will also be supposed that both IO and OO share the same measurements of length and, at all epochs, agree about the values of the lengths and distances of the physical entities of our world.

In what follows, the letter τ will be used to represent the time variable (clock readings) of the IO observer and the letter t that of the OO observer.

Suppose that at a given instant, for example "today", epoch of our measurements (here on the Earth) of the redshifts of the celestial bodies), we synchronize all the OO clocks of the world with the IO clock, setting their time readings equal to $t = \tau = 0$ and equating, in this instant, their time interval units (although, as postulated above, they will gradually desynchronize).

The light that we receive *today* (at the present epoch in which we have synchronized the IO and the OO clocks) from any distant galaxy has traveled all the way at a constant speed *c* for the Ideal Observer. This assertion is implied by a basic hypothesis of the model that asserts that the carriers of the light type disturbance, called aetherinos, move always, as seen by IO, at constant velocities).
If the distance between the emitting galaxy and the Earth is (and it will be supposed that has always been) *d* then the light activating today's Earth's detectors departed the galaxy at the IO epoch $\tau_E = -d/c$

Let the function f(τ) describe the increase with the epoch, observed by IO, in the OO clocks rates and in the orbiting speeds of most bounded particles and bodies.

NOTE: this same function f(τ) will also describe the increase with the epoch, observed by IO, in the speed of light or more precisely in the speed of those carriers (aetherinos) that are able to trigger a light-type disturbance in the material detectors with which they collide. The speed of the aetherinos able to trigger the detectors is always equal to c (i.e. to $3*10^8$ m/s), as measured by the OO clocks, because it is considered that those detectors are triggered when the aetherinos cross a specific small distance of the detector in a time interval equal to the period of a specific vibration of matter. But as has been said, the time intervals of the vibrations of matter (their tick rates) keep, by hypothesis getting shorter (as seen by IO).
(It must be insisted that the aetherinos, while traveling through space without colliding with matter, do not vary their velocity as seen by the Ideal Observer IO. The disturbance that a given detector D_1 will detect as light is transported by aetherinos of a constant speed v_{I1} (as seen by IO) which is such that, when those aetherinos reach the given detector D_1, the clocks of the Official Observer that are *close* to the detector are advancing at a rate such that OO assigns to those aetherinos a speed equal to c (i.e. to $3*10^8$ m/s). But there may exist at the same time another "flow" of aetherinos traveling through space at a bigger but also constant speed v_{I2} (as seen by IO) that do not trigger the detector D_1 but encounter at a later epoch another detector D_2 and manifest itself "as light" because at this later epoch the clocks local to the detector are oscillating faster (as seen by IO) and it again happens that such v_{I2} speed is seen by OO as c).

Considering that both observers IO and OO share the same space standards (x, dx,…), the increase with the epoch observed by IO in those typically constant OO speeds can be expressed as:

[9b-1]

$$u_I[\tau] = u_I[0]\,f[\tau] = u_O\,f[\tau] \quad \Rightarrow$$

$$\frac{dx}{d\tau} = \frac{dx}{dt} f[\tau] \quad \Rightarrow$$

$$\frac{dt}{d\tau} = f[\tau]$$

where the sub index I denotes "as measured by IO" and the sub index O denotes "as measured by OO". Notice also that the speeds of the light and the force carriers (aetherinos), that do not vary for IO, vary in time for OO according to $v_O[\tau] = v_I/f[\tau]$

Since f[τ] relates, at the epoch τ, the rates of the IO and the OO clocks it will be called a "*Tempo rate law*".

NOTE: More precisely, the Tempo Rate Law $dt/d\tau = f[\tau]$ describes, at a given epoch, the ratio between the time interval assigned by OO to a pair of events (instants) and the time interval between those same events assigned by IO, using his clock.
Notice that a Tempo Rate Law $dt/d\tau$ can be expressed as a function of the IO epoch τ (like in $f[\tau]$) or as a function $g[t]$ of the OO epoch *t* (For example, $g[t]$ can be deduced from $f[\tau]$ integrating the differential equation $dt/d\tau = f[\tau]$ to obtain the relation $t[\tau]$, then deducing from it the relation $\tau[t]$ and finally replacing this last in $f[\tau[t]]$).

A simple hypothesis for the **Tempo Rate Law** that relates in our world the rate of the IO clock to the rate of our standard OO clocks is:

[9b-1b] $$\frac{dt}{d\tau} = e^{\mu t}$$

that, with the boundary condition $\tau = t = 0$, gives

[9b-1c] $$t = -\frac{Log[1-\mu\tau]}{\mu}$$

and therefore the *Tempo Rate Law* $dt/d\tau$ as a function of τ becomes (replacing [9b-1c] in [9b-1b]):

[9b-1d] $$f[\tau] = \frac{dt}{d\tau} = \frac{1}{1-\mu\tau}$$

According to the description made above, the radiation arriving today τ=t=0 to our telescopes from a galaxy, located at a distance *d* from the Earth, departed the galaxy at the IO epoch:

[9b-2] $$\tau_E = -d/c_I[0] = -d/c$$

where c is the speed of light in vacuum (approximately $c= 3 * 10^8$ m/s).

The red shift z of a radiative atomic transition is defined as:

[9b-3] $$z = \frac{\lambda_R - \lambda_0}{\lambda_0} = \frac{\lambda_R}{\lambda_0} - 1 = \frac{\nu_0}{\nu_R} - 1$$

where
ν_0 is the frequency of a given atomic transition (a given spectral line) measured in the proximity of the source (in the lab) by a detector at rest relative to the emitter and
ν_R is the observed shifted frequency of that specific spectral line when its light comes from a distant source and is measured at the Earth.

According to the observational facts the law of Hubble is:

[9b-3b] $$z = \frac{H_0 d}{c}$$

where

d   is the distance at which was the source from the Earth when the light that we are now observing was emitted, and
H_0 is the Hubble constant whose experimental value is approximately

[9b-3c] $$H_0 \cong 75 \text{ Km sec}^{-1} \text{ Mpc}^{-1} \cong 2.5 * 10^{-18} \text{ sec}^{-1}$$

At the old epoch $\tau_E = -d/c$ when the light departed the far away galaxy, the electronic orbits of the atoms were performed (as seen by IO) at slower speeds than today. The frequencies (as measured by IO) of the spectral lines are supposed to be directly proportional to the orbital speeds of the atomic electrons.
A generic orbital speed that has today ($t = \tau = 0$) the value u[0], had in the epoch τ_E the IO value:

[9b-4] $$u[\tau_E] = u[0]\, f[\tau_E]$$

and hence, if today, in the epoch τ=t=0 the IO observer measures in some given spectral line the frequency $\nu[0] = \nu_0$, in the epoch τ_E he would measure for that spectral line the frequency:

[9b-5] $$\nu[\tau_E] = \nu[0]\, f[\tau_E]$$

Realizing that the frequencies called in [9b-3] ν_R and ν_0 are equal to respectively $\nu[\tau_E]$ and $\nu[0]$, and assuming, by hypothesis, the Tempo rate law $f[\tau] = 1/(1- \mu\, \tau)$ then [9b-5] becomes:

[9b-6] $$\nu_R = \nu_0 \frac{1}{1-\mu\tau} = \nu_0 \frac{1}{1+\mu\, d/c}$$

where τ has been replaced by its value τ_E given in [9b-2]
The red-shift [9b-3] is therefore

[9b-7] $$z = \frac{\nu_0}{\nu_R} - 1 = \mu\, d/c$$

that represents the *cosmological red-shift law* according to the model.

This expression [9b-7] of the red shift in the spectral lines of distant atoms is equal to Hubble's law *if it is supposed that the constant* μ *has a value equal to Hubble's constant* H_0, or more precisely equal to:

[9b-8] $$\mu = H_0 = 2.5 * 10^{-18} \text{ sec}^{-1}$$

Assuming that the systematic cosmic red shift is due to the Tempo Rate Law described above and not to an expansion of the Universe, then it may be asked:
The disturbance that we, at the Earth, detect today as light (and hence with OO-speed c) from a galaxy located at a distance d from us, what speed did it had at the epoch of its emission when measured by the local OO atomic clocks of the distant galaxy? The answer is as follows:
The IO epoch of emission of such light is $\tau_E = -d/c$ and at that epoch the atoms and hence the OO atomic clocks of the galaxy were running slower than today as measured by the Ideal clock. The rate between the galaxy's atomic-clocks time t and the Ideal time τ (based on aetherino travelled distances) was actually

[9b-9] $$\frac{dt}{d\tau} = \frac{1}{1-\mu\,\tau_E} = \frac{1}{1+\mu\, d/c}$$

and therefore the flow of light carriers that trigger today the light detectors of the Earth (because of their speed c), had at the epoch of their emission a speed c_E (measured with the OO atomic clocks of the galaxy) such that:

[9b-10] $$c_E\, dt = c_{EI}\, d\tau$$

where c_{EI} is the IO speed of those specific flows carrying this radiation and hence, since $c_{EI} = c$ (due to synchronization made above) and using [9b-9]:

[9b-11] $$c_E = c_{EI}\, d\tau/dt = c\, d\tau/dt = c/f[\tau_E] = c\,(1+\mu\, d/c)$$

For example, the radiation received at the Earth from a galaxy distant 5000 Mpc (and therefore seen with a $z = H_0\, d/c = 1.25$) has been carried by a flow of carriers that in the epoch of emission had a speed, as measured by the OO local atomic clocks of the galaxy, equal to:

$$c_E = c\,(1+\mu\, d/c) = c\,(1+ H_0\, d/c) = 2.25\, c$$

(Notice that in that older epoch in which emerged from the distant galaxy the disturbance that we detect today at the Earth as light, those carriers of OO speed $c_E = 2.25$ c did not have the adequate speed *to trigger* the light detectors at that emissive galaxy. The carriers triggering the light detectors at that epoch (and at all epochs) were those of OO speed equal to c).
According to the model, the ordinary sources of radiation emit "light-type-modulated flows of carriers" in a wide plurality of speeds relative to the emitter.

This model is therefore able to explain that in a non-expanding universe one may also observe red shifts (related with the distance) in the spectral lines from distant sources. In other words, there is no need to assume an expanding universe and a Big Bang to explain the Hubble redshifts. The Universe could instead be (1) basically stationary (in a continuous process of creation and destruction of stars), (2) not expanding neither contracting (but subject to a hierarchy in which all celestial bodies are gravitationally orbiting other more massive bodies) and (3) plausibly infinite in size and age.
These possibilities seem important considering that the Big Bang cosmology has some controversial issues (Examples: An ad hoc inflation period needs to be assumed in the theory to remove some inconsistencies between the age and size of the Universe; According to some cosmologists it is difficult to explain the existence of well formed galaxies in very early epochs after the Big Bang; Although General Relativity explains that it is the space itself that expands (and not the bodies that explode away) it is still not clear at what level in the hierarchy of the celestial bodies (galaxies?, clusters of galaxies?, super clusters of galaxies,…?) does gravitation counteract the presumed expansion of its constituents,…).

Proposed test of the model.

The interpretation proposed above, based on a Tempo Rate Law, predicts not only the cosmic redshifts but also predicts that the orbiting speeds of most bound bodies (e.g. planets around stars, stars around their galaxies…) increase with the epoch. Such increase of speeds of the orbiting bodies, together with the invariability of the orbiting radii, allows that the local observers (whose OO clocks tick at an increasing rate) measure the same revolution periods of the orbiting bodies (and the same laws of Physics) at all epochs. Therefore, when observing galaxies of equal type and size at different distances from us, we should observe that the farther the galaxy the smaller (as seen from the Earth with our clocks) the *average* speed of its stars. Doing those observations would constitute a test of the model.

Note: Notice that observing in distant galaxies smaller *average* speeds of its stars is not inconsistent with the fact that the rotation speeds of the outer stars of the galaxies are bigger than the values predicted by Newton-Kepler dynamics (which gave rise to the hypothesis of dark matter or alternately to MOND theories).

NOTE: A suggested experiment.

CMBR = Cosmic Microwave Background Radiation
MR = Microwave Radiation.

But assuming a non-expanding universe as an hypothesis, the problem is now to explain the CMBR (Cosmic Microwave Background Radiation) without a Big Bang.
An intuition is that the CMBR is just the "noise of the aether" that by its very nature is able to "trigger" detectors of radiation. The random collisions of the aetherinos of an undisturbed aether with a detector of radiation would trigger in the detector a "blackbody-type" distribution of frequencies. If that were so, then the CMBR is not coming from the depths of the universe but should be detectable everywhere where the aether is present. For example a detector of radiation placed behind a screen that shields any hypothetical microwave radiation coming from the outer space, should also detect microwave radiation of the CMBR type (blackbody of 2.7° K).
It is suspected that no experiment has yet placed its detectors behind a screen able to shield any Microwave Radiation (MR) from outer space, because material screens are in general much hotter than 2.7° K and emit so much blackbody radiation that it would be a hard task to deduce if the screen is shielding or not the CMBR. But perhaps a specific experiment can be designed to solve that issue; perhaps enclosing a detector of MR in a container made of a material that is known to shield the MR from the outside, and cooling both the container and the detector below 2.7° K.

Another feature that should be experimented inside that cold shielding container is the *anisotropy* of the observed radiation (using a detector with good angular resolution and able to observe in all directions of space). The prediction is that the MR detected inside the container should show a anisotropy coincident in direction and "Earth-speed" to the one that has been observed in the CMBR of the sky. That is because the aether model interprets such anisotropy as due to the velocity of the detector (the Earth) relative to the aether and this effect should not be affected by enclosing the detector in a container that shields radiation since the great majority of the aetherinos (like do the neutrinos) penetrate huge amounts of matter without colliding with it and therefore, unlike radiation (that is a modulation of the flows of aetherinos) that can be shielded (or cancelled), the distribution of velocities of the aetherinos can still manifest its anisotropy behind shields of radiation. Such anisotropies in the distribution of aetherinos velocities of the local aether would leave its signatures in the intensities of those radiation-type phenomena that the model ascribes to the "noise of the aether").

See more at: https://www.eterinica.net/cmbr_aether_en.pdf

Rotation curves of galaxies.

The same paradigms (Tempo Rate Law, etc…) proposed above to explain Hubble's Law can be applied to explain the observed rotation curves of galaxies without invoking the existence of dark matter. The following description can therefore be considered a MOND (Modified Newtonian Dynamics) theory.

It is again supposed that the carriers of the gravitation force travel, as measured by the Ideal Observer (IO), at a constant velocity.

When the distance between the attracting bodies is very big, that implies that the gravitation-type disturbance created by the body #1 takes a long time to reach the target body #2 because the most influent carriers of the "gravitation disturbance" are supposed to have finite speeds of the order of c (relative to the body target of the gravitation force). Again, as said above about light, the gravitation disturbance created by a massive body, inserts its signature (modulation) in carriers of a plurality of speeds but only those that reach the target body with the adequate speed relative to it have a significant influence on the force suffered by this target body.
But a long traveling time implies, due to the existence of a Tempo Rate Law explained above, that during such travel time the matter and the clocks of the target body have increased their intrinsic vibration rate and therefore the carriers that were considered in the vicinity of the source as responsible of the gravitation force are seen today as having a speed too small to implement the gravitation on the target body. The carriers that have today a significant influence in exerting the gravitation force on the target body, had a bigger speed relative to the source body (as measured by its clocks) when they were modulated and as a consequence **the gravitation force suffered by the bodies with mass does not decay with the distance simply as the inverse distance square law $1/d^2$ but as $g[d]/d^2$ where g[d] is a function that increases linearly (though very slowly) with the distance d.**

NOTE: This assertion about the behavior of the gravitation force between very distant bodies is **not** an ad hoc hypothesis but is a prediction of the *EVE model of the aether* obtained applying the model's description of gravitation in the context of a Tempo Rate Law. The reader familiar with the concepts and paradigms of the model can find such description and prediction at
https://www.eterinica.net/EVE9/Eve9.pdf and at
https://www.eterinica.net/EVEG/Force_between_neutral_bodies.pdf .

Recall first that the *Tempo Rate Law* proposed by the model is (see above)

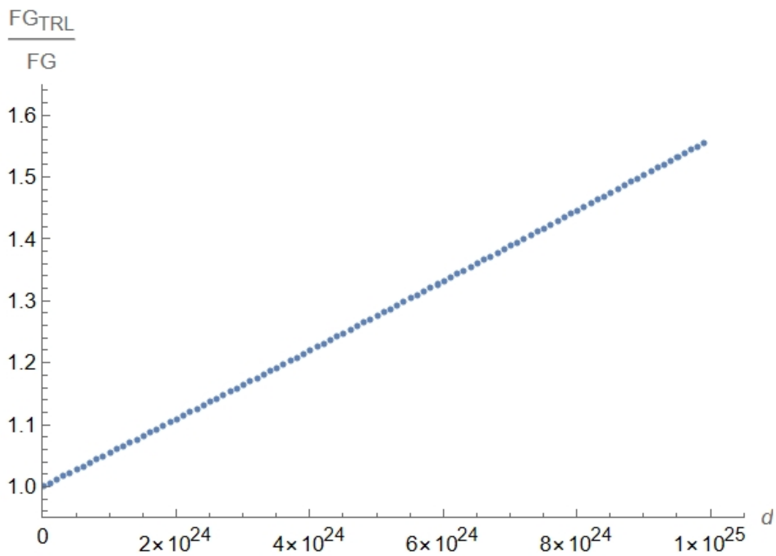
[9b-1d] $$f[\tau] = \frac{dt}{d\tau} = \frac{1}{1-\mu\tau}$$

where t measures time as read by the Official Observer (OO) in his material clocks (e.g. in atomic clocks) while τ measures time as read by the Ideal Observer (IO) in its clock (for which the force "carriers" move always at constant velocities).
As explained above, if the OO and the IO clocks are synchronized today, epoch at which is measured the gravitation force suffered by the target body #2 (due to the disturbance created a long time ago by the body #1), then, assuming that the aetherinos more efficient in carrying a gravitation-type disturbance are those of speeds (relative to the target body) close to c, the Tempo Rate Law [9b-1d] can be expressed as a function of the distance d between the bodies replacing the IO epoch τ by τ_E= -d/c to express the rate $dt/d\tau$ between the OO and the IO clocks at the earlier epoch τ_E in which the body #1 was creating the disturbance observed today (τ=t=0) at the body #2). Giving:

[9b-9] $$\frac{dt}{d\tau} = \frac{1}{1-\mu\tau_E} = \frac{1}{1+\mu d/c}$$

I) The ratios $F_{GT}[d] / F_G[d]$ have been evaluated for a large set of distances d separating the bodies, where
F_{GT} is the gravitation force exerted by one body on the other when *assuming the Tempo Rate Law* [9b-9] and
F_G is the gravitation force exerted by one body on the other when *not* accounting for the Tempo Rate Law

The following plot, Fig[9b-2] shows the results obtained



Fig[9b-2]

where the ordinates give the values of the ratios $F_{GT}[d] / F_G[d]$ and the abscissas give the distance d, in meters, between the interacting bodies.

But since the purpose of those evaluations was getting an approximate idea of how the ratio $F_{GT}[d] / F_G[d]$ evolves with the distance d, somewhat arbitrary values were assigned to the constants involved in the calculi and therefore the slope of the function $F_{GT}[d] / F_G[d]$ plotted in Fig[9b-2] does not claim to be well adjusted to reality.

It can be seen that a good fit to the set of ratios $F_{GT}[d] / F_G[d]$ that have been evaluated is given by the simple function

[9b-18] $g[d] = 1 + k\, d$

where, to fit the set of values $F_{GT}[d] / F_G[d]$ (that are conditioned by the specific assignments of the constants of the model) the constant k of g[d] must be assigned, in this example, the value

[9b-19] $k = 5.6*10^{-26}\ m^{-1}$

II) The *rotation curve* of a spiral galaxy predicted by the model assuming $F_{GT}[d] / F_G[d] = g[d] = 1 + k\, d$ has been obtained reasoning as follows::

Note: by *rotation curve of a galaxy* is here understood the relation that gives the orbiting speed v of any star around the center of the galaxy as a function of its distance d to the center of the galaxy.

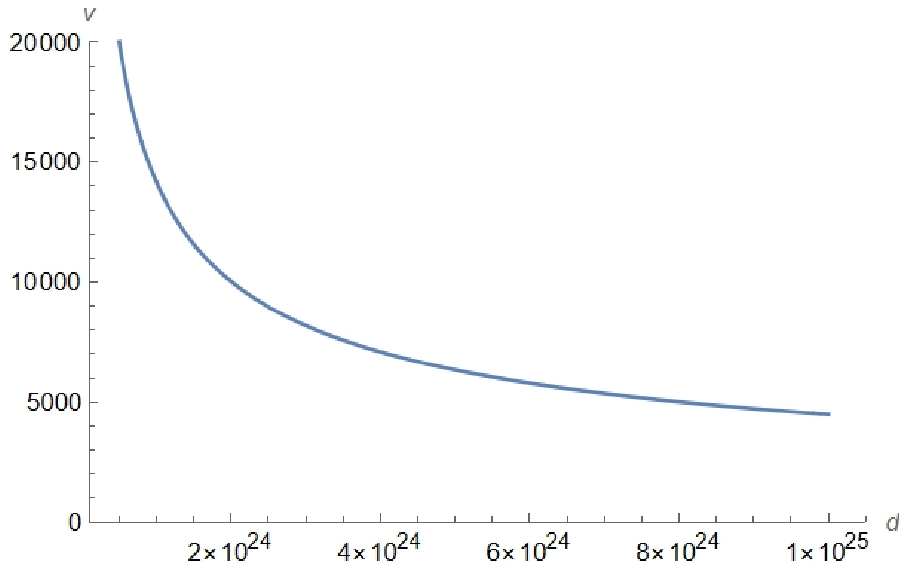
In Newtonian dynamics, that ignores the influence of a Tempo Rate Law, the orbiting speed v of a star in a circular orbit around the nucleus of a galaxy of mass M is obtained equating the centripetal (gravitation) force to the centrifugal force suffered by the orbiting star of mass m, as follows:

[9b-20] $$G\frac{M\,m}{d^2} = \frac{m\,v^2}{d} \quad =>$$

[9b-21] $$v = \sqrt{\frac{G\,M}{d}}$$

and taking
$G = 6.674 * 10^{-11}\ m^3\ Kg^{-1}\ s^{-2}$
$M = 3 * 10^{42}$ Kg (for example)

a plot of a typical rotation curve of a galaxy predicted by Newton's dynamic is:



Fig[9b-3]
Rotation curve of a typical galaxy according to Newton's dynamics

Note: the ordinates of the plot give the orbiting speeds of the stars in $m\ s^{-1}$ and the abscissas give the orbital radii d in meters.
Note: it has been supposed that nearly all the mass M of the galaxy is located *inside to* the orbits of the pertinent stars).

But if, due to the existence of a Tempo Rate Law, the gravitation force between two distant bodies is given by a law of the type

[9b-22] $$F_{GT} = g[d]\ G\frac{M\,m}{d^2} = (1 + k\,d)\ G\frac{M\,m}{d^2}$$

as suggested by the evaluations done by the model of the set of quotients $F_{GT}[d] / F_G[d]$ (between the gravitation force $F_{GT}[d]$ assuming TRL and the gravitation force $F_G[d]$ without TRL) then, when accounting for the effects of a Tempo Rate Law, the orbiting speed v of a star in a circular orbit around the nucleus of a galaxy of mass M can again be obtained equating the centripetal (gravitation) force to the centrifugal force suffered by the orbiting star of mass m, as follows:

[9b-23] $$g[d]\, G \frac{M\,m}{d^2} = \frac{m\,v^2}{d} \qquad \Rightarrow$$

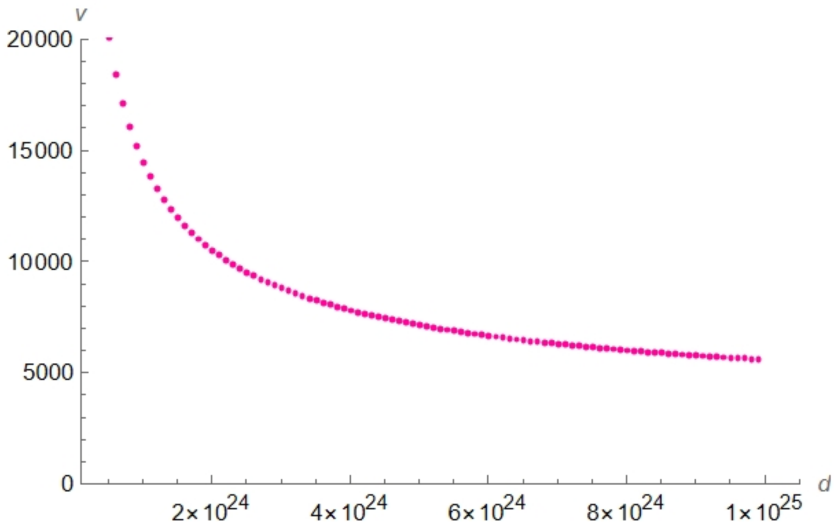
[9b-24] $$v = \sqrt{\frac{G\,M\;g[d]}{d}}$$

Taking again

$G = 6.674 * 10^{-11}\ m^3\ Kg^{-1}\ s^{-2}$
$M = 3 * 10^{42}\ Kg$

and assigning to the constant k of g[d] = 1+ k d the value
$k = 5.6*10^{-26}\ m^{-1}$

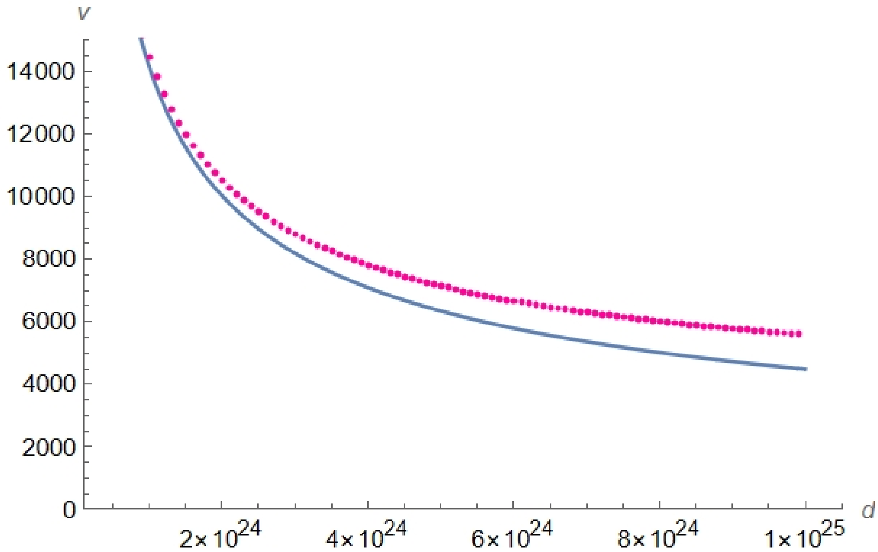
a plot of a typical rotation curve of a galaxy predicted by this model would be:



Fig[9b-4]
Rotation curve, according to the model of a typical galaxy

Note: the ordinates of the plot Fig[9b-4] give the orbiting speeds of the stars in $m\ s^{-1}$ and the abscissas give the orbital radii d in meters.
Note: it has been supposed that nearly all the mass M of the galaxy is located *inside to* the orbits of the pertinent stars).

When showing both galaxy rotation curves (the Newtonian of Fig[9b-3] and the non-Newtonian of Fig[9b-4]) in the same image, the following Fig[9b-5] is obtained



Fig[9b-5]

Rotation curves of a typical galaxy.

Newtonian's prediction in blue; Model's prediction in red

Note: Since g[d] = 1 + k d tends to 1 when the distance d tends to 0 and since the constant k is expected to be very small then Newton's Gravitation Law can be considered an approximation for "small" (non-cosmic) distances of the more general gravitation law given in Eq[9b-22].

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