COMPREHENSIVE PAPERS ON EXPONENTIAL EXPANSION

M.D. Earl 2023

I have compiled most of the information regarding exponential expansion (XPXP) from the web site, exponentialcosmos.com, in order to present a single source for the reader.

The theory, of course, is not complete. Unimaginable aspects must be addressed and it is thought that perfecting XPXP will take quite a bit of time by many. I anticipate that mathematicians and physicists will eventually realize the validity of the concept and therefore continue the investigation of XPXP.

THE THEORY SPEAKS FOR ITSELF, circumstantial evidence is abundant. XPXP provides a viable alternative to the standard model, which seems to be faltering in recent times.

The illustrations are crude, but they get the point across for the most part. The math sometimes skips steps...it is hoped that the reader will be able to “fill in the blanks”. Many times the information is repetitive, this is because the content is shown on many pages of the XPXP site, and has not been edited out.

The “shorts” presented on the site are not included in this paper. These are designed to clarify certain aspects of the theory in a concise manner. It is suggested that the reader go to the “shorts” on the website when necessary.

IT IS PROPOSED THAT AN INTELLIGENT, UNBIASED, ASSESSMENT COMPARING THE STANDARD MODEL WITH XPXP WILL RESULT IN A VERIFICATION OF XPXP.

Begin with an overview of the cosmic expansion:

OVERVIEW OF THE PROPER COSMIC EXPANSION :

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- The galaxies and the space between expand exponentially.
- An observer's position simultaneously exponentially expands with the universe.
- The few galaxies which do not obey the H/L relationship are described as "peculiar"
- All expansion properties are instantaneous.
- The expansion is exponentially time-dependent, the light-time distance is a true measure of the separation of the galaxies

The universal expansion field is a function of the density of the entire universe. A spatially expanding acceleration field is produced by any matter, on any scale. It is proposed that the H/L law also applies to the expansion of concentrated matter, producing what we know as "gravitation". The exponential expansion of concentrated matter differs from the free exponential expansion of the Hubble Flow because of the interaction of internal closely-spaced expanding matter. (see GRAVITY...)

A thorough mathematical knowledge of XPXP is necessary to see the advantages of this model over the present λCDM model.
"EXPONENTIAL" IN THIS MODEL IS NOT SYNONYMOUS WITH "EXTREME". It is not the inflation of the standard model.

The Hubble/Lemaitre Law (H/L) describes a universe that is expanding exponentially. The exponential nature of velocities, accelerations and distances are barely noticeable on the local level, since the universal exponential expansion factor is governed by Hubble's constant, which has an infinitesimally small value (~ 10^ -18 m/sec²). Accordingly, the expansion is discernible only for very large distances and speeds... in a manner analogous to "relativistic" effects of the standard model. As a check for the validity of this expansion theory, exponential expressions should correspond to common "non-relativistic" expressions, just as Einstein's relativistic expressions do. This is because e^Hot approximates 1, unless t is significantly large.

It proposed that the present standard cosmological model (λCDM) provides approximations of the true workings of the universe. This is why it is believed by most scientists that only small adjustments to the theory are necessary to explain inconsistencies. But 95% of the matter and energy of the universe is missing ! It is contended that a more realistic model is necessary.

Probably the most attractive aspect of the XPXP theory is that it is all-encompassing. An understanding of the principles of the cosmic flow leads to math principles which explain other phenomena such as gravitation, redshift, universal acceleration etc. When thoroughly understood, XPXP becomes an excellent candidate for the "theory of everything". It is anticipated that it applies on all scales.

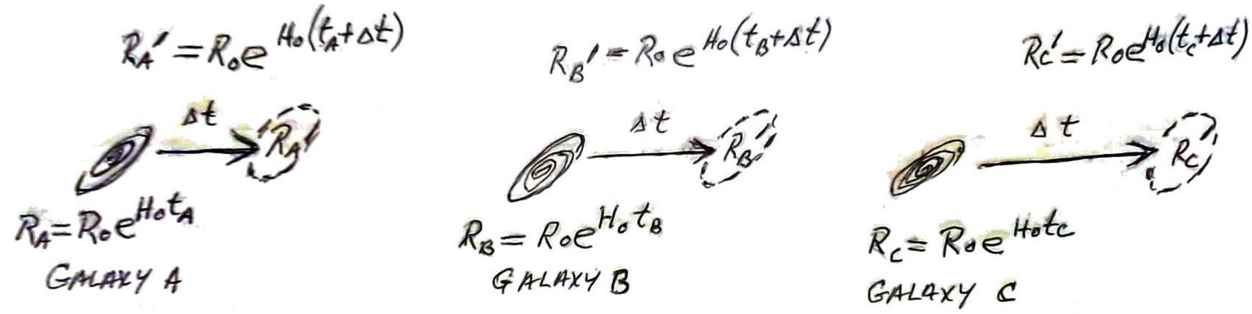
The expansion field of the cosmos is described in the Hubble/LeMaitre (H/L) law. One property of this expansion is that the universal density is constant, because the general equation describes a concurrent increase of universal matter and volume. The value of Ho is density dependent, and therefore is also constant. The XPXP theory presented herein proposes that the λCDM logic which requires that Ho has changed in the past, is faulty. That logic was produced to provide agreement with λCDM model and to suggest a "big bang".

The radial movement of "proper" galaxies in the cosmic expansion is illustrated in Figure 20-1. Because the expansion occurs in all directions, and is exponential, it is somewhat difficult for earth-bound humans to imagine its ever-increasing effects. As a proper galaxy of the flow moves, so do all other universal components and the space between. All have their own instantaneous expansion position, velocity, and acceleration. A simplification of these motions assigns an arbitrary expansion direction, realizing that any direction is expanding during the volumetric expansion. Relative motions of the cosmic components may then be mathematically analyzed. There is no "special" direction, which is consistent with the cosmological principle. A familiar cosmic analogy of the expansion is the baking of raisin bread, in which all of the raisins expand away from each other...but in this model they are exponentially expanding.

GENERAL ILLUSTRATION OF PROPER EXPONENTIAL EXPANSION:

To begin a simplified exploration of the xpxp galactic flow, terms like scale factors, comovement, relativistic, etc. must be abandoned. These terms may be considered once the exponential expansion is understood.

Figure 20-1. Proper Galactic Motion:



DURING A TIME INTERVAL Δt, THESE PROPER GALAXIES RECEDE FROM AN OBSERVER LOCATED AT R_A. MORE DISTANT GALAXIES MOVE FASTER AND FARTHER, ACCORDING TO THE HUBBLE/LEMAITRE LAW. IT WILL BE SHOWN THAT THE INITIAL LIGHT-TIME SEPARATION OF THESE GALAXIES (THE LIGHT-TIME INTERVALS) AMAZINGLY DO NOT CHANGE!

Some properties of the expansion:
- Proper galaxies exponentially recede from an also expanding observer at R_A.
- All galaxies exponentially increase in position, velocity and acceleration

EQUATIONS OF MOTION OF THE UNIVERSE : A SINGLE GALAXY

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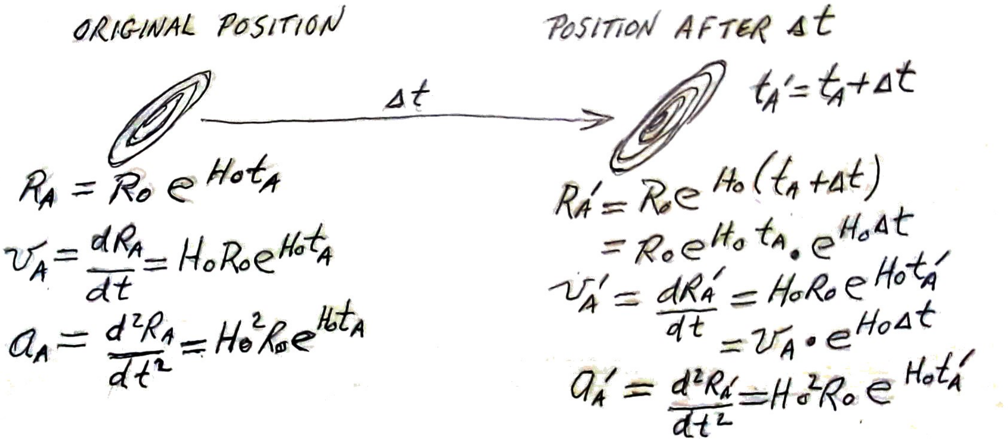
Understanding the movements of matter and space in the exponentially expanding (XPXP) universe requires a knowledge of exponential mathematics. It is an important premise of this theory that an XPXP universe cannot be described using common inertial math.

Nearly all galaxies participate in the proper cosmic expansion, the "Hubble flow", and obey the Hubble-LeMaitre Law: $dR/dt = H_oR$, leading to an exponential expression: $R = R_oe$^H_ot (see H/L Law). Instantaneous position, velocity, and acceleration are derived from this simple relationship. A complete understanding of the motions of the universe is necessary to fully grasp the importance of XPXP.

Figure 30-1. THE DISPLACEMENT OF A PROPER GALAXY IN THE EXPANSION



- Note that a Maclaurin expansion of the exponential terms in Figure 1 yields approximate values of $R \sim (H_o R_o)t \sim C_o t$, and $v \sim (H_o^2 R_o)t \sim H_o C_o t$. (see Maclaurin expansion) These approximations correspond to distance = light speed x time, and velocity = acceleration x time of the standard model.
- Multiplication by an expansion factor of e^Hot provides expressions for position, velocity and acceleration. Also, because Hot is minuscule and e^Hot ~ e ^ 0 = 1, in "normal" situations, the exponential nature of the universe goes unnoticed.
- XPXP is ongoing and continuing, thereby producing an accelerating universe. This was a surprise to many when discovered in the late 20th century. No need for "dark energy". The proper universal acceleration is $(H_o^2 R_o)$ e^Hot = $(H_o C_o)$ e^Hot. This conforms to the acceleration discovered in the late 20th century.

EQUATIONS OF MOTION OF THE UNIVERSE :
TWO GALAXIES

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The Hubble-LeMaitre (H/L) Law: **dR/dt = HoR**,

leads to an exponential expression: **R = Roe^Hot**. (as shown previously)

Instantaneous position, velocity, and acceleration of "proper" galaxies are derived from this simple exponential growth equation.

In the Hubble Flow, the galaxies differ in their properties by the proper time interval separating them. It may be imagined that a distant galaxy occupies a position that the observer's galaxy will occupy after some time interval. By comparing two proper galaxies, an expression for all proper galaxies may be formulated. It must be realized that all expressions are instantaneous, and constantly changing.

An important concept is "distance". To find the instantaneous distance between 2 proper galaxies, the position of one galaxy must be subtracted from the position of the other. Both are expanding exponentially. Because the H/L law mandates that all proper galaxies are moving at light speed for their position, this procedure is simple:
Figure 31-1. shows two proper galaxies, A and B, occupying two instantaneous positions:

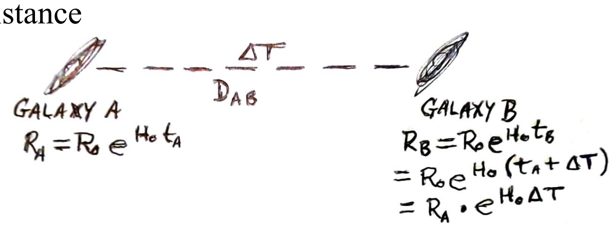
$$\mathbf{R_A = R_o e^{\wedge} H_o t_A} \qquad \mathbf{R_B = R_o e^{\wedge} H_o t_B,}$$
$$\mathbf{= R_o e^{\wedge} H_o (t_A + \Delta T)}$$

where $\mathbf{t_B > t_A}$ and $\mathbf{\Delta T = t_B - t_A}$ **= Light time interval**

The distance between the two proper galaxies = $\mathbf{D_{AB}}$

$$\mathbf{D_{AB} = R_B - R_A = R_o e^{\wedge} H_o t_B - R_o e^{\wedge} H_o t_A}$$
$$\mathbf{= R_o e^{\wedge} H_o (t_A + \Delta T) - R_o e^{\wedge} H_o t_A}$$
$$\mathbf{D_{AB} = R_o e^{\wedge} H_o t_A \,(e^{\wedge} H_o \Delta T - 1)}$$

Figure 31- 1. Galaxy Distance



If $\mathbf{R_A}$ is the location of the observer, then $\mathbf{R_A = R_o}$,

$$\mathbf{D_{AB} = R_o \,(e^{\wedge} H_o \Delta T - 1)}$$

A MacLaurin expansion of this expression approximates:

$$\mathbf{D_{AB} = H_o R_o \Delta T \sim c_o \Delta T}$$

This example demonstrates that the distance from the observer to a galaxy (in the standard model), is an approximation.

EQUATIONS OF MOTION OF THE UNIVERSE: INCREASING SEPARATION IN THE COSMIC FLOW

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The separation distance of galaxies in the cosmic flow increases with time in accord with the exponential nature of cosmic expansion. All proper galaxies move at light speed with respect to a stationary universe, per the H/L law, and the distance between them is a function of time. A method for understanding this increasing separation is to determine the positions of two galaxies before and after some time interval Δt.

Figure 32-1. Before displacement time interval Δt:

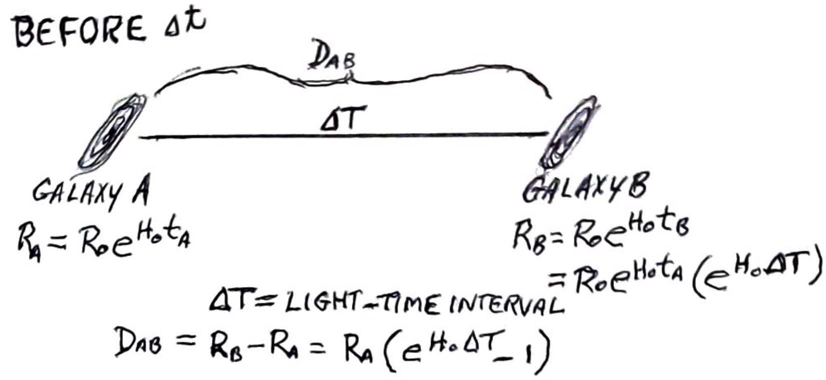

Figure 32-1. shows two proper galaxies, A and B at their initial positions. ΔT is the Light-Time interval between the two galaxies, which represents the time necessary for light to traverse the distance between the two. Because both galaxies are moving at proper speed with respect to a stationary universe, relative velocity also may be calculated at the new positions.

Figure 32- 2. After displacement time interval Δt:

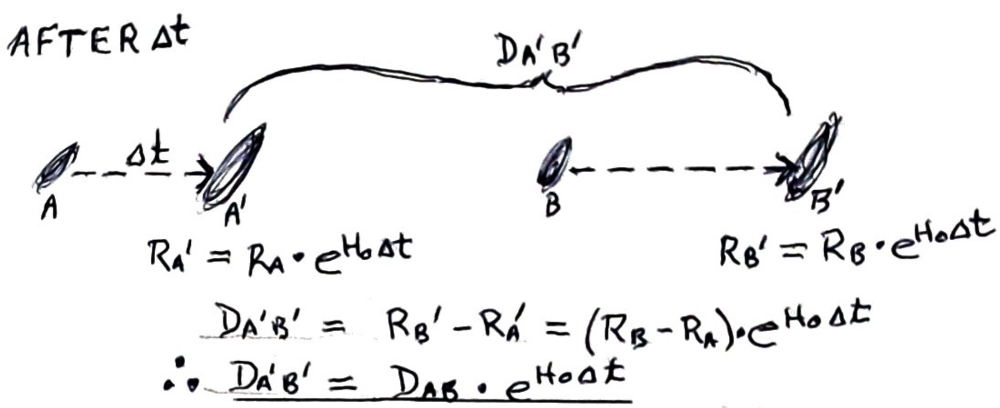

Figure 32-2. shows the positions of the galaxies after some common time interval Δt during which both galaxies displace. This time should not be confused with the Light-Time interval ΔT between the galaxies, where D_{AB} = R_A(e^HoΔT-1). A calculation of the new distance, $D_{A'B'}$,can be compared with the original separation D_{AB}, showing that after some time increment Δt, any distance expands by a factor of e^HoΔt.

EQUATIONS OF MOTION OF THE UNIVERSE
TIME SEPARATION OF PROPER GALAXIES

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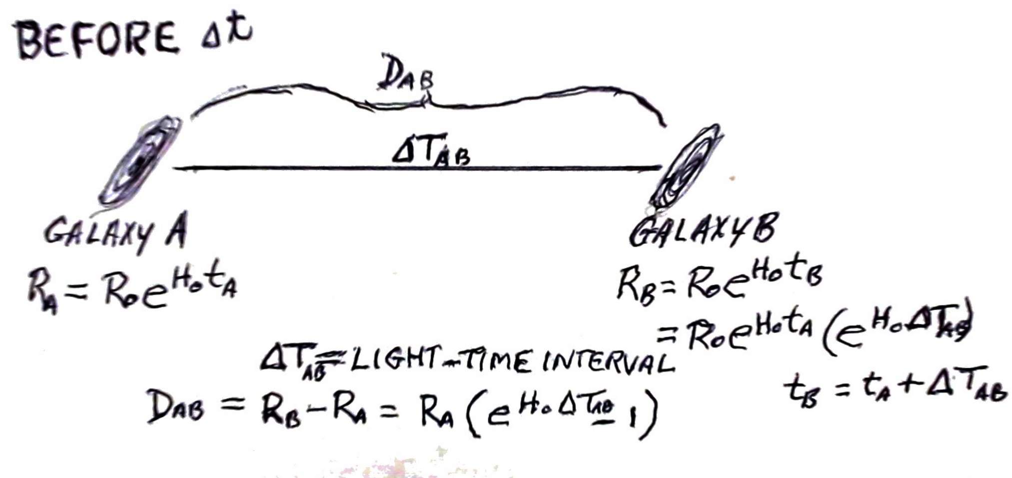
We have seen that the distance between galaxies in the proper flow increases with time. All proper galaxies move at light speed $c_o\, e^{H_o t}$ with respect to a stationary universe in accordance with the Hubble/LeMaitre (H/L) Law. It may seem evident that, since the separation between galaxies increases, it will take light an increasing period of time to span the gap. The λCDM model suggests this, and therefore predicts a darkened sky in the distant future as the galaxies recede. But the exponential expansion (XPXP) math tells a different story:

Figure 33-1. Initial positions of two galaxies - before displacement of Δt



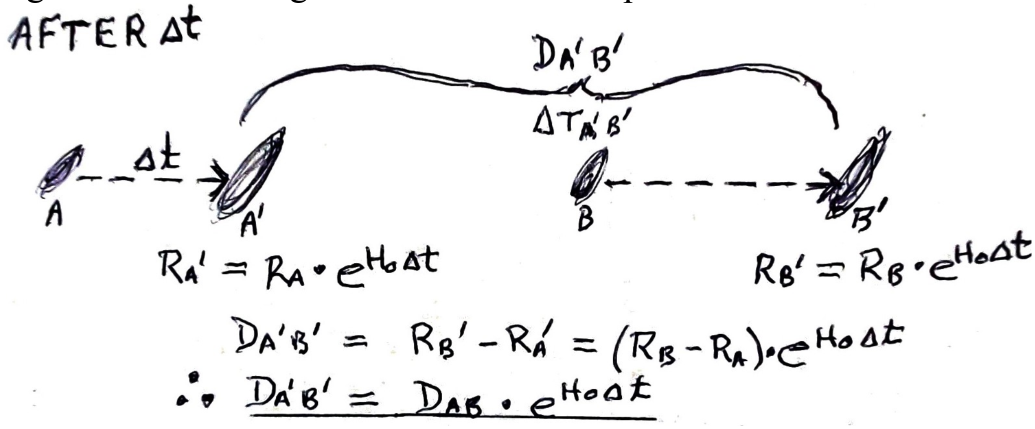
In Figure 33-1, because the proper galaxies are moving at (proper) light speed, **ΔT_{AB}** represents the initial light-time interval between galaxy A and galaxy B

$$R_A = Ro\, e^{Ho t_A} \qquad R_B = Ro\, e^{Ho t_B} \qquad t_B = t_A + \Delta T_{AB}$$

$$R_B = Ro\, e^{Ho(t_A + \Delta T_{AB})}$$

$$D_{AB} = R_B - R_A = Roe^{Ho t_A} \cdot e^{Ho(\Delta T_{AB})} - Ro\, e^{Ho t_A} = Roe^{Ho t_A} \cdot (e^{Ho(\Delta T_{AB})} - 1) \qquad \langle 1 \rangle$$

Figure 33- 2. Both galaxies move to new positions after some Δt



After displacement of both galaxies during Δt :

$$D_{A'B'} = R_{B'} - R_{A'} = Ro\, e^{Hot_B} \bullet e^{Ho\Delta t} - Ro\, e^{Hot_A} \bullet e^{Ho\Delta t}$$

$$D_{A'B'} = (Ro\, e^{Hot_B} - Ro\, e^{Hot_A}) \bullet e^{Ho\Delta t} = D_{AB} \bullet e^{Ho\Delta t}$$

THIS INDICATES THAT THE <u>DISTANCE</u> BETWEEN GALAXIES INCREASES BY A FACTOR OF e^HoΔt AFTER Δt.

$$D_{A'B'} = Roe^{Hot_A} \bullet (e^{Ho(\Delta T_{AB})} - 1) \bullet e^{Ho\Delta t} \qquad [1]$$

From figures 1 and 2, expressions for $\mathbf{D_{A'B'}}$ in terms of $\mathbf{\Delta T_{AB}}$ and $\mathbf{\Delta T_{A'B'}}$ are derived:

$$D_{A'B'} = Roe^{Hot_A} \bullet (e^{Ho(\Delta T_{AB})} - 1) \bullet e^{Ho\Delta t} \qquad [1]$$

$$D_{A'B'} = R_{B'} - R_{A'} = Roe^{Hot_A} \bullet e^{Ho\Delta t} \bullet e^{Ho(\Delta T_{A'B'})} - Roe^{Hot_A} \bullet e^{Ho\Delta t}$$

$$= Roe^{Hot_A} \bullet e^{Ho\Delta t} \bullet (e^{Ho(\Delta T_{A'B'})} - 1) \qquad [2]$$

From equations [1] and [2] :

$$(e^{Ho(\Delta T_{AB})} - 1) = (e^{Ho(\Delta T_{A'B'})} - 1)$$

by canceling common terms:

$$\mathbf{\Delta T_{AB} = \Delta T_{A'B'}}$$

<u>**THIS RESULT SHOWS THAT THE LIGHT-TIME INTERVAL BETWEEN PROPER GALAXIES DOES NOT CHANGE !!!**</u>

It implies several important characteristics of universal motion, some of which are:

- T_o, the age of the visible universe (the Hubble Time), is constant, because the light-time interval to the farthest (proper) galaxy is constant. The inverse of To, is H_o, and is therefore also constant.
- The redshift of proper galaxies does not change because the shifted wavelength of light is a function of an unchanging ΔT.
- Galaxies will not "fade to darkness" in the distant future, as predicted by the λCDM model.
- The observer and measuring devices are expanding concurrently with the cosmic expansion. XPXP suggests an eternal "expansion from within", wherein all things exponentially expand in all scales, and no BIG BANG happened.
- XPXP opens a new possibility for cosmic agreement with quantum physics.

CORRECTING THE GREAT MISTAKE

- AN ALTERNATIVE LIGHT SPEED SOLUTION: RELATIVE VELOCITY IN AN EXPONENTIAL UNIVERSE

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In the 19th century, experiments showed that light speed had the same value regardless of the motion of the observer or source, contrary to Galilean and Newtonian relativity. The light speed problem was resolved when constant universal light speed was accepted, became a postulate of special relativity, and time became variable. It has remained unchallenged for over 100 years. But is it possible that there is another consideration that will explain the counter intuitive measurements made by Michelson/Morley and others? Is there just one method to explain the light speed problem? Relativity has supposedly been proven countless times, but it is proposed herein that a different approach may refute these proofs.

Acceptance of time dilation and other relativistic effects is second-natured today. But when it was initially presented, special relativity was as radical as any crazy theory we have today. Exponential expansion (XPXP) suggests that scientists have been "perfecting an incorrect theory".

A mathematical understanding of an exponentially expanding universe provides an alternative answer to the light speed problem. Consideration of the exponential math of movement for both light and the observer shows that light speed is always measured as a constant, because both are increasing exponentially. If light speed is not constant, then the present standard model must be abandoned.

A description of the cosmic flow based upon the Hubble/Lemaitre Law (H/L) shows an exponentially expanding universe. This possibility was dismissed in the early 20th century in favor of relativity, which was based upon non-exponential math of Lorentz and others. Only a mathematical understanding of an exponential expansion, especially with regard to light speed, will provide an alternative (and more logical) description of how the universe works.

In order to formulate a method to measure relative speeds in an exponentially expanding universe, conventional mathematics must be rejected. If standard model math, derived in an inertial frame of reference, is used to solve universal problems, accurate answers cannot be expected. The XPXP universe presented here must be described with exponential mathematics, and cannot be described with conventional mathematics. It will be seen that the incongruity in the galactic distance/velocity graph is caused, not by a problem with the H/L Law - but instead by the incorrect astronomical mathematics of the standard model.

Both Special Relativity and XPXP approximately agree with Newtonian mechanics at lower speeds. Both e^Hot and the Lorentz gamma approximate 1 under normalconditions. The approximate correctness of the standard model has led scientists to assume that the standard model is basically correct, but is occasionally in need of only minor adjustments. This is wrong. Relativity must be abandoned, and a corrected description (XPXP) of the universe must be accepted.

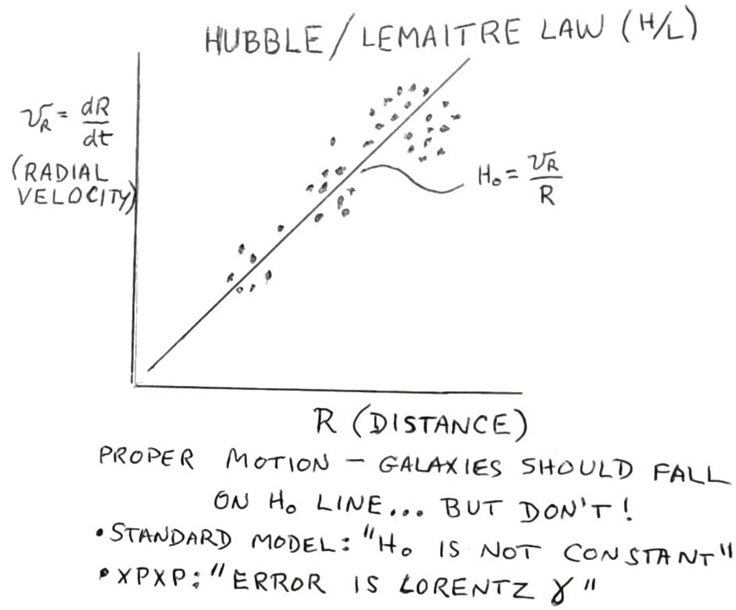
It is asserted that the very basis of S.R. (constant c and variable time) has created a model which is fundamentally incorrect and pervades all aspects of astronomy and cosmology. The methods of exponential mathematics are not intuitive and are difficult to accept, especially for those who have devoted their lives to relativity. Common assumptions must be abandoned. Simple concepts such as the distance formula, **distance = velocity x time**, are wrong.

Historically, the "GREAT MISTAKE" of cosmology was the acceptance of relativity with the assumption that light speed is a universal constant. The Lorentz factor, which was derived in the 19th century (essentially using the Pythagorean theorem), was used by Einstein to formulate the effects of special relativity. It is a major stumbling block for the true exponential nature of the universe. The Lorentz gamma:

$$\gamma = \frac{1}{\sqrt{1-(\frac{v}{c})^2}}$$

The Hubble/LeMaitre (H/L) law conflicted with relativity (see distance/velocity diagram, Figure 40- 1.). It was abandoned because the galactic distances did not strictly agree with the relativistic velocities predicted using the Lorentz γ . Therefore, Ho became a "parameter". An XPXP model addresses this issue with the argument that, in the non-exponential standard model, astronomical measurements for a distance/velocity graph are flawed.

Figure 40-1. Velocity/distance diagram



With knowledge of the mathematical principles of XPXP, it will be shown that light speed is measured as a constant from any proper or peculiar frame of reference. This offers an alternative to the GREAT MISTAKE (i.e. simplistically assuming constant universal light speed).

At a minimum, showing this mathematical alternative to the light speed problem should cause physicists to question the present thinking.

THE THREE XPXP MOTIONS:

A working knowledge of the concepts of an exponentially expanding universe is required before a comparison can be made to the λCDM model.

XPXP states that there are three types of motion in the universe: proper, peculiar, and light. All are exponentially increasing, so that a calculation of their relative speeds is not as simple as conventional subtraction. Certain considerations must be made, involving a little deeper thought.

A basic premise in the measurement of comparable XPXP speeds is that, when measuring one speed relative to another, BOTH MUST OCCUPY THE SAME POSITION. This requirement becomes obvious when considering that, in the XPXP model, all motions are increasing and accelerating and only an instantaneous measurement is valid. A mathematical method for describing each of the motion types must be presented. Beginning with the H/L law, these formulas may be derived.

The XPXP equations (Ho constant) for PROPER position and velocity are:

$$R_{proper} = R_0 e^{Ho\, t_{proper}} \qquad v_{proper} = H_o R_0 e^{Ho\, t_{proper}}$$

These equations were derived directly from the Hubble/LeMaitre Law as follows:

$$\text{HUBBLE/LEMAITRE LAW} \quad dR/dt = HoR$$

$$\text{CROSS MULTIPLY} \quad (1/R)\, dR = Ho\, dt$$

$$\text{INTEGRATE} \int (1/R)\, dR = \int Ho\, dt$$

$$\ln (R/Ro) = Ho\, t$$

$$\text{EXPONENTIAL} \quad R/Ro = e^{Ho\, t}$$

$$\text{POSITION} \quad R = Ro\, e^{Ho\, t}$$

$$\text{VELOCITY} \quad V = HoRo\, e^{Ho\, t}$$

In order to differentiate and integrate exponential expressions, an exponential constant must be identified for the expression, so that expressions for position, velocity and acceleration may be calculated.

These are the 3 exponential motions, with the associated exponential constants for each motion:

Proper : Ho
Peculiar: Ho
Light: 2Ho

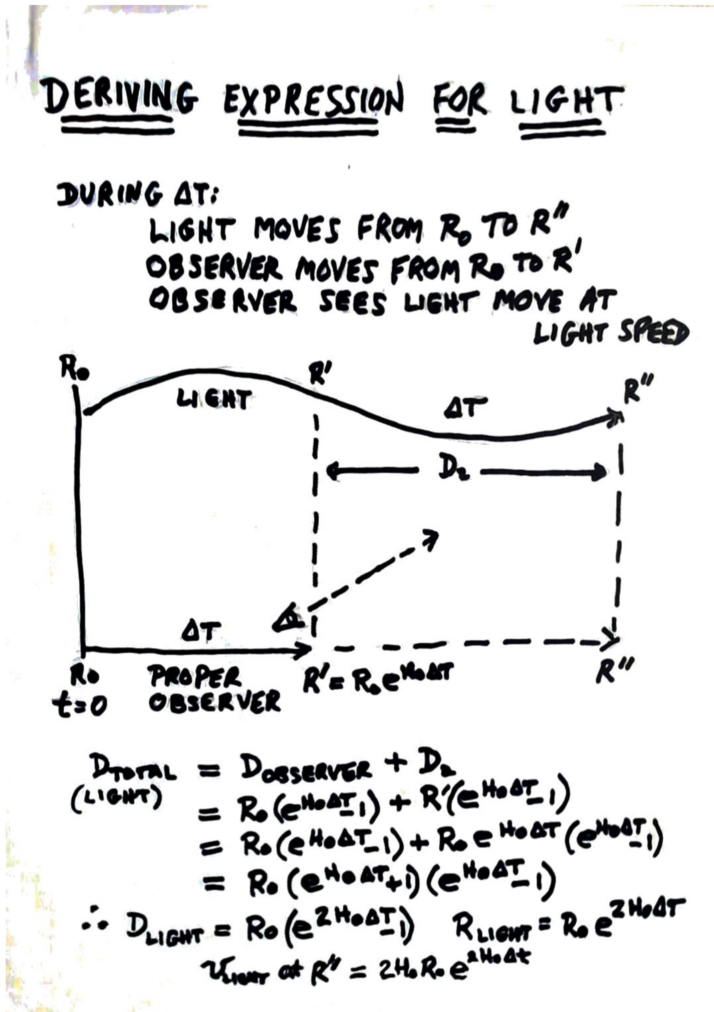
LIGHT -

The XPXP equations for LIGHT position and light velocity are:

$$R_{light} = R_0 e^{2H_O t_{light}} \qquad v_{light} = 2H_O R_0 e^{2H_O t_{light}}$$

These equations were derived previously by considering light speed from the perspective of a properly-moving observer as shown in Figure 2.

Figure 40- 2. DERIVATION OF XPXP EXPRESSION FOR LIGHT



The exponential constant for differentiating light is 2Ho, while the exponential constant for proper motion is Ho. In Figure 40- 2, an observer in proper motion is unaware of his/her motion. While this observer moves during Δt, light moves (exponentially) at light speed ahead of him/her. A simple calculation yields the exponential expression for light speed:

$$v_{light} = 2H_O R_0 e^{2H_O t}$$

In order to measure light speed in XPXP, a proper observer and the light must occupy a common position, and the values at that position are instantaneous. This is reasonable, because light is moving significantly faster than a proper observer. A photon cannot be accurately measured by the observer once it moves beyond. Figure 40-2. shows the exponential manner by which both light and proper motion progress as a function of time. It is (once again) noted that the exponential expansion constant for light is 2Ho, and that of proper (and peculiar) motion is Ho... therefore light moves significantly farther than a proper observer moves during the same time interval.

An assumption is that any light passing any position moves at light speed regardless of its origin; if light is emitted from a source at any position in the cosmos, the travel time to the measurement position from the source will determine its speed there. In short, whether light is emitted or passing through a position, it is moving at light speed.

Because both light speed and a proper observer's speed are exponentially increasing, determining the relative speed of light involves finding the *proper* speed at a position occupied by both (instantaneous), and thereafter finding the speed of *light* at that same position (and instant). By comparing the result, it will show a constant relationship between the two speeds, suggesting an alternative reason for the constant light speed assumption of early 20th century physicists .

During an equivalent time interval, light propagates farther than either proper or peculiar motions. In order to find a common position, the time necessary for each form of motion to reach a common position must be determined. Starting at an arbitrary position, Ro, the time it takes for a proper object can be described as Δt_{proper}, and the time that it takes light to reach that same position can be described as Δt_{light} (which is intuitively significantly less than Δt_{proper}). To describe both at the same position, the relationship between the proper time interval and the light time interval can be calculated by equating the two distance expressions, as below:

$$R_{proper} = R_0 e^{H_0 \Delta t_{proper}}$$

$$R_{light} = R_0 e^{2H_0 \Delta t_{light}}$$

$$R_{proper} = R_{light}$$

$$R_0 e^{H_0 \Delta t_{proper}} = R_0 e^{2H_0 \Delta t_{light}}$$

$$H_0 \Delta t_{proper} = 2H_0 \Delta t_{light}$$

$$\Delta t_{light} = 1/2\ \Delta t_{proper}$$

In short, light will reach a position in 1/2 the time that a proper object will. Just as the fastest runner in a footrace will pass a slower runner at one location, then another runner at a different location, etc. - light speed can be measured at any position along the route. This is not time dilation, as in relativity, but a measurement of the absolute time interval to reach a position for any of the motions.

By using this time relationship between light and proper motion it can be determined that any proper observer will measure instantaneous light speed as approximately 3x10^8 meters /sec. at the observer's location. The same procedure is also used to find the velocity of light as measured by a peculiarly-moving observer. According to classical Galilean physics, the measure of the speeds should be additive, giving differing relative values for approaching and receding sources, etc. The constant light speed measurements of 19th century led to a counter-intuitive theory of Relativity. Comparing peculiar speed with light speed at a common position shows that the relative speed of light is always measured as a constant 3x10^8 meters /sec.

Figure 40-3a. The THREE XPXP MOTIONS :

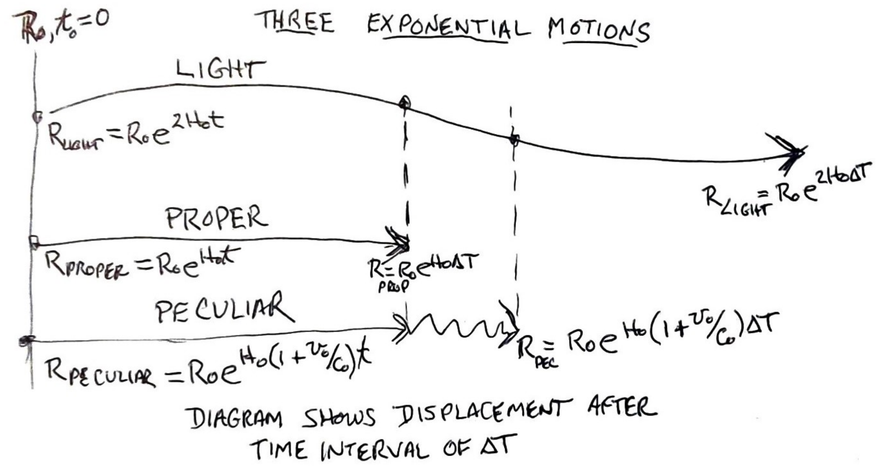
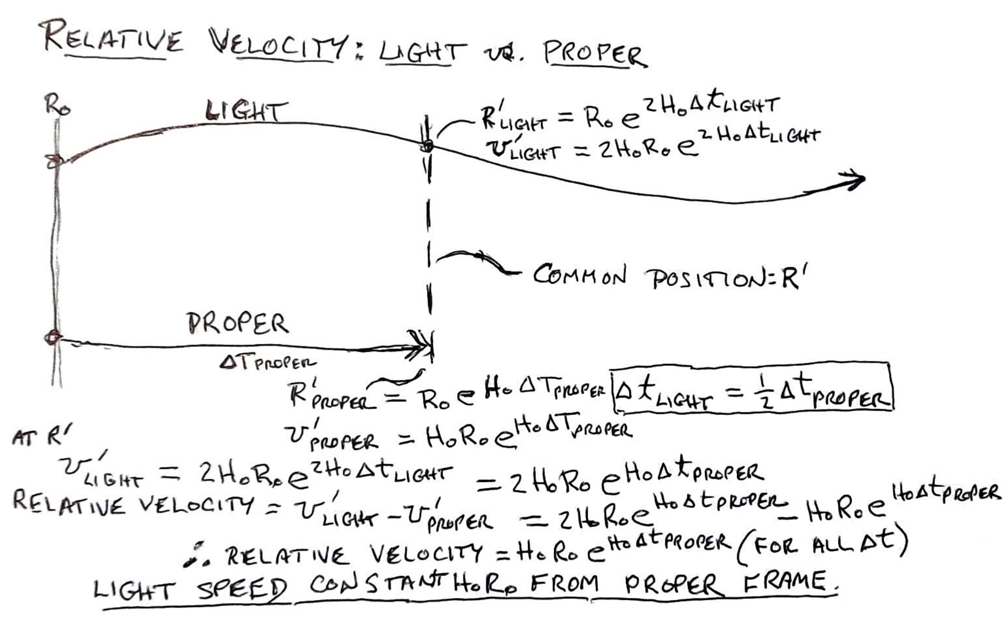


Figure 40- 3a. shows a simplified illustration of the three motions...proper, peculiar, and light. To simplify, all motions are in the same direction in Figures 3a, 3b, and 3c . More complicated motions prove to be mathematically consistent.

Speeds at a common position, using exponential mathematics, show that light speed is measured as a constant HoRo (with a common exponential term) as seen by all observers in proper and peculiar motion. To show this, a position and velocity must be determined for both motions, so that comparing proper speed and peculiar speed with light speed shows that light speed is measured as a constant, but it is not a constant with respect to a stationary universe, as in the standard model. The consequences of this concept are substantial, affecting all aspects of physics.

Figure 40-3b. RELATIVE VELOCITY: Light vs. Proper motion



Comparing movements at position R′ (a position common to both light and a proper observer) the relative speed is determined to be the Hubble proper speed, as measured by the observer. In a calculation of relative light velocity for both proper or peculiar motions, it is seen that light, either emitted or passing through Ro, has an instantaneous velocity of 2HoRo·e^2Hoto = 2HoRo.

PECULIAR MOTION

To find relative light velocity for an observer in peculiar motion, the same method may be used, i.e. determine the XPXP velocity of each at a common position. The peculiar position of the observer can be stated as:

$$R_{peculiar} = R_0 e^{H_0(1+(v_0/c_0))\Delta t_{peculiar}}$$

To determine the time relationship of peculiar motion and light, begin by finding the position expression for light at the same position as the peculiar observer from a common "starting" position, Ro. By equating the distance of each from position Ro, the time relationship may then be found:

$$R_{light} = R_0 e^{2H_0\Delta t_{light}}$$

$$R_{peculiar} = R_0 e^{H_0(1+v_0/c_0)\Delta t_{peculiar}}$$

$$R_{peculiar} = R_{light}$$

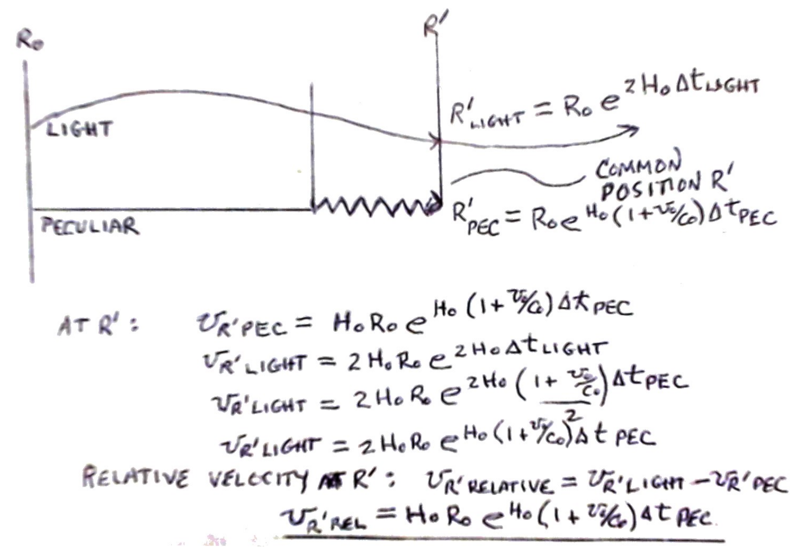
$$R_0 e^{H_0(1+v_0/c_0)\Delta t_{peculiar}} = R_0 e^{2H_0\Delta t_{light}}$$

$$H_0(1+v_0/c_0)\Delta t_{peculiar} = 2H_0\Delta t_{light}$$

$$\Delta t_{light} = \frac{(1+v_0/c_0)\Delta t_{peculiar}}{2}$$

This relationship holds for any position common to light and an object moving peculiarly at some constant speed vo.

Figure 40- 3c. RELATIVE VELOCITY- Light vs. Peculiar motion



Determining the relative velocity between light and proper or peculiar motion is made by subtraction at a common position. This is possible when the two velocities have identical exponential factors. Figure 40- 3c. demonstrates that a peculiar observer will see light moving exponentially at twice the light speed of the observer's unrealized (exponential) peculiar motion, and would measure it as "light speed". The result of these processes show that light speed will be measured as a constant HoRo by any proper or peculiar observer (both have the same exponential factor).

ACCORDINGLY, ANY OBSERVER MEASURES LIGHT SPEED AS CONSTANT.

***ASSUMING THAT LIGHT SPEED IS A UNIVERSAL CONSTANT IS REFUTED BY THE XPXP MODEL*. RELATIVITY HAS MISGUIDED PHYSICS FOR OVER 100 YEARS. (THE "GREAT MISTAKE")**

EQUATIONS OF MOTION OF THE UNIVERSE:

XPXP LIGHT WAVES - MEASURING UNIVERSAL DISTANCES

41AA M.D. Earl 2023

Light waves are constantly emitted and received throughout the universe, providing a method of measurement for astronomers. It is submitted that the measuring techniques currently in use, although appearing to be correct, produce results that are invalid. Recognition of the XPXP character of the universe presents an opportunity to correct erroneous measurements of distances and velocities in space.

The Relativistic Doppler Shift is a tool that astronomers currently use to determine the velocities of very distant galaxies. The logic is: When light from a source having a known wavelength has a shift in wavelength toward either end of the spectrum when received, the source is moving toward or away from the observer. The wavelengths are changed due to the relative motion (just like on earth). A red shift indicates that the waves are stretching, and the source is receding. A red shift of light from virtually all of the cosmic galaxies is proof of an expanding universe.

In the late 20^{th} century, it was discovered that the cosmic expansion was inexplicably accelerating. It is submitted that this universal acceleration is exponential (at Hoco e^Hot) and should be expected in an XPXP universe.

Currently, to determine the velocity of a distant galaxy, redshift ("z") is measured, then the Lorentz factor γ is used to calculate the "relativistic doppler shift". Thereafter, solving for v in the formula establishes the velocity of the galaxy. The measurement of the redshift is essentially determined by detecting the wavelength of light received, then comparing that wavelength with the wavelength of light emitted at the source. The λCDM relative velocity = z • c

The Lorentz factor, gamma (γ), was derived on earth, using standard math (Pythagoras). It wrongly assumes a constant universal light speed: where:

$$\gamma = \sqrt{\frac{1}{1 - {v^2}/{c^2}}}$$

γ is applied to detected light to determine the velocity of very distant galaxies. XPXP states that this leads to an erroneous galactic velocity. Amending this error requires a total reconsideration of the nature of light.

A light wave produced by a source at rest in the λCDM model is shown in Figure 41-1. The wave propagates unchanged through space until detected.

Figure 41-2. shows a receding source in the λCDM model, producing a “stretched” wave of identical period. Standard math states that the length of a wave is produced at the source and from that location remains unchanged until hitting a detector. i.e. the recessional velocity of the source determines the wavelength. Note that the (non-exponential) distance formula is used, where .
$\lambda_o = c \cdot \mathbf{T}$.

Figure 41-1. Creation and propagation of a λCDM light wave (stationary source):

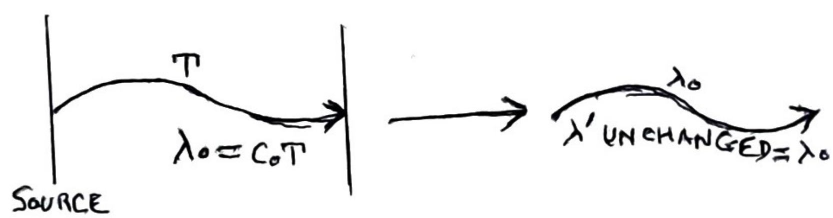
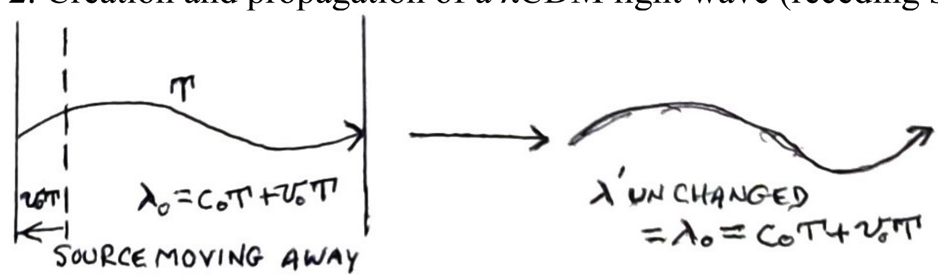


Figure 41-2. Creation and propagation of a λCDM light wave (receding source):



This wave model fundamentally differs from that of the XPXP model, in that an XPXP wave, like any length, exponentially expands during its “time of flight”.

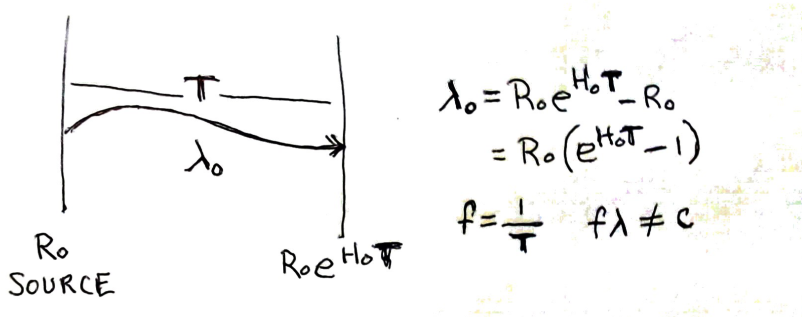
THE XPXP STRUCTURE OF AN ELECTROMAGNETIC WAVE :

To understand of the properties of an XPXP light wave, the logic and math is similar to that of the standard model - but exponential expansion principles must be applied.

The proposed method for determining the length of a light wave is the same as for any <u>length</u> in an XPXP universe, i.e. specify the two known exponential end positions, then subtract. By recognizing the XPXP nature of light, new astronomical principles may be applied to correct and simplify the measuring process as it now exists.

In Figure 41-3., an XPXP wave of light is shown being emitted from a properly moving source. It moves at light speed and goes through one cycle during the time interval **T** (the period). **T** remains constant for the life of the wave, but the length of the wave exponentially expands during the time of flight of the wave. It must be considered that a light wave moves at light speed relative to the expanding proper flow, and thereby increases in length relative to the flow. It is eventually detected (from the flow perspective) and has a longer wavelength.

Figure 41-3. An XPXP light wave with a period **T**



Note that a Maclaurin expansion of the expression for **λo** produces an expression **λo** ~ c · **T** , which is an approximation currently used in the λCDM model and is erroneously thought to be exact.

The wave moves at light speed ***<u>relative to the flow .</u>*** (see the propagation of light formula) It is defined by the period, the time interval necessary to traverse from Ro to R′. The frequency is 1/**T**. Once a light wave is created, it moves off at light speed and exponentially expands during its "time of flight" until it arrives at a detector where it is measured. The expansion of a light wave is **λo · e^2Hot**, while the proper expansion is **e^Hot**, so <u>light waves expand at e^Hot relative to</u> <u>the proper expansion</u>. To a proper observer, any light wavelength will expand by e^Hot until it is detected. THIS ALSO INDICATES THAT **<u>THE EXPANDED</u>**

<u>WAVELENGTH OF LIGHT RECEIVED BY A PROPER GALAXY FROM ANOTHER PROPER GALAXY WILL NOT CHANGE OVER TIME, SINCE THE LIGHT-TIME BETWEEN THEM IS UNCHANGING.</u> "e^Hot" (where t = "time of flight") is unchanging because the light-time interval between proper objects is unchanging (see previous work). This also suggests that, in an XPXP universe, <u>the night sky will not fade to black as predicted in the standard model universe.</u>

The light wavelength increases with respect to the Hubble flow during the time between the emission and the detection. At the detector, the wavelength received (λ') will be shifted toward the red end of the spectrum where $\lambda' = \lambda_0$ e^Hot . Since the expansion occurs in all directions, the redshift will apply in all cases, except rare peculiar sources.

If the source and the detector are both moving properly, the "time of flight", Δt, does not change(shown previously). This means that the redshift between proper galaxies does not change. However, the "time of flight" for light emitted from galaxies in <u>peculiar</u> motion will change with the v/c component of the exponent. Stars revolving in a spiral galaxy are peculiar relative to that galaxy and therefore the wavelength of light from those stars within the galaxy will shift. This corresponds to a "Doppler shift", in that it appears to be velocity dependent. Stars revolving around a galactic center will exhibit a blue or red shift relative to that center's galactic movement. (Figure 41-4 and Figure 41-5.) Stars moving away from the observer on one side will show a redshift, with a longer time of flight. A blueshift will occur on the opposite side. Obviously, the shift of the starlight within the galaxy is minimal in comparison to the cosmic shift of the galaxy as a whole.

Figure 41-4. A PECULIAR XPXP SOURCE RECEDING FROM DETECTOR

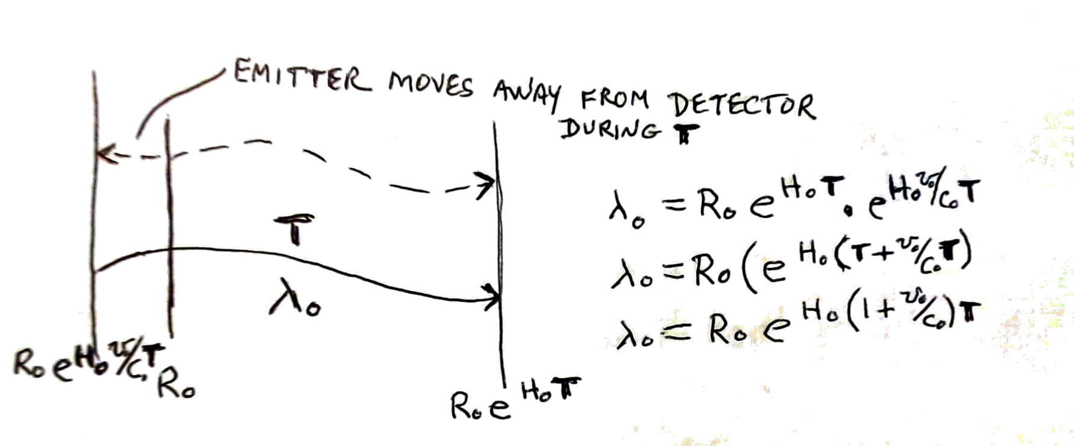
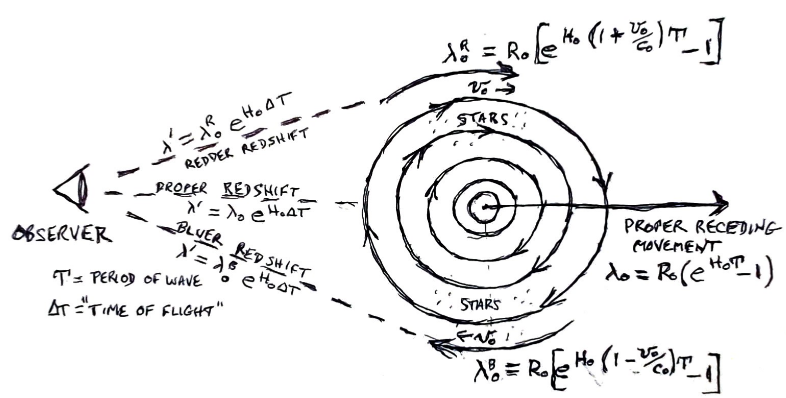


Figure 41-5.   Peculiar shift in wavelength of Stars within a Galaxy



The relationship between wavelength **λ** and frequency **υ** are not as perceived in an inertial frame, i.e. : $\boldsymbol{\lambda \cdot \upsilon \neq c}$ **and** $\boldsymbol{c \cdot \tau \neq \lambda}$ ($\boldsymbol{\tau}$ = period). These equations are approximations of the exact XPXP relationships.

Because the formula for XPXP light wavelength is:

$$\boldsymbol{\lambda_0 = R_0\,(e^{H_0\tau} - 1)}$$ where τ is the period,

the frequency (**υ**) and wavelength (**λ**) are not as straightforwardly related as thought today where **υ** x **λ** = c. Instead, **υ** x **λ** =1, and the relationship is as shown below. A MacLaurin approximation shows how the incorrect formula used today is an approximation of the correct XPXP formula:

MacLaurin:

$$\boldsymbol{\lambda = R_0\,(e^{H_0\tau} - 1)}$$
$$\boldsymbol{\lambda \approx R_0\,(H_0\tau + 1 - 1)}$$
$$\boldsymbol{\approx H_0 R_0\,\tau \approx C_0\,\tau}$$
$$\upsilon = 1/\tau \quad \text{therefore} \quad \lambda\,\upsilon \approx C_0$$

This demonstrates the distinction between (exact) XPXP values and the current (approximate) values for light waves. Approximate λCDM measurements are adequate for most astronomical purposes, but as technology improves, astronomers and cosmologists are dealing with increasingly large distances, times, and velocities. In order to thoroughly understand our universe, the XPXP model must be adopted. Such acceptance requires major mathematical changes in astronomy and physics in general, possibly leading to a better understanding of everything.

EQUATIONS OF MOTION OF THE UNIVERSE:

42AA   M.D. Earl 2023

XPXP REDSHIFT AND PECULIAR λ SHIFT

The wavelength of light (and all electromagnetic radiation) increases as it propagates through space. In the XPXP model, light moves at light speed relative to the proper expansion of the universe, which is itself moving at light speed with respect to a stationary universe. This relationship produces the effect that a proper observer measures light speed as having a constant value. During the propagation of a light wave through space, the length of the wave increases relative to the proper XPXP frame.

The result is that a light wave received at a distance from a source has lengthened during its flight, and this lengthening is detectable as a “shift” toward the red. This property provides a valuable method for measuring the universe. But a valid exponential mathematical expression for a light wave is derived by applying exponential principles, rather than inertial principles currently used.

Because the wavelength shift appears to correspond to the Doppler effect we see on earth, the expansion or contraction of light waves is attributed to the Doppler effect in the λCDM model, and is associated with the relative speed of the galaxy. In the Doppler math, the relative velocity of the source and detector affects the wavelength received by the detector. For extreme velocities, an expression for a “relativistic Doppler shift” has been formulated (using the Lorentz gamma) to determine velocities of more distant galaxies.

XPXP principles for light and its exponential movement must describe the change of light wavelength (and therefore frequency) at the detector. According to the XPXP model, the expansion of light waves is twofold.

First, because wavelength is a distance measurement, and it increases as a function of the propagation time interval during which the wave moves between the emitter and the detector, it causes the proper redshift. The λCDM Doppler effect is a function of relative velocity; in XPXP the travel time determines the effect. <u>The time interval between proper galaxies is unchanging</u> (shown previously), and accounts for the cosmic redshift. It predicts that the universe will look the same in the future as it does now. On the contrary, the standard model predicts that the galaxies will recede to darkness in the distant future.

Second, a shift in wavelength toward the blue or red in XPXP is seen as an effect of peculiar motion, evidenced because of relative motion of the source and detector. An example of such a peculiar shift occurs in the arms of spiral galaxies. The light-time interval of these galaxies determine the redshift of the galaxy as a whole, while the movement of the stars in the arms will be continuously changing relative to the galaxy, creating a blue or red shift. This is because the peculiar motion of the stars change the light-time interval. Peculiar movement represents an exponential vo/co time adjustment, to be shown below.

LIGHT AND PROPER MOTION:

As light propagates through space, it expands, but at a rate that exceeds the proper expansion of the Hubble flow. We observe light moving at "light speed" from our properly-moving frame of reference (also moving at "light speed"). The relationship between light and proper motion has been derived previously.

Light speed relative to a stationary universe = $2H_o R_0 e^{2H_o t}$

Proper velocity relative to a stationary universe = $H_o R_0 e^{H_o t}$

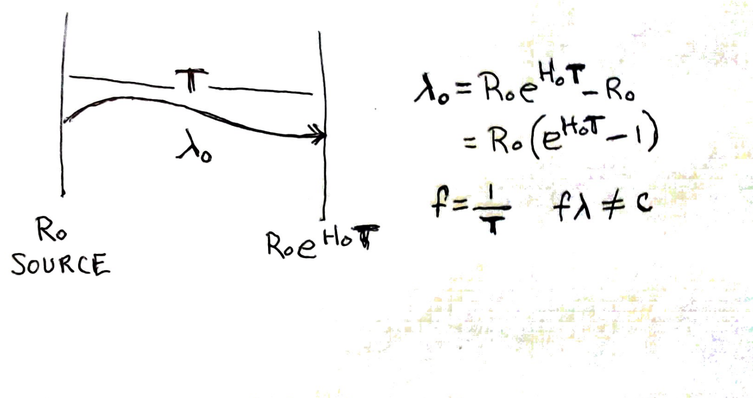
Light speed relative to the proper flow = $H_o R_0 e^{H_o t}$

In these expressions for motion, **t** determines distance, velocity and acceleration. During a time interval, the properties of both proper motion and light increase.

Proper and peculiar expansion rates are governed by an expansion factor **e^Hot** , wherein Ho is the universal exponential expansion (Hubble) constant. Light, however, has an exponential expansion constant of 2Ho, and therefore an expansion factor of **e^2Hot** . This is the mathematical result derived by assuming that light is viewed as moving at light speed by a proper observer (shown previously). This also mathematically explains a constant measurement of light speed from either a proper or peculiar frame.

The wavelength of light increases **<u>with respect to the cosmic flow</u>**, causing the universal redshift. A redshift is the resulting effect of the light-time difference between two positions in the proper flow and is unchanging (shown previously). The XPXP wavelength increase differs from the relativistic Doppler calculation which is currently used to determine the velocity and distance of remote galaxies.

FIGURE 42-1. Creation of a light wave from the perspective of a proper observer.



The wave of FIGURE 42-1. is produced in the cosmic flow, where:

$\lambda_0 = R_0\,(e^{H_0\tau} - 1)$ is the wavelength of light at the source.

τ is the period of the wave

$f = {}^{1}\!/_{\tau}$ is the frequency of the wave

To simplify, the light emission begins at Ro where t = 0

From FIGURE 42-1, an expression for a base wavelength at the source is:

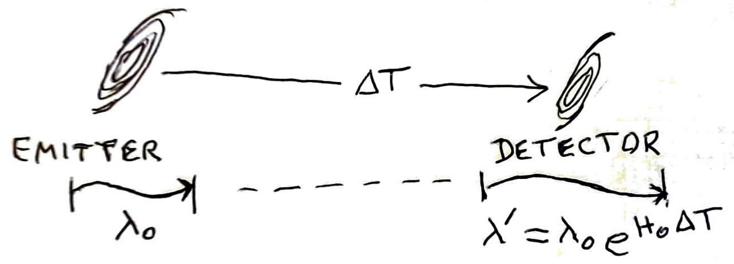
$$\lambda_0 = R_0\,(e^{H_0\tau} - 1)$$

Note that a Maclaurin approximation corresponds well with the current equation for light:

$$\lambda_0 \approx R_0\,(H_0\tau + 1 - 1) \approx H_0 R_0\,\tau \approx C_0\,\tau$$

After a wave is produced, it propagates at light speed relative to the proper frame, therein increasing by a factor of $e^{H_0\Delta t}$ where Δt is the "time of flight". A detector is located in the proper frame and detects the modified wavelength of: $\lambda' = \lambda_0\,e^{H_0\Delta t}$

FIGURE 42-2. Expansion of light wave



The expansion of a wave during its "flight" accounts for the cosmic redshift in an exponential universe, seen in FIGURE 42- 2 :

The λCDM model claims that, over sufficient time, the visible universe is increasing in volume and therefore the galaxies will eventually fade to obscurity. The XPXP universe refutes that notion, because the math indicates that <u>all</u> things are expanding exponentially, and the observer's view of the universe will expand, causing a substantially unchanged universe over time.

Furthermore, the XPXP model appears to logically be an "expansion from within" and a "big bang" is improbable.

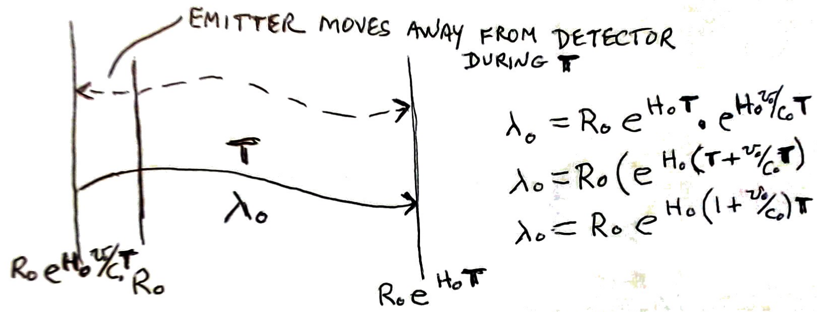
EXPONENTIAL RATIONALE FOR DOPPLER EFFECT

Consideration must be given for light transmission which occurs with the peculiar motion of the source or detector, or both. The cosmic expansion of light causes a cosmic redshift, expanding while moving relative to proper expansion. In a similar manner, peculiar motion will lengthen or shorten the wavelength. This movement more nearly corresponds to the Doppler effect, in that it is a function of relative motion. An explanation for these effects follows:

FIGURE 42-3. shows a difference between a wavelength produced by a proper source (as in FIGURE 42-1) and a wavelength produced by a source moving away peculiarly from the direction of the detector.

During τ, the source wave increases by $R_0 e^{H_0 (v_0/c_0)\tau}$, so that the wave now has the initial length of : $R_0 e^{H_0(1+(v_0/c_0))\tau}$ before beginning its expansion during its cosmic flight. The wave is lengthened (shifted to the red) as it is produced at the source, and thereafter expanded during flight.

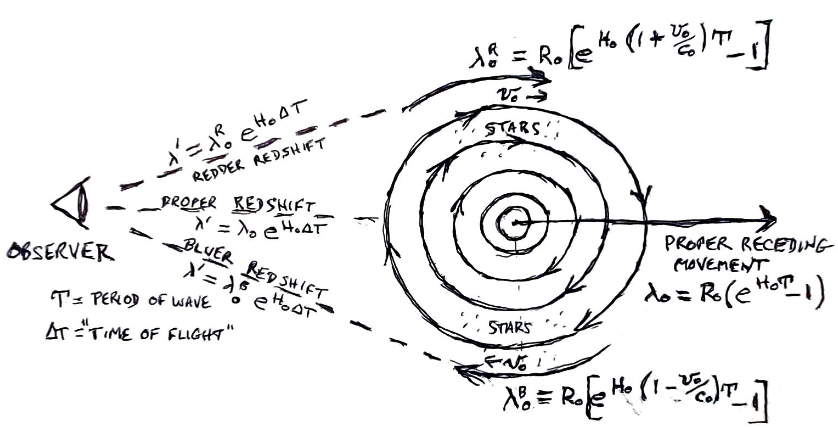
FIGURE 42-3. Peculiar source moves away from detector.



For a source moving toward the detector, (v_0 / c_0) is exponentially subtracted, resulting in a shortened wavelength, therefore a shift toward the blue. It can be seen that the cosmic redshift is dependent on the “time of flight”, whereas the peculiar shift is dependent on the relative peculiar velocity.

An illustration of light waves emitted by a spiral galaxy is shown in FIGURE 42-4. The galaxy as a whole is red shifted according to the light-time distance to the galaxy. Stars on either side are moving peculiarly toward the observer (blue-shifted) or away from the observer (red-shifted). Through a similar analysis of the shifts in the arms, it was determined that the stars beyond the bulge of these galaxies unexpectedly moved at a constant velocity, therefore leading to “dark matter”.

FIGURE 42-4. Stars rotating in a spiral galaxy



FINDING DISTANCE AND VELOCITY IN THE XPXP UNIVERSE

An understanding of the properties of XPXP light waves provides a simple method for distance and velocity measurement of remote galaxies.

STANDARD MODEL CALCULATIONS

The present-day methods of measurement in astronomy seem to be consistent, but are flawed in their approaches, which revert to their inertial roots. Parallax, Standard candles,etc. use a constant c as a coefficient for distance measures, and velocities are determined with standard or relativistic Doppler calculations. When examining these astronomical procedures, it is seen that all are incorrect in light of XPXP.

Astronomers presently compare an expanded wave from a galaxy with a known wave produced locally. By applying the relativistic Doppler effect, the speed of a distant galaxy is determined. A basic formula for relativistic frequency is:

$$freqency_{received} = \sqrt{\frac{c \pm v}{c \mp v}}\, freqency_{emitted}$$

where v = velocity of the galaxy and positive/negative is determined by the approach or recession of the galaxy.

The relativistic Doppler equation is then solved for v, and an associated distance is acquired by other means(e.g. luminosity).

The derivation of relativistic doppler shift is a calculation using the standard inertial math and logic of the λCDM model. It is therefore suggested that the relativistic Doppler shift is incorrect, and this is why the Hubble/LeMaitre law does not conform with the distance/velocity plot of known remote galaxies.

XPXP CALCULATIONS

The exponential math of the XPXP model is consistent and logical. It is seen that, during the time of flight of a light wave, the wave increases in length by a factor of $e^{H_0 \Delta t}$ so that $\lambda' = \lambda_0 e^{H_0 \Delta t}$ where Δt = "time of flight"
The distance between an observer in a proper position (at t = 0) to a galaxy is $R = R_0 e^{H_0 \Delta t}$. By measuring the "**z**" of a galaxy, the following calculation results in the XPXP distance.

$$\lambda' = \lambda_0 e^{H_0 \Delta t}$$

$$R = R_0 e^{H_0 \Delta t}$$

$$\frac{\lambda'}{\lambda_0} = \frac{R}{R_0}$$

$$z = \frac{\Delta\lambda}{\lambda_0} = \frac{\lambda' - \lambda_0}{\lambda_0} = \frac{\lambda'}{\lambda_0} - 1 = \frac{R}{R_0} - 1$$

$$z + 1 = \frac{\lambda'}{\lambda_0} = \frac{R}{R_0}$$

$$\frac{R}{R_0} = z + 1$$

$$R = R_0(z + 1)$$

The velocity of this galaxy is the derivative of R, which is:

$$H_0 R = H_0 R_0 e^{H_0 \Delta t}$$

Therefore, XPXP provides a consistent process for distance measurement of the galaxies of the universe. XPXP replaces the (incorrect) non-exponential mathematics of the λCDM model.

EQUATIONS OF MOTION OF THE UNIVERSE:

PECULIAR DECELERATION IN THE EXPONENTIALLY EXPANDING (XPXP) UNIVERSE

50AA M. D. Earl 2023

Although XPXP mathematically describes a logical universe, it is difficult to prove experimentally. Just as special relativity is significant only at extreme speeds, XPXP is not noticeable in common situations. XPXP is dependent upon e^Hot which approximates 1 (because Ho is extremely small and e^0 = 1). There are, however, "anomalies" which occur in space that are recently noticed as the result of improvements in technology and exploration. These include flyby anomalies and deceleration of long distance spaceprobes. An explanation for these anomalies is not possible in the λCDM model... but is expected in the XPXP model.

Most galaxies move properly, i.e., they obey the Hubble/Lemaitre law, (H/L), and are visible only telescopically. Motion that we normally see is therefore peculiar, and the properties of such peculiar movement must agree with observations and conform to an XPXP universe.

On rare occasions, peculiarly moving spacecraft have shown an unexplainable deceleration. It will be shown that in the XPXP model, during some time interval, a spacecraft should fall short of the distance expected to be reached in the λCDM model. This has been seen as anomalous in several instances, the most notable being the deceleration of approximately 10^-10 m/sec² (~ -Hoc) of two pioneer probes sent outside the solar system early in the space program, in opposite directions. Additionally, the shut down of the New Horizons flyby of Pluto in 2015 can be attributed to this same deceleration. A discussion regarding this shutdown is shown in a you tube video. The "deceleration" is, in fact, not a deceleration, but instead an effect showing that, although peculiar motions are accelerating, they are not accelerating at a rate close to that of the cosmic accelerated expansion. This expansion is presently unrecognized, so the deceleration remains unexplained.

THE λCDM MODEL FOR MOTION

The unaccelerated λCDM model asserts that all motion is treated in the same manner. Distance is defined by a simple formula: distance = velocity X time.

If a "target" is located at a constant distance D from an initial "stationary" position, then, for any object having a constant velocity v_o :

$$D = \mathbf{v}_o \, \Delta t$$

All non-relativistic λCDM motions obey this equation, so that:

for light- $D = c_o \, \Delta t_{light}$ for an object- $D = \mathbf{v}_o \, \Delta t_{object}$

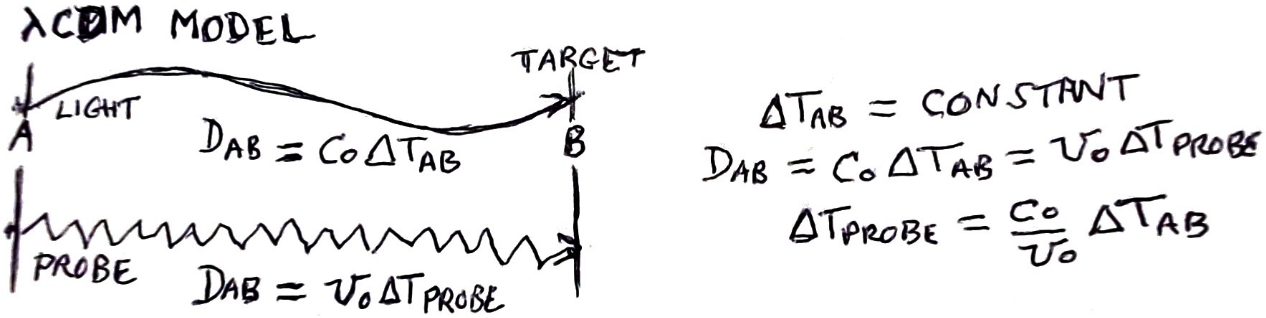
To find a λCDM comparison between the time it takes for light to reach a position and the time for an object to reach the same position:

equate distances: $c_o \, \Delta t_{light} = \mathbf{v}_o \, \Delta t_{object}$

solve for peculiar time: $\Delta t_{object} = (c_o / \mathbf{v}_o) \, \Delta t_{light}$

Therefore, in the λCDM model, a spacecraft should reach a target in the time that light takes to reach there, multiplied by c_o/v_o. To measure a distance in space, the time it takes for a light signal to traverse the distance must first be determined. This is the light-time distance to the target. It must be noted that an accurate distance measurement requires an accurate method to transmit and receive a light signal (or other electromagnetic radiation) from or to a "target". According to the λCDM model, once a rest distance is measured, it is believed to be unchanging thereafter. (see Figure 50-1.)

Figure 50-1. λCDM DISTANCE



If a spacecraft does not reach a target in the calculated time, the standard model has no explanation. But the XPXP model asserts that the spacecraft will fall short, interpreted as a deceleration of approximately Hoc in the λCDM model. This will be shown, but a further understanding of XPXP peculiar motion is necessary.

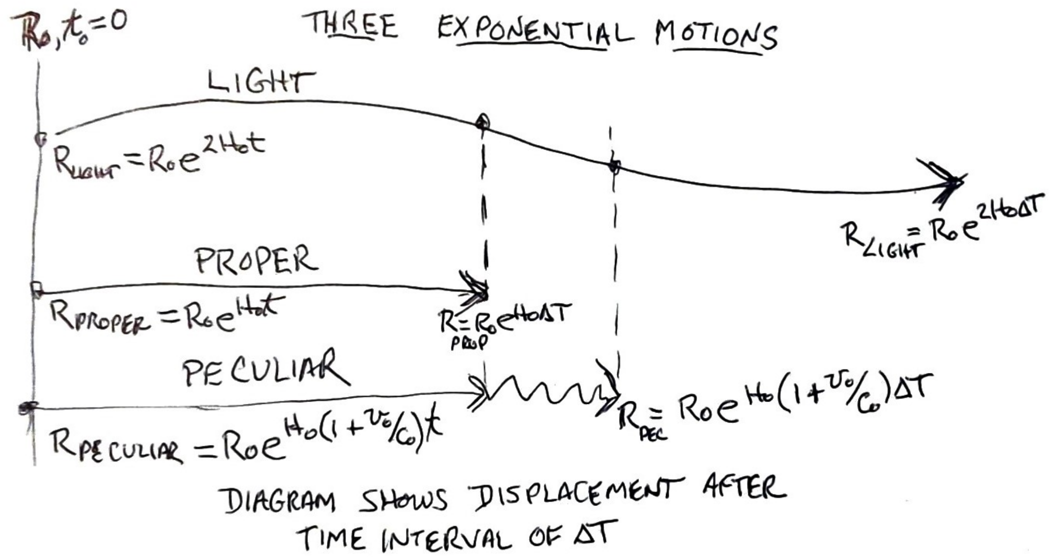
THE THREE TYPES OF XPXP MOTION

The standard model treats all motion in the same manner, but the methods are based on scientific conclusions established on the surface of the Earth. Newton's laws work well, even in the space program. To understand XPXP motion, it must be seen as an alternative form of universal movement.

Motion in the XPXP cosmos exists in three forms: Light, proper, and peculiar. By examining the three forms of motion in the exponential model, a mathematical method for describing those motions may be established, i.e., relative speeds, distances, and accelerations. It must be first understood that all XPXP values are instantaneous, and that the methods of the standard model must be questioned for all expressions.

The expression for proper motion was derived directly from the H/L law (shown previously). It is notable that proper expansion is occurring at light speed . But why not? Since we, as proper observers, see light receding at the speed of light, it seems inconceivable that light speed is actually "twice" that of the flow. It is similar to the proposition made to the ancients that the earth was moving around the sun at an inconceivable speed of 4 miles per second. The XPXP expression for light is derived by positioning an imagined observer in proper motion (shown previously). The expression for peculiar motion was found by resolving various mathematical situations for objects moving relative to other motions. It has shown to be successful in this regard. An examination of the three XPXP motions is initiated by determining the distance that each travels from a common exponentially expanding starting position (at t=0) during an equal time interval, as shown in Figure 50-2.

FIGURE 50-2. XPXP motions



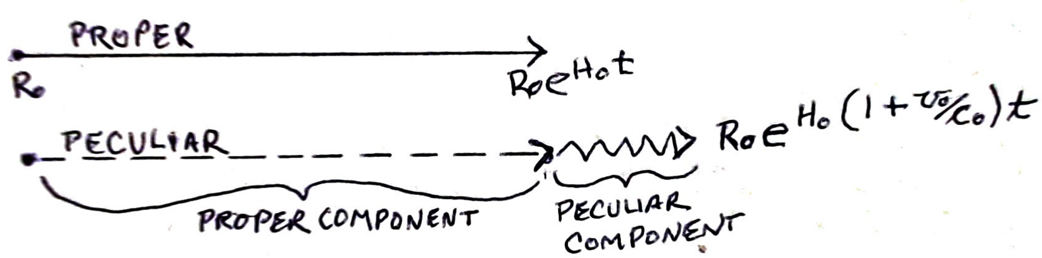
It has been established in the XPXP math of the cosmic flow, that the light-time distance between proper galaxies is unchanging. (see "time separation of proper galaxies") Likewise, the light-time distance between proper spatial positions is constant, i.e., the space between galaxies is expanding exponentially. Although the distance between these positions increases, the light velocity also exponentially increases (both by e^Hot). This results in an unchanging relative light speed measurement. This seems counterintuitive. It has important repercussions - which began with the erroneous assumption that the universal expansion was not accelerating. Only recently has it been proven that the universal expansion is indeed accelerating, calling for "dark energy" to substantiate the λCDM model. XPXP states that **the universal expansion is not only accelerating, but this acceleration is Hoc = Hoce^Hot** (no dark energy required).

THE XPXP EXPRESSION FOR PECULIAR MOTION

XPXP peculiar motion differs in mathematical form from XPXP proper motion and XPXP light. A peculiar object must be considered to be moving relative to the proper expansion of the universe. An observer in a chair sees an airplane passing by, that motion must both conform with the expansion of the observer and move relative to that observer. With this in mind, peculiar motion is proposed to have two XP components: one which is consistent with the proper universal expansion, and another describing the peculiar motion with respect to the proper universal expansion. Both components comply with the established exponential mathematical procedures.

The proper component of the total peculiar motion conforms with the expansion of the properly expanding frame. Thereafter, a peculiar component of the object's motion must be contrasted to the properly accelerating spatial expansion. That is, the peculiar object is moving through the expanding space, but accelerating at a lesser rate. Figure 50-3. illustrates peculiar motion:

Figure 50-3.



From figure 50-2, a mathematical expression for <u>total</u> peculiar motion is:

$$\boldsymbol{R}_{peculiar} = \boldsymbol{R}_0\, \boldsymbol{e}^{H_0(1+(v_0/c_0))\Delta t_{peculiar}}$$

It is comprised of two multiplicative components:

$$\boldsymbol{R}_{peculiar} = \boldsymbol{R}_0\, (\boldsymbol{e}^{H_0(1)\Delta t_{peculiar}} \bullet \boldsymbol{e}^{H_0(v_0/c_0)\Delta t_{peculiar}})$$

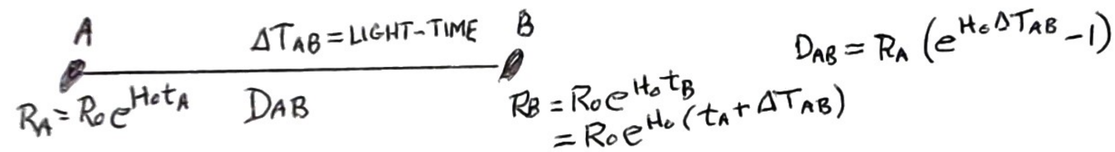
proper component ***peculiar component***

The proper component of the total peculiar motion conforms with the proper universal expansion, allowing both to mathematically cancel. The peculiar component represents the movement of the peculiar object with respect to the proper universal flow. It can be imagined that an observer who is unaware of their own proper motion will see a peculiar object moving at some speed (less than light speed) past them.

A comparison of the distances between a proper expansion and the movement of a peculiar object through the proper expansion should show a shortfall of the expected distance made by the peculiar object. This is expected because the peculiar object is accelerating less than the proper expansion is accelerating. In actual practice, only extreme distances and times will show this shortfall, but they have appeared in the space program. On those rare occasions, they have been termed "anomalies". Light, of course, continuously accelerates maximally at $H_o c_o e$^$H_o t$ with respect to proper motion.

In an example of the XPXP model regarding peculiar motion, a "target", R_B, is located a known distance D_{AB} from a starting position R_A. (Figure 50- 4).

Figure 50- 4. INITIAL XPXP CONDITIONS FOR FINDING DISTANCE



The method of measurement of D_{AB} is to determine time for light (or any other electromagnetic radiation) emitted from or returned to a receiver located at R_A. It should be kept in mind that this measurement, in the XPXP model, represents an instantaneous distance that will increase... but with an unchanging light-time interval representing an expanded distance at some future time. Because the time that light takes to traverse the distance is constant in both the λCDM and the XPXP calculations, it can be seen that the standard model has been preferred because of its inherent simplicity.

A one-way measurement of the light-time interval ΔT_{AB} describes the proper expansion distance relative to a stationary universe as presented in the H/L Law. ΔT_{AB} is unchanging during the expansion even though the distance increases (shown previously).

In the λCDM model, a spacecraft launched at t=0 is expected to reach the target when the time of flight is Δt, where

$$\Delta t = (c_o / v_o) (\Delta T_{AB}).$$

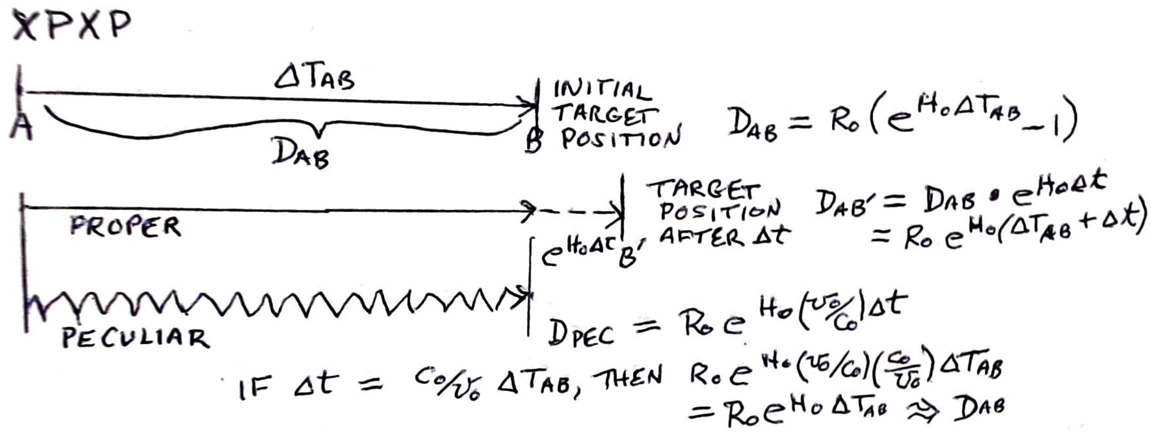
(see above)

This math and logic of the standard model assumes no accelerated expansion.

In contrast to the math and logic of the standard model, the XPXP model says that during an expected travel time of $(c_o / v_o) \cdot (\Delta T_{AB})$, the distance to the target expands. (Figure 50- 4.) If $c_o = v_o$, then "the time of flight" is ΔT_{AB}, which is consistent.

Figure 50-5. illustrates that, by assigning a common starting position for both the universal expansion and the peculiar motion, a comparison of the <u>positions</u> after some Δt will show incongruity. This is because the spatial expansion and the peculiar motion are accelerated at different rates.

Figure 50-5.



The peculiar component of the total peculiar motion of the spacecraft moves at an exponentially increasing velocity which is accelerating at less than the proper expansion acceleration of the space through which it moves. The values of the peculiar velocity and acceleration are dependent upon the peculiar exponent, which is a fraction - ((vo /co) Hot) - of the universal expansion exponent Hot. The initial target distance is found by subtraction of the initial starting proper position, where t=0, from the initial proper position of the target. It is important that <u>position</u> is distinguished from <u>distance</u> in XPXP. Although the proper expansion is occurring at light speed, and instantaneous positions are determined by the H/L law, distances are subtractive processes and account for “normal” situations which closely approximate the λCDM values.

In the illustration (Figure 50- 5.), a proper target is located some *known* light-time distance from the starting position. It may be noted that finding the exact distance to heavenly objects is not a simple matter. A signal time sent and returned by a distant probe, then divided by 2, presents the best method for distance. But distance to planets cannot presently be measured in this fashion. The ephemeris for a planet provides a good approximation. Figure 50-5. compares the expectations of the of the λCDM model and the XPXP model. According to XPXP, although the target appears to be stationary, it is properly expanding. The measure of the distance from t=0 will be exponentially expanded after some Δt. After the Δt time interval, the <u>distance</u> from the starting position is given by the initial distance and an increased expansion distance that occurs during Δt:

initial distance:

$$D_{AB} = Ro(e^{Ho(\Delta T_{AB})} - 1)$$

expanded distance:

$$D'_{AB} = R_0(e^{Ho(\Delta T_{AB})} - 1)e^{Ho(t_{proper})}$$

Under the λCDM model, the predicted time to reach the target is: (co / vo) ΔT_{AB}.

But under the XPXP model, there is a different result. While the probe is moving toward the target, the space and target are exponentially expanding ever so slightly with respect to the starting position. However, the time that a light signal traverses the distance remains unchanged. The peculiar motion is also accelerating during the time of flight, but (see acceleration math below) the acceleration of the peculiar component of the total peculiar motion is less than that of proper motion. The peculiar probe reaches the original position of the target, but the target has expanded to a new position B′. The light-time distance to this new position from the starting position remains **ΔT_{AB}** - therefore standard model observers believe that an expansion does not exist. Nevertheless, the probe does not reach its target.

The XPXP expanded distance to target: $R_{B'} = R_0 e^{H_0 \Delta T'_{AB}} e^{H_0 \Delta t}$

It has been shown that the light-time separation of proper positions is constant (see "time separation of proper galaxies"), therefore A→ B′ = ΔT_{AB}. Standard math cannot justify the constant proper separation time of the XPXP model.

The displacement of a peculiar probe during any Δt is: $R_0 e^{H_0(v_0/c_0)\Delta t}$

Substituting the expected λCDM arrival time, $\Delta t = (c_0/v_0)\Delta T_{AB}$, into the peculiar expression:

$$R_0 e^{H_0(v_0/c_0)(c_0/v_0)\Delta T_{AB}} = R_0 e^{H_0 \Delta T_{AB}}$$

, which is the initial light-time distance to the target. The shortfall **Ro** $e^{H_0 \Delta t_{proper}}$ of the spacecraft is caused by the expansion of the target distance during the time of flight. It is not discernible in most common situations. A deceleration of $H_o c_o\, e^{H_0 \Delta t}$ of a peculiar object is approximately $-10^{-10} m/\sec^2$. The most notable unexplainable occurrence of this in the space program is the "pioneer anomaly".

Therefore, acceleration of a peculiar object is typically insignificant in comparison to the unrecognized acceleration of the universe, so that a peculiar object seems to decelerate (to those that do not realize the XP accelerated expansion of the cosmos.)

Comparing proper and peculiar radial values:

Proper

$$R = R_0 e^{H_0 \Delta t}$$

$$V_R = H_0 R_0 e^{H_0 \Delta t}$$

$$A_R = H_0^2 R_0 e^{H_0 \Delta t} = H_0 C_0 e^{H_0 \Delta t}$$

Peculiar

$$R = R_0 e^{H_0 (v_o / c_o) \Delta t}$$

$$V_R = H_0 (v_o / c_o) R_0 e^{H_0 (v_o / c_o) \Delta t} = v_o e^{(v_o / R_o) \Delta t}$$

$$A_R = (v_0^2 / R_0) e^{H_0 (v_o / c_o) \Delta t} = (v_0^2 / R_0) e^{(v_o / R_o) \Delta t}$$

This indicates that the exponential factor for the expression for acceleration of the cosmos (proper acceleration) is substantially greater than that for peculiar motion. At present, because the acceleration of the cosmos goes unrecognized, a typical deep space probe may <u>appear</u> to decelerate. In reality, the deceleration is produced because the acceleration of the (peculiar) probe is significantly less than the cosmic acceleration. On the rare occasions when the properties of probes can be measured at a great distance, they display an approximate negative $H_o c$ acceleration, which is attributable to the unrealized cosmic acceleration rather than a mysterious "deceleration".

EQUATIONS OF MOTION OF THE UNIVERSE:

PERCEIVED $H_o c$ DECELERATION OF PECULIAR OBJECTS

51AA M.D.Earl 2023

Most galaxies conform to the Hubble/LeMaitre relationship. A precept of the exponential expansion theory (XPXP) is that it occurs on all scales. But it goes unrealized.

After consideration, it should be recognized that most motion that we observe is peculiar. Not until the improved technology of the space program have anomalous effects of XPXP begun to appear.

The exponential expansion is easily observable only in the Hubble flow, where the solution to the differential equation of the Hubble/Lemaitre Law, e^Hot, is significant. Only recently has evidence appeared in the form of inexplicable "anomalies" in the velocity and position of space probes during flybys and deep space explorations. The inability of the standard model to explain these anomalies is the result of non-exponential (inertial) mathematics.

The mathematical methods of relativity must be abandoned to successfully explain an

XPXP universe. Only with an understanding of XPXP math can a comparison be made between the two models. It is contended that the very basis of special relativity, the inertial calculations of Lorentz et.al., are incorrect, and therefore make relativity an approximation at best. As such, those well-versed in the principles of relativity are actually at a disadvantage when grasping the principles of XPXP. It should be expected that a stubborn resistance to such a new concept will be seen in those who have substantially dedicated their lives to the principles of relativity.

That being said, visualizing interactions within an XPXP universe is difficult, because we are so attuned to our inertial roots.

PECULIAR MOTION:

The mathematical form for position, velocity and acceleration of peculiar motion differs from that of both proper expansion and light. The information below shows the position and velocity for light, the proper flow, and peculiar motion relative to a universal "rest frame". To simplify, the expansion is described positively and in one direction.

This leads to these positions and velocities :

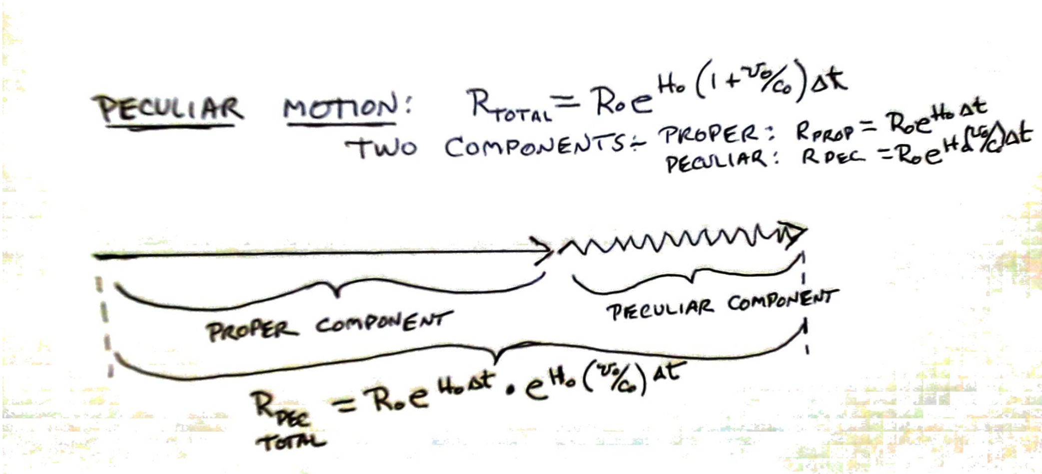
	POSITION	VELOCITY
Proper motion:	$R_0 e^{H_o t}$	$H_o R_0 e^{H_o t}$
Light motion:	$R_0 e^{2H_o t}$	$2H_o R_0 e^{2H_o t}$
Peculiar motion (total)	$R = R_0 e^{H_0(1+v_0/c_0)t}$	$H_0 R_0 (1 + v_0/c_0) e^{H_0(1+v_0/c_0)t} = (H_0 R_0 + v_0)\, e^{H_0(1+v_0/c_0)t}$ where v_0 and c_0 are constants
—		
Peculiar motion (peculiar component)	$R = R_0 e^{H_0(v_0/c_0)t}$	$H_0 R_0 (v_0/c_0) e^{H_0(v_0/c_0)t}$

The form of the exponent for peculiar motion and the illustration of figure 51-1 shows that the total peculiar motion for an object is comprised of two components. A peculiar object must expand with the universal expansion (the proper component) while simultaneously moving relative to the proper background expansion at a rate less than light speed (the peculiar component). A proper observer therefore sees a peculiar object moving away from him/her. As previously shown, actions in an XPXP universe are multiplicative:

$$R_0 e^{H_o(1)t} e^{H_o(v/c)t}$$

Where the first component describes the universal expansion and the second component is peculiar, as in Figure 51-1:

Figure 51-1



The universal expansion acceleration is greater than that of a peculiar object moving at a velocity less than light speed is found by taking the second time derivative for each expression, shown below. The peculiar object moves with respect to the flow, but with a lower acceleration. The calculation suggests that only large distance and time measurements will show a discrepancy, on the order of 10^-10 m/sec² because vo is insignificant relative to co.

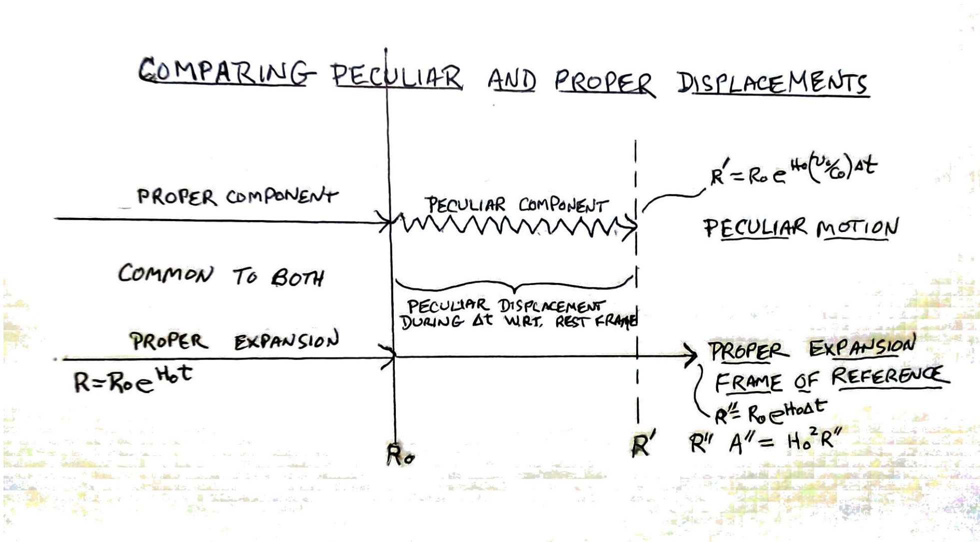
Proper acceleration: $$H_o{}^2 R_0 e^{H_o t} = H_o c_0 e^{H_0 t}$$

Peculiar acceleration : (component) $$H_0 v_0 (v_0/c_0) e^{H_0 (v_0/c_0)t} = (v_0{}^2 / R_0) e^{H_0 (v_0/c_0)t}$$

By comparing displacement from an arbitrary initial proper position, the motion of a peculiar object and the exponential expansion of the space that it occupies will indicate what appears to be a deceleration. Both the peculiar object and the space surrounding it are exponentially accelerating, but at different rates. Since a proper observer is also properly accelerating in an XPXP universe (but unaware of it), the peculiar object appears to be infinitesimally decelerating.

Currently, a distance measurement to a space probe is simply $c_o \Delta t$, where c_o is constant (speed of light), and the exponential expansion of space is unrecognized. The XPXP theory contends that $c_o \Delta t$ is an approximation of the true distance since the spatial background expands as time progresses. For most intents and purposes, this approximation suffices, but more precise measurements require some exponential math (methods shown previously).

Figure 51-2.



In Figure 51-2, it can be seen that the proper expansion "common to both", may be disregarded. Therefore, by examining the peculiar component of the total peculiar motion with respect to the properly expanding frame, a comparison may be made.

The distance between Ro and R′ represents the peculiar displacement during the time interval Δt. It is the peculiar component of the total peculiar motion.

But, while the peculiar object is displacing, the proper frame is expanding, as represented by the distance from Ro to R".

The expectation, in the standard model, is that the peculiar object will reach R′ after a time interval of $(c_o/v_o)\,\Delta T$, where ΔT is the light-time distance to R′. ΔT does not change, since Ro and R′ are both proper positions, and it has been established that the light-time interval between proper galaxies is unchanging. The "time of flight" of the peculiar object also represents the time that R′ expands to a new position R". In the standard model, the calculation for the "time of flight" for the peculiar object is:

$$v_o\,\Delta T_{probe} = c_o\,\Delta T_{light}$$

$$\Delta T_{probe} = (c_o / v_o)\;\Delta T_{light}$$

The distance from R′ to R" is R′e^HoΔt. This indicates that the proper frame is accelerating (second time derivative) at $H_o c_0\, e^{H_0 t}$ compared to the acceleration $(v_0^2 / R_0)\, e^{H_0 (v_0/c_0) t}$ of the peculiar object. An observer in the proper frame would see a minuscule shortfall in the expected position of the peculiar object, interpreted as a deceleration of the peculiar object. This phenomenon is measurable only at large distances and speeds (such as in deep-space probes) and has yet to be recognized.

As an example (see figure 3), a stationary object located at position B is measured to be a distance D_{AB} by a light signal detected as being ΔT_{light} away from an observer at position A. The λCDM model considers the light-travel time to the object as constant, because the distance is determined using $D_{AB} = c \times \Delta T_{light}$, and the distance does not change. Accordingly, at some Δt later, the distance remains unchanged.

However, in the XPXP model, the framework of the space expands properly over time, so that D_{AB} increases to D_{AB} x $e^{H_0 \Delta t}$ after Δt .

Because Δt is the time interval that the probe needs to arrive at the target in the λCDM model, where $\Delta t = (c_o / v_o)\ \Delta T_{light}$, it is less than the time necessary for the probe to actually reach the target.

GRAVITY...
EXPONENTIAL EXPANSION OF CONCENTRATED MASSES

90AA M.D. Earl

The unique character of the theory of exponential expansion (XPXP) is that it provides a general principle that applies to all cosmic phenomena. A convincing aspect of the theory is that it mathematically describes gravitation as an exponential expansion, both internally and externally, of a concentrated mass. But how can that be? Intuitively, since we live on the surface of a concentrated mass, gravity seems to be the opposite of an expansion. It may help to imagine that an "attraction" is really the inability of an object to "keep up with" an unrealized exponential spatial expansion.

Gravitation is one form of XPXP. The cosmic flow and spiral galaxies are others, also addressed here. (See "Embodiments of exponential expansion")- to see the simple differences between the three.

Under the λCDM model, there is no direct correlation between the expanding cosmos and gravitation, except that gravitation was predicted by many to be a braking force for the universal expansion. It was a surprising discovery that not only was the universal expansion not slowing, it was actually accelerating. An explanation was suggested that an undetectable "dark energy" exists, which counteracts gravity. An understanding of XPXP will show a logical explanation of universal acceleration that is consistent for both gravitation and universal expansion.

XPXP for the Hubble flow is derived from the Hubble/LeMaitre (H/L) Law, based on Hubble's direct observations of galactic movement in the universe. The exponential nature of the H/L Law has been disregarded because it mathematically conflicts with the established Standard Model. Ho must be constant if the universal expansion is exponential, and everyone "knows" that Ho is not constant. That conclusion is <u>incorrect</u> because it is based upon the math and measurements of the standard model.

In the proposed XPXP model, the spatial expansion created by matter causes acceleration of masses traveling through that spatial expansion. Expanding space may be created by a variety of matter distributions- from the universe as a whole to small masses. In a manner similar to relativity: "Matter creates spatial expansion fields, and spatial expansion fields tell matter how to behave".

Presently, the gravitational laws of Newton and Einstein are considered to be universal, existing wherever matter exists. But the unanticipated discovery of the acceleration of the universe required a correction to the standard model... dark energy. Additionally, standard model gravitational principles do not explain the constant velocity of stars in the arms of spiral galaxies, requiring...dark matter.

Consequently, it appears that matter distributions other than concentrated masses fail as valid examples of gravitation. It is unreasonable to assume that the rules derived on the surface of the earth by Newton and Einstein automatically extend to all universal situations.

It should be noted that XPXP analyses of embodiments of an expansion are structural, representing instantaneous situations. After any time interval all values change, including those of the observer.

XPXP APPLIES TO ALL MATTER DISTRIBUTIONS

A postulate of the exponential expansion theory is that XPXP occurs wherever matter is present. The quantity and distribution of the matter determines the nature of the expansion. The general XPXP principles therefore apply to both the cosmic flow and gravity. It is proposed that Newton/Einstein gravitation is a local embodiment of exponential expansion, and "gravity" is present only when matter is concentrated.

The exponential expansion (XPXP) of concentrated matter differs from that of the free galaxies of the Hubble flow. Closely-spaced matter interacts with adjacent, closely-spaced matter. Because matter expands and produces spatial expansion, the expansion of adjacent matter is inhibited and affects the overall expansion of the matter. This conflict suggests that matter confined within a concentrated mass expands at a lesser rate than the volume expands. There are two subsequent internal effects produced: 1) the density within the sphere decreases as the radius increases and 2) the conflicted internal expansion results in a matter-energy conversion, releasing heat and other forms of energy. This conversion is consistent with Einstein's $E=MC^2$.

A "surface" is produced when the sphere runs out of matter, and Mo and Vo are defined, after which only a spatial expansion occurs. This spatial expansion is an exponential expansion of the volume of the surrounding space.

An ideal exponential expansion of a concentrated mass should have several observable characteristics:

- An exponentially expanding sphere having a substantially defined surface.
- A massless space surrounding the spherical mass displaying Newton/Einstein gravitational properties, e.g., a negative inverse-squared radial acceleration
- Internally, volumetric increasing spherical "shells" which decrease in density ρ outwardly, and reach a minimum value ρo at the surface, representing the average density for the entire sphere.

THE EXPANSION OF CONCENTRATED MATTER ACTS IN TWO WAYS...
INTERNAL (UNTIL THE SURFACE) AND EXTERNAL (BEYOND THE SURFACE)

Exponential math describes both internal and external expansion of concentrated matter. Internal exponential expansion is matter-induced and is analogous to the cosmic flow. But it differs from the cosmic expansion in that the expansion of internal matter is obstructed by adjacent expanding matter. This results in an inhibition of the exponentially expanding mass. Externally, where no further matter exists, the expansion takes a significantly different form: an exponential spatial expansion only, showing the properties of Newtonian/Einsteinian gravitation. It should be again noted that XPXP reveals that "gravitation" is limited to concentrated matter.

Exponential expansion solves the galaxy rotation problem without adding (non-existent) dark matter. The discovery of the "flattening of the velocity curve", wherein the stars move at an unexpected constant velocity in the arms of spiral galaxies is seen as evidence for "dark matter" under the standard model. A dark matter halo seemingly explains the anomalous speed of those outer stars... but such dark matter cannot be detected.

PART 1 - INTERNAL XPXP OF CONCENTRATED MASSES

An examination of the exponential expansion of a concentrated mass begins with a comparison to the cosmic flow.

The Hubble flow: M=Mo e^3Hot

V = Vo e^3Hot therefore:

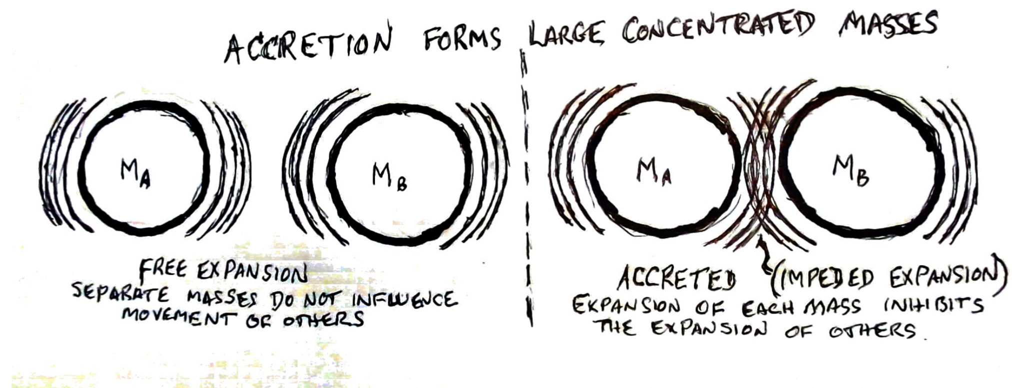
density constant = Mo/Vo

$$H_O = \frac{\sqrt{G_E \rho_0}}{3}$$

The logic and math of the equations of motion in the Hubble flow also pertain to both the internal and external expansion of concentrations of matter. However, concentrated matter is distinguished from other matter distributions in that internal matter is in close proximity to adjacent internal matter. It is proposed that all matter within a body creates an exponential volumetric expansion, just as the matter of the universe creates the accelerating volumetric spatial expansion field of the Hubble flow. In the universe, particles (galaxies/stars) of the XPXP universe have substantially no effect on each other. In this cosmic "free expansion", the volume and mass of the universe both expand unimpeded, thereby creating a constant universal density on a large scale.

But within a concentrated mass, accreted matter particles create spatial acceleration fields which conflict with expansion fields of adjacent matter. Figure 90- 1. shows this process, wherein the spatial acceleration fields created by two particles are in conflict and therefore the particles accelerate toward each other and eventually accrete to form a larger mass. Devoid of any other forces, the combined masses continue to expand and remain together and the accelerative forces offset. This process accounts for the accretion of matter to form planets, etc., and the interaction is wrongly interpreted as being caused by a pull of gravity. It can be imagined that an observer who is not aware of an expansion, could consider the effect an "attractive" force. It is difficult for humans to imagine an expansion, instead of a simple "pull" of gravity.

FIGURE 90-1



The exponential expansion process continues in all directions but is impeded by surrounding matter. This resistance affects the expansion of the total mass, while the expansion of the volume is unimpeded. This process produces a radially decreasing internal density.

The spatial volume of concentrated matter exponentially expands in the same manner as the universal expansion, i.e. proportionally to R^3.

In the Hubble flow the galaxies do not interact, and therefore are in "free expansion" and the expansion of matter is proportional to the cube of the radius, while the spatial volume also expands proportionately to the cube of the radius. This relationship produces a constant universal density, wherein $\rho o = Mo/Vo$ and therefore produces a constant Ho. The effect of particle interaction creates a distinct difference between the Hubble Flow expansion and the expansion of a concentrated mass.

ENERGY-MASS RELATIONSHIP IN XPXP

Before analyzing the internal expansion of concentrated masses, it should be noted that the obstruction of the expansion of concentrated matter appears to produce a mass-energy conversion. It is known that temperature and pressure increase when descending into planets and stars. On earth, the mantle and core are clearly at higher temperatures and pressures than the crust. There is reason to believe that it is true for all concentrated universal bodies.

A simple Newtonian calculation below shows XPXP consistent with E=MC^2. It is proposed that a mass/energy conversion occurs within concentrated masses accounting for the high temperatures and pressures observed. The XPXP theory maintains that both matter and space expand as a natural process. Equations of Newtonian mechanics may be applied to create a situation that causes a mass to differ from the cosmic expansion. Energy must be applied to a mass which is expanding within the proper flow to prevent that mass from moving in accordance with the flow. That energy is interpreted as the energy of the motion, and bringing it to "rest" is a method to determine the total energy of the motion. The "free expansion" of the Hubble flow provides a model that is as simple as possible. Imagining the work (energy) necessary to stop an object from expanding in the Hubble flow produces an expression showing a relationship between energy and mass as seen below:

NEWTONIAN EXPRESSIONS: (Second Law) $\mathbf{F = M \cdot A}$

Force = Mass x Acceleration

(Work = Energy) $\mathbf{E = F \cdot D}$

Energy = Force x Distance

$E = (M \cdot A) \cdot D$

The corresponding expressions in XPXP:

R = Distance = Roe^{Hot}

M = Mass = $Mo\, e^{3Hot}$

A = Acceleration = $Ho^2Ro\, e^{Hot} = HoCo\, e^{Hot}$

C = Light Speed = $Co\, e^{Hot} = HoRo\, e^{Hot}$

The energy of a properly moving mass may therefore be shown to be:

E = Energy = $(M \cdot A) \cdot D$

$E = (Mo\, e^{3Hot} \cdot Ho^2Ro\, e^{Hot}) \cdot Roe^{Hot}$

$E = (Mo\, e^{3Hot}) \cdot (Ho^2Ro^2\, e^{2Hot})$

$E = (Mo\, e^{3Hot}) \cdot (Co^2\, e^{2Hot}) = (Mo\, e^{3Hot}) \cdot (Co\, e^{Hot})^2$

$\mathbf{E = M \cdot C^2}$

Thus, the energy needed to "stop" an exponentially expanding mass in the cosmic flow suggests Einstein's famous mass/energy relationship. It is proposed that the inhibited expansion of matter internal to planets and stars includes some conversion of matter to energy.

When familiar with the exponential mathematics of this model, it is seen that matter creates an expanding spatial field which affects the movement of other matter through it. An object moving through an accelerating spatial field may change direction or magnitude, as the space through which it moves expands. It is said of relativity that "matter bends spacetime and spacetime tells matter how to move". It may be said of the XPXP model that "matter creates accelerated expansion fields, and accelerated expansion fields tell matter how to move". The XPXP acceleration fields account for "gravitational attraction", orbits, and accretion of matter.

A MATHEMATICAL EXPRESSION FOR THE INTERNAL EXPANSION OF A CONCENTRATED MASS.

In formulating a mathematical expression for the expansion within a concentrated mass, some observations and assumptions must be made:

- Both matter and volume of a concentrated mass exponentially increase as a function of time.
- Mass and volume increase as radius increases, but the density decreases, implying a mass increase less than a volume increase.
- Because of the proposed internal interaction between closely-spaced expanding matter particles, the exponential spatial expansion (volume) and the exponential matter expansion increase at different rates. The spatial expansion continues as in free expansion, while the expansion of the matter is impeded by surrounding expanding matter, and therefore does not increase equivalently to the volume. This situation explains an exponentially reducing density until the surface.
- Matter increases in direct proportion to the radius (an assumption...yet to be verified), while volume increases as R^3.
- The expansion is "local", e.g. Mo is the mass of the concentrated object, not the universe.
- Internal "shells" or spheres can describe the internal expansion, and all matter external to a particular shell does not affect the expansion of the shell. (consistent with Newton et al.)
- Exponential expressions describe the matter and volumetric expansions of an internal shell.

A review of the cosmic expansion should be a starting point for relating to the expansion of concentrated masses (See Hubble-LeMaitre Law). A universal sphere in the cosmic expansion expands exponentially and has a radius of Ro, and a Hubble constant Ho as a factor :

FOR UNIVERSE:

$$A_V = G_E M_0 e^{3H_0 t} \qquad where \qquad Ho = \frac{\sqrt{G_E \rho_0}}{3} = \sqrt{\frac{G_E M_0}{12\pi R_0^3}}$$

$$v_R = \frac{G_E M_0 e^{3H_0 t}}{4\pi R^2 Ho} \, where \; Ho = \frac{\sqrt{G_E \rho_0}}{3} = \sqrt{\frac{G_E M_0}{12\pi R_0^3}} \;\; and \;\; R = R_0 e^{H_0 t}$$

$$Then \; v_R = \sqrt{\frac{G_E M_0}{12\pi R_0}} e^{H_0 t} = HoR_0 e^{H_0 t}$$

REM: $\mathbf{G_E = 12\pi G_{(Newton)}}$ and Ho differs from the Ho of the standard model .
When $t = T_o$ the surface of the sphere is defined (where $T_o = 1/Ho$).

Note: In the Hubble universal expansion, because of the vastness of space, matter in galaxies does not significantly interact with matter in other galaxies.

If the principles of the general expansion equation for the free expansion of the universe apply to gravitation, Ho cannot be constant. G_E certainly cannot be a variable, because it is a statement for the spatial expansion caused by <u>any</u> matter. The density in H must be non-constant. A proposed expansion coefficient, H, where the density is exponentially decreasing will produce an embodiment of the expansion differing from the cosmos (see "short"- exponential expansion embodiments). H accounts for gravitation and spiral galaxies. Hubble's constant, Ho, is a special case of the general expansion coefficient H.

The <u>spatial</u> expansion (volume) within a concentrated mass increases with R^3 (as it does in the Hubble flow), while it is proposed that the <u>matter</u> increases with R. This combined expansion suggests the accretion of matter and other properties of expanding concentrated masses.

It may be difficult to envision the process, but realizing the exponential increase in volume Vo e^3Hot in time t, the matter within the volume increases to Mo e^Hot. In this manner, the expansion of concentrations of matter differs from the free expansion of the universe.

Therefore, **INTERNALLY**, for any sphere of mass Mo:

$$\boldsymbol{V} = \boldsymbol{V}_0 \boldsymbol{e}^{3H_o t} \quad \text{and} \quad \boldsymbol{M} = \boldsymbol{M}_0 \boldsymbol{e}^{H_o t}$$

leading to the revelation that the <u>density</u> of internal spheres will decrease until the surface. Once again, it is proposed that the <u>expansion of matter is proportional to the radial expansion</u>, while the <u>spatial expansion remains proportional to the cube of the radius</u>. This unequal expansion of the matter and volume continues until reaching a "surface", where M=Mo and V=Vo, after which no further matter is added. But space continues to expand beyond the surface, and defines gravitation as we know it. The general principles for <u>universal</u> exponential expansion apply to the expansion of concentrated matter.

A further aspect of the concentrated matter embodiment of exponential expansion:

To be consistent, the expansion within a sphere must have an origin such that in time To, the surface forms a sphere of volume Vo and of mass Mo. By mathematically adjusting the origin of expansion to Ro/e^1, the calculations are consistent , i.e., the radius of the sphere becomes Ro (at the surface) etc. (See Short: "centering the expansion")

$$\boldsymbol{R} = \frac{\boldsymbol{R}_0}{\boldsymbol{e}^1} \boldsymbol{e}^{H_o t} \quad \text{and } \boldsymbol{M} = \boldsymbol{M}_0 \frac{\boldsymbol{e}^{H_o t}}{\boldsymbol{e}^1} \text{ and } \boldsymbol{V} = \boldsymbol{V}_0 \frac{\boldsymbol{e}^{3H_o t}}{\boldsymbol{e}^3}$$

The time, t, defines the expansion extending from Ro/e^1 to Ro and all positions in between.

For most purposes, mathematically omitting this adjustment has not presented any problems, since it is simply a multiplication by a constant and there is no "special" location in the universe.

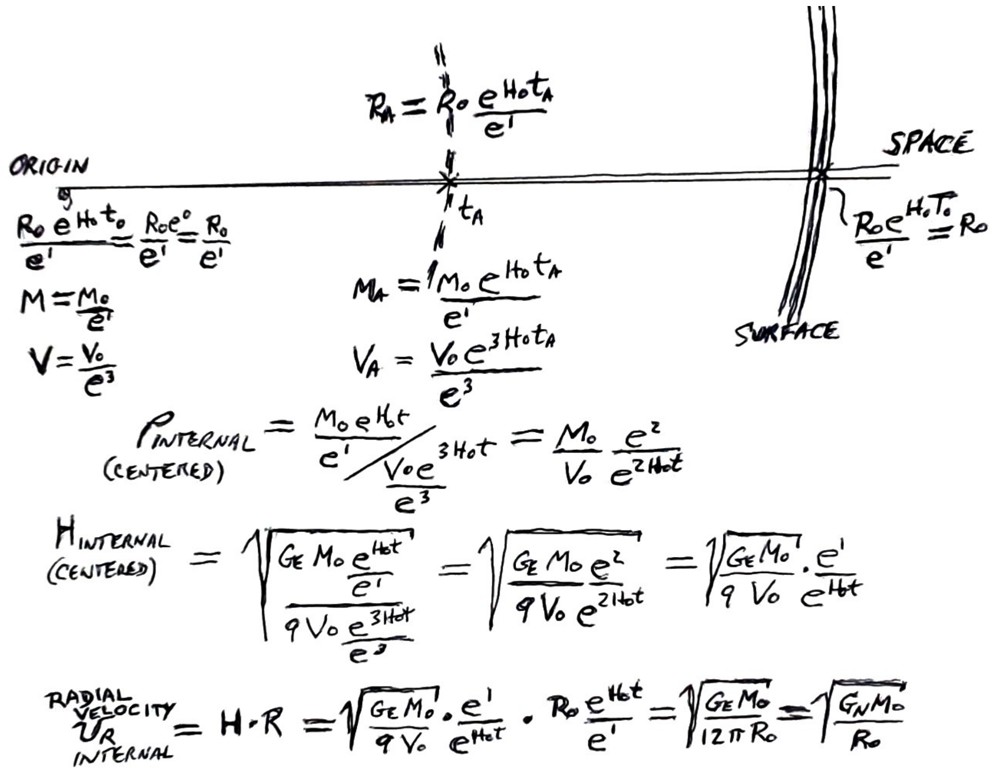
However, an origin for the XPXP of concentrated matter simplifies the understanding of that expansion. The origin of the expansion of concentrated matter is centrally located within a sphere of radius Ro. The values for Vo, and Mo <u>at the surface</u> of the sphere are therefore also defined, as is Ho.

Earthly values for Mo and Ro are used to calculate the radial velocity at Earth's surface, and the result agrees with the Newtonian orbital velocity at the surface of the earth. Additionally, the radial velocity may be calculated for any interior "shell".

The principles of exponential expansion are the same for concentrated masses as in cosmic free expansion, except that Ho must refer to the parameters of the object, rather than those of the universe. Therefore, using exponential principles, a complete description of the instantaneous internal values for the position, velocity, and acceleration for any location within the sphere may be calculated, shown in Figure 90-2.

For depths within the earth, seismic evidence has established that the density (and pressure) increases with depth, consistent with this exponential model.

Figure 90-2. INTERNAL XPXP OF CONCENTRATED MASSES



Note that <u>all</u> values of radial velocity are the Newtonian (surface) orbital velocity, $\sqrt{G_N M_O / R_0}$
because **$G_E = 12\pi G_{(Newton)} = 12\pi G_N$**
This applies to any internal position, so that the internal radial velocity is constant.

This process for finding the radial velocity for <u>any</u> expansion is to first determine the coefficient, H, for the particular expansion, then multiply by R.

From Figure 90-2, the <u>internal</u> expansion of concentrated masses may be determined. This expansion is dependent upon the unequal expansions of matter and space caused by that matter. The spatial expansion is proportional to R^3, while the matter expansion is proportional to R.

The expansions are exponential, where M = Mo e^Hot and V= Vo e^3Hot. The density at any position is then ρo /e^2Hot, and reduces with time, until the surface.

By centering the origin of the expansion so that R=Ro/e^1, the surface is located at Ro. ("centering the expansion")

The radial velocity within a concentrated sphere is constant at all distances because, within the sphere, H = Ho e^1/ e^Hot and when multiplied by R =Ro e^Hot/e^1, the exponential factors cancel out. The radial velocity at any internal position, therefore, is the Newtonian orbital velocity at the surface.

PART 2 - GRAVITATION: EXPANSION OF SPACE SURROUNDING A CONCENTRATED MASS

The space surrounding a concentrated mass exhibits what was described as "Gravitation" by Newton. Newton described the properties of gravitation, but could produce no real reason for its existence. General relativity proposes that masses bend "spacetime", and passing masses will be governed by that bent spacetime. Relativistic gravitation cannot explain several aspects of cosmic phenomena, including the universal acceleration and the flattening of the velocity curve in spiral galaxies. In the late 20th century, when universal acceleration was discovered, an explanation for that acceleration called for dark energy. Rather than clarifying standard model, it became more complicated.

By envisioning an expanding sphere of mass Mo,then applying the general philosophy of the universal expansion (i.e. matter induces a spatial expansion), a mathematical analysis of such an expansion can be accomplished. But, before looking at an exponential expansion for the sphere, it is suggested that an examination of constant volumetric acceleration of G_EMo and standard mathematics may produce some insight. It is seen below that the equations of such an expansion describe Newtonian gravitation. (See Table 90-1.) The "coincidental" connection between gravitation and volumetric expansion prompted this investigation of XPXP.

Table 90-1:

Volumetric Acceleration (m³/sec²) $A_{VC} = G_E M$ (2)	**Radial Acceleration** (m/sec²) $A_{RC} = -\dfrac{G_E M}{12\pi R^2}$ (7) (Newton's Law where $G_E = 12\pi G$)
Volumetric Velocity (m³/sec) $V_{VC} = dV/dt = V_{VCo} + G_E M t$ (3) $V_{VC} = dV/dt = 4\pi R^2 (dR/dt)$ (4)	**Radial Velocity** (m/sec) $(dR/dt) = V_{RC} = \dfrac{V_{Co} + G_E M t}{4\pi R^2}$ (8) $(dR/dt) = V_{RC} = \sqrt{(G_E M)/(6\pi R)}$ (9) (Newtonian Escape velocity)
Volume (m³) $V = V_o + V_{VCo} t + ½ G_E M t^2$ (5) $V = 4/3 \pi R^3$ (6)	$R = \sqrt[3]{\dfrac{3 G_E M_o t^2}{8\pi}}$ (KEPLER) $R^3 \propto t^2$

Table 90-1. shows data for an expanding imaginary sphere. The **non-exponential** mathematics (differentiation and integration) of expansion of this illustrative sphere is assigned a constant volumetric acceleration of $G_E M_o$, where G_E is some proposed universal expansion constant and Mo is the matter present to induce the expansion. The values derived from the basic premise of a constantly accelerating volumetric expansion of a mass show an obvious connection to Newtonian gravitation. (The expression for radial velocity (V_R) differs from the radial velocity of XPXP by sq.rt. 2). This non-exponential math shows a Newtonian character for an acceleration field.

Observations from Table 90-1:

Conventional equations (non − XPXP) for volumetric expansion

Imagine a sphere of mass $\boldsymbol{M}_0$ *which is expanding with a constant volumetric acceleration:*

Volumetric acceleration: $Av = f(t) = constant = \boldsymbol{G}_E \boldsymbol{M}_0$

Integrate to find volumetric velocity: $Vv = \boldsymbol{G}_E \boldsymbol{M}_0\, t$

Integrate to find volume: $V = \mathbf{1/2}\, \boldsymbol{G}_E \boldsymbol{M}_0\, \boldsymbol{t}^2$

Volume identity: $V = \mathbf{4/3}\boldsymbol{\pi R}^3$

Equating the two expressiions: $\mathbf{1/2}\, \boldsymbol{G}_E \boldsymbol{M}_0\, \boldsymbol{t}^2 = \mathbf{4/3}\boldsymbol{\pi R}^3$

It can be seen that this relationship between time and radius is that of Kepler's Laws

Through differentiation and substitution, important expressions for radial velocity and radial acceleration can be derived:

$$V_R = \sqrt{\boldsymbol{G}_E \boldsymbol{M} / 6\boldsymbol{\pi} R} \qquad and \quad A_R = -\boldsymbol{G}_E \boldsymbol{M} / 12\boldsymbol{\pi R}^2$$

These are the Newtonian escape velocity and acceleration.

XPXP values should correspond to these values.

Although a volumetric expansion of a sphere of mass Mo exhibits Newtonian characteristics, it will be shown that an exponential expansion of a such a sphere is a better fit.

To see the correspondence between Newton's gravitational equations and equations for exponential gravitational expansion (both are positions beyond the surface of the sphere), the spatial field must display certain properties:

- A positive radial velocity which decreases as R increases, where R is the distance from the center of the sphere to the measurement position.
- A negative radial acceleration field which begins at the surface of the sphere, decreasing by $1/R^2$ thereafter.

Standard mathematical practices apply... e.g. the derivative of the exponential expression of radial velocity produces a radial acceleration. Motion of an object through the expansion field appears to be affected by a "pulling" force, but it is not. (GR and XPXP)

It is proposed that, in a concentration of matter, that the internal expansion of matter during a time interval is less than the expansion of the volume (space) during that time interval. This suggests an outwardly decreasing density. But beyond the surface (the boundary where no further matter is added), the surrounding space continues to expand. The radial velocity and acceleration at any position in this space may be determined as a function of R. It is noted that both the external velocity and external acceleration are greater when a position is closer to the surface, and reduce as R increases. "Gravity", as we know it, begins at the surface.

In the XPXP model, the XPXP (unrecognized) earthly sphere produces an accelerated expansion of space beyond the surface having a character that seemingly is a pulling force. It is proposed in XPXP that a "pulling force" is actually a situation in which an observer sees an unrecognized spatial expansion field and an object in the expansion field seems to decelerate. This is seen as "falling" in gravitational situations. Beginning with the general principles of the universal exponential expansion, and assuming differences in concentrated matter, an XPXP expression for gravity may be formulated.

Because an acceleration field expands radially from a spherical mass, an object passing by the sphere will appear to change both velocity and direction...the closer to the surface, the greater the change. What we call gravity is the result of this accelerated expansion of space. It appears to have an effect which is the reverse of the cosmic expansion, in that the character of the cosmic expansion shows galaxy speeds increasing with distance. In gravitation, the expansion of space causes matter to appear to be accelerated toward a center of mass. The dynamic properties of the sphere and the surrounding space are determined by the amount of matter present. Matter accretes because of exponential expansion, forming rocks to planets to stars.

To formulate an expression for XPXP gravitation, it is necessary to recognize differences between the free expansion of the Hubble flow and an inhibited internal expansion of concentrated matter. In both situations the expansion is produced when matter is present...and both have positive radial velocity. But accretions of concentrated matter eventually "run out of matter", creating a boundary after which an exponential spatial expansion occurs. This situation defines gravitation, and suggests that the rules of Newtonian/Einsteinian gravitation is limited to concentrations of matter.

At the surface of a concentrated mass, the form of the expansion changes dramatically. Internally, the mass of the exponentially expanding sphere increases in proportion to the radius, while the spatial volume exponentially expands with the cube of the radius. Because matter ceases to exist after the surface, the matter-induced expansion diminishes exponentially. Below, an exponential expression for the expansion of the space <u>surrounding</u> a sphere of <u>radius Ro</u> is shown.

In any XPXP, an expansion coefficient H must be determined. Ho, Hubble's constant, pertains to the universe, but not all XPXP situations. We have seen that density determines the character of an expansion...constant in the cosmic flow and internally decreasing in concentrated matter. The density of matter at a position in the space surrounding a sphere of concentrated matter has a constant mass, Mo, and a volume which increases exponentially. The combination produces an expansion coefficient H which is not constant.

$$H = \sqrt{\frac{G_E\, M_0}{9V_0\, e^{3H_0\, t}}} = \sqrt{\frac{G_N\, M_0}{R_0{}^3\, e^{3H_0\, t}}}$$

It is seen that H reduces with increasing R. The second expression is the Newtonian H (where **$G_E = 12\pi G_{(Newton)} = 12\pi G_N$**). This makes the radial velocity more recognizable.

The radial velocity is simply the product HxR . In Newtonian terms:

$$v_R = \sqrt{\frac{G_N\, M_0}{R_0{}^3\, e^{3H_0\, t}}}\, R_0\, e^{H_0\, t} = \sqrt{\frac{G_N\, M_0}{R_0\, e^{H_0\, t}}}$$

This is the Newtonian orbital velocity, but in an exponential form. The radial velocity decreases as R increases, agreeing with what is astronomically observed.

Differentiating the XPXP radial velocity will give the radial acceleration:

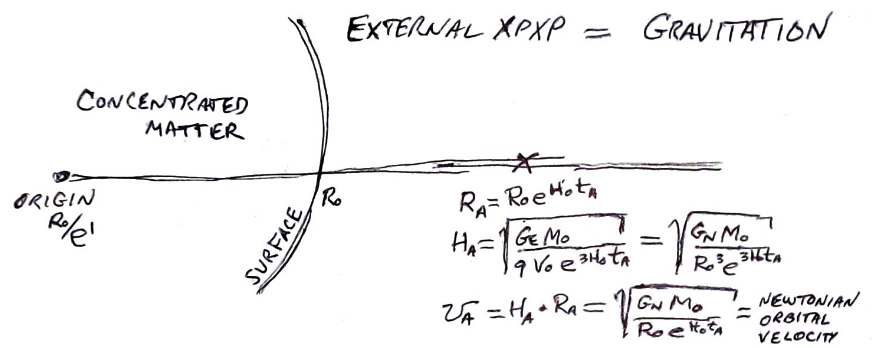
$$v_R = \sqrt{\frac{G_N\, M_0}{R_0\, e^{H_0\, t}}}$$

$$a_R = d/dt \sqrt{\frac{G_N\, M_0}{R_0\, e^{H_0\, t}}} = \sqrt{\frac{G_N\, M_0}{R_0\, e^{H_0\, t}}} \cdot d/dt\,(e^{-H_0\, t}) = \sqrt{\frac{G_N\, M_0}{R_0\, e^{H_0\, t}}} \cdot (-\, Ho\, e^{-H_0\, t})$$

$$= \sqrt{\frac{G_N\, M_0}{R_0\, e^{H_0\, t}}} \cdot (- \sqrt{\frac{G_N\, M_0}{R_0{}^3\, e^{3H_0\, t}}} \cdot (e^{-H_0\, t}) \quad = - \frac{G_N\, M_0}{R^2{}_0\, e^{2H_0\, t}} \cdot (\frac{1}{e^{H_0\, t}})$$

The radial acceleration is negative and inverse squared...agreeing with Newtonian gravitation.

Figure 90- 3. XPXP Gravitation



The values for the radial velocity and radial acceleration therefore agree with observed gravitational values.

These exponential expressions define a local external spatial expansion caused by a concentration of matter. This implies that such an external expansion occurs only for concentrated matter, and Newton/Einstein gravitation principles cannot be applied to other distributions of matter. A passing object will experience what is now considered to be an "attractive" force toward the mass (or bent space-time). In actuality, the exponentially expanding spatial acceleration fields produced by XPXP affect matter in a manner similar to "curved space-time" of general relativity.

SUMMATION OF XPXP OF CONCENTRATED MASSES

XPXP provides a mathematical explanation for the expansion of concentrated matter that uses the same principles as the universal model. Internally, impeded expanding matter produces a conversion of matter to energy, resulting in an outwardly decreasing internal density. This causes a constant radial velocity for the expansion within the sphere. Externally, a negative inverse-squared acceleration field is created.. Beyond the surface, the effect of a constant mass and a continuing volumetric expansion field produces the effect that we call "gravitation".

Presently, in the standard model, "gravitation" (Newtonian and GR) is considered to be a universal concept, with corresponding expectations . But XPXP contends that gravitation is valid only for the space surrounding concentrated masses such as planets and stars. Gravitation fails when applied to distributions of matter in forms other than concentrated masses. Specifically, standard model gravitational principles do not explain the constant velocity of stars in the arms of spiral galaxies and the unexpected acceleration of the universe as a whole. Rather than creating mythical modifications (like dark matter and dark energy) to justify such major problems, there must be a realization that A GREAT MISTAKE WAS MADE. A return to the very basis of the universal model is necessary...and XPXP becomes the solution.

CORRELATION BETWEEN UNIVERSAL XPXP AND GRAVITATION

It has been established that the exponential volumetric acceleration (A_V) and radial velocity (v_R) of an ideal universal sphere are:

(UNIVERSE)

$$A_V = G_E M_0 e^{3H_0 t} \qquad where \qquad H_0 = \frac{\sqrt{G_E \rho_0}}{3} = \sqrt{\frac{G_E M_0}{12\pi R_0^{\,3}}}$$

$$and \quad G_E = 12\pi \; G_{NEWTON}$$

$$v_R = H_0 R_0 e^{H_0 t} = \sqrt{\frac{G_E M_0}{12\pi R_0}}\, e^{H_0 t}$$

G_E is the universal expansion constant.

After substitutions and conversions, it is seen that the exponential expression for universal radial velocity agrees exactly with the Newtonian gravitational expression for circular orbital velocity in all but the exponential expansion factor.

It is proposed that gravitation and the cosmic expansion are two expressions of the same principles... one in which Ho is constant (cosmos) and the other in which H is not constant (gravity). This difference limits the existence of "gravitation" to concentrations of matter.

($\textbf{\textit{NEWTONIAN GRAVITATION}}$)

EXPRESSION FOR CIRCULAR VELOCITY IS:

$$V_R = \sqrt{G_{NEWTON} M_O / R} = \sqrt{\frac{G_E M_0}{12\pi R}}$$

Of course, the substitution values for mass and radius for the universe are different than those of the local values for gravitational objects. Universal values produce a (constant) density significantly smaller than the density of concentrated matter. **It is notable that the expansion constant, G_E, is consistent in both equations.**

It is also presented in this model, (shown in "gravity-xpxp of concentrated matter"), that the internal volumetric expansion of concentrated masses is exponential and expands with a positive radial velocity, corresponding to that of the cosmic expansion, but with a critical difference.

For universal radial velocity

$$v_R = \sqrt{\frac{G_E M_0}{12\pi R_0}}\, e^{H_0 t}$$

Equations for internal volumetric expansion of concentrated matter (as shown in "gravity-xpxp of concentrated matter") and free volumetric expansion (as in the Hubble flow) have the same form, but the internal expansion of the mass of concentrated matter does not increase equally with the volume of the spatial expansion. This causes a decrease in the mass density radially and insures that the radial velocity within concentrated matter is constant, where:

$$v_R = \sqrt{\frac{G_E M_0}{12\pi R_0}} = \sqrt{\frac{G_N M_0}{R_0}}$$

until reaching Ro. This expression is recognizable as the Newtonian orbital velocity at the surface. At the surface,the limit of the mass, Mo, is reached. Beyond the surface, no further matter exists, resulting in an expansion with the character of gravitation. Gravitation and the Hubble flow may be considered embodiments of exponential expansion. Another embodiment of XPXP is that of spiral galaxies, and explains the "flattening of the velocity curve" problem.

The correlation between the cosmic expansion and gravity; that gravity is actually part of an exponential expansion of a sphere of concentrated matter implies that principles of exponential expansion exist on all scales. It is illogical to assume that the particles of matter (such as atoms) do not expand in a manner corresponding to the masses that they form. This suggests that exponential expansion is a unifying principle between the cosmic standard model and the quantum standard model... a "theory of everything".

EXPONENTIAL EXPANSION OF SPIRAL GALAXIES

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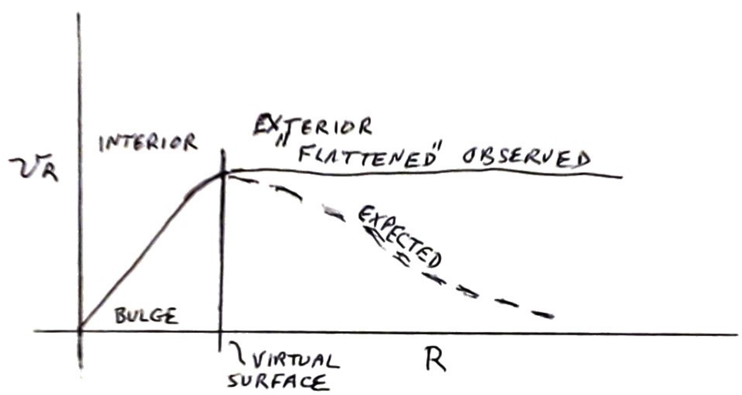
It has been observed that stars revolving in the arms of spiral galaxies are unexpectedly moving at substantially the same velocity. Because this phenomenon is contrary to standard gravitational principles of Newton and Einstein, wherein stars more distant from the galactic center should move more slowly... an explanation for the anomalous movement was sought. "Dark matter" seemed to be the only solution available and remains the best guess for the anomalous behavior. To date, the existence of dark matter remains unproven.

Exponential expansion provides a path to a better understanding. It is submitted that G_E is a universal constant for the expansion of any matter, and therefore applies to all situations. It is also submitted that the XPXP occurs in several forms, such as the cosmic flow, gravitation, and galaxies. As a rule, the instantaneous radial velocity for a position may be found by finding a value for H, then multiplying by the position vector, R. Ho for the universe is constant, but H for other astronomical situations may not be constant, and may produce a different expansion character.

Some general observations of spiral galaxies: The stars within the bulge of spiral galaxies move in a familiar way...the velocities of the stars increase in direct proportion to the distance from the center. This is analogous to the movement of the galaxies in the cosmic Hubble flow, and therefore implies an (unhindered) exponential expansion of both the volume and mass. It also is notable that stars within galaxies have very little interaction with each other, as compared to the matter within concentrated masses. At the outer limit of the bulge, the radial velocity reaches a maximum and remains constant thereafter. This is termed a "Flattening of the velocity curve". FIGURE 92- 1. shows a rough drawing of this relationship between distance and velocity for stars in a spiral galaxy.

FIGURE 92-1. Spiral galaxy - velocity vs. distance curve



The expansion field created beyond the surface of a concentrated mass describes Newtonian gravitation (see "gravity"), with a decreasing radial velocity and a negative radial acceleration. Figure 92-1. shows an <u>expected</u> λCDM galactic decreasing radial velocity compared to the “flattening” that is observed. Applying the principles of Newtonian gravitation or general relativity to this situation does not work, unless a dark matter halo is hypothesized.

The velocity of stars within the bulge behave in a manner similar to the galaxies in the Hubble flow, i.e. their radial velocities increase exponentially. A maximum is reached at the “edge” of the bulge. This maximum star velocity can be thought of as being located at a “virtual surface”. But the bulge does not have a well-defined surface, like that of concentrated matter surrounded by space (as in planets and stars). It is suggested that, because stars in galaxies do not substantially interact with other stars, they do not form a true surface. Instead, it suggests that the stars at the boundary and beyond exponentially add enough matter to offset the exponential decay of the expansion in this region. The galactic exponential expansion is defined by the local values of the galaxy: Ho, Mo,Vo, To and ρo and (just as in the universe) obey the general equation for a matter-induced volumetric acceleration. External to the bulge, rather than an exponential decay caused by an absence of matter as described in gravitation, the additional matter provided by the stars located in the arms of the spiral galaxy offsets such a decay and produces a constant radial velocity in these arms. This is shown in the mathematics of the situation, when M= Mo e^Hot at a position within the arms, affecting the density in H and causing the radial velocity to be constant.

In a manner similar to the XPXP cosmic flow and gravitation, a method very different from conventional λCDM math will explain the flattening of the velocity curve. As in other XPXP situations, the properties of the expansion are determined by the expansion constant G_E and the density at the position. By formulating an H and multiplying it by R, an instantaneous radial velocity is determined:

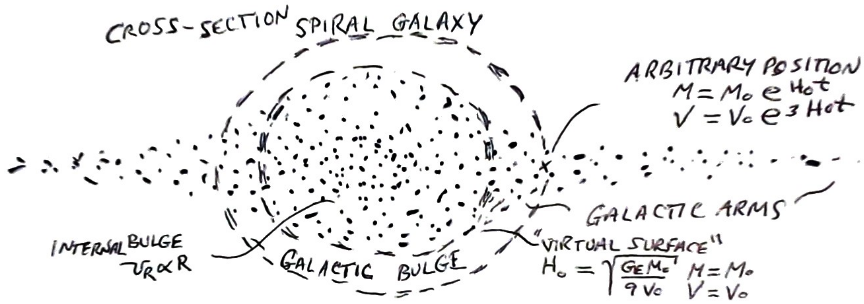
Use G_E and ρ =M/V to formulate an H of the particular situation, where H may be a constant Ho or variable, depending upon the concurrent expansion of the matter and volume. Because of the linear increase of the radial velocity and distance of the stars within the galactic bulge, it is assumed that both the matter and the volume are expanding proportionately to R^3, just as in the Hubble flow. This implies that, within the bulge, the character of the expansion is analogous to that of the Hubble flow and has a constant Ho, where:

$$\boldsymbol{R = R_0 e^{H_0 t}} \quad \textit{and} \qquad \boldsymbol{Ho}\,(\textbf{internal}) = \frac{\sqrt{G_E\,\rho_0}}{3}$$

But, unlike the cosmos, galaxies run out of matter. Rather than forming a surface at Ro (as in concentrated matter), the stars have freedom of movement, and are not affected by nearby stars. It is assumed that this characteristic of spiral galaxies creates a spatial expansion which produces a constant radial velocity for stars beyond the bulge. The distribution of the <u>matter</u> from the virtual surface (where M=Mo, and V=Vo) outwardly follows the form M=Mo e^Hot, which is increasing, but at a lower rate as t increases. Volume continues to expand exponentially where V= Voe^3Hot in this region.

An exponential distribution of matter (stars) which satisfies M=Mo e^Hot is shown in Figure 92- 2. It is accounted for in the cross-sectional shape of spiral galaxies. The tapered shape of the star population suggests the exponential reduction in matter as distance increases.

Figure 92-2.



The radial velocity of the expansion of the space beyond the bulge can be determined in the same manner as in the other forms of XPXP, wherein the H of the expansion is multiplied by R, to provide a radial velocity. The math is shown below; it causes the expansion field in the arms of spiral galaxies to have a constant radial velocity throughout, indicating that all stars have the same velocity. These stars are not accelerated, therefore do not behave as in gravitation. In Figure 92-2. a representative arbitrary position is shown to be at a radial distance for a sphere inside which the matter is included to produce the density, and therefore H. In the space surrounding the bulge, matter (stars) is exponentially added, and forms arms and a diminishing disk. For spiral galaxies:

$$\boldsymbol{M}\,(\textbf{external}) = \boldsymbol{M_0 e^{H_0 t}} \quad \boldsymbol{V}\,(\textbf{external}) = \boldsymbol{V_0 e^{3H_0 t}} \quad \boldsymbol{R = R_0 e^{H_0 t}}$$

$$\boldsymbol{H}\,(\text{external}) = \sqrt{\frac{G_E M_0 e^{H_0 t}}{9V_0 e^{3H_0 t}}} = \sqrt{\frac{G_E M_0}{9V_0 e^{2H_0 t}}}$$

$$\boldsymbol{v_R = H \cdot R} = \sqrt{\frac{G_E M_0}{9V_0 e^{2H_0 t}}} \cdot R_0 e^{H_0 t} = \sqrt{\frac{G_N M_0}{R_0}}$$

after doing the math. **(REM: $G_E = 12\pi G_N$)**

The product of HxR is: $\sqrt{\frac{G_N M_0}{R_0}}$, which is equal to the Newtonian Orbital Velocity for the virtual surface of the bulge and beyond.

The stars at the virtual surface and beyond therefore have a common radial velocity, which plots as a flattening of the velocity curve. **No "dark matter" is necessary for this result**.

EMBODIMENTS of XPXP:

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The distribution of matter in the cosmos produces expansions with differing characteristics, although all are created through the same expansion principles developed from the H/L Law. These expansions appear to be vastly different, but an analysis shows that they are embodiments consistent the XPXP model.

The nature of the expansion is determined by the XPXP coefficient H, which is $Ho = \frac{\sqrt{G_E \rho_0}}{3}$ for the free cosmic expansion of the galaxies from the H/L Law. The product of Ho and R gives the radial velocity of the expansion. Looking at Ho, ρ is the only element in the expression which can change to create a variable H. Ho is constant for the universe, but is it always constant? It is not, and the formula for the XPXP coefficient of other distributions of matter has led to the conclusions that describe the embodiments of the XPXP.

The density of the expansion is the combined effect of the exponential expansion of the mass and the space that the mass generates. In all embodiments, the volume continues to exponentially expand, so that R=Ro e^Hot. The expansion of the matter, however, may be limited in quantity, or inhibited by adjacent expanding matter. A constant density suggests that universe as a whole does not have limitations.

Three XPXP embodiments addressed here are: 1. the galactic flow, 2. concentrated matter, and 3. spiral galaxies.

<u>1. GALACTIC FLOW</u> :

The simplest form of XPXP is the cosmic flow; the motion of the galaxies as described in the the Hubble/LeMaitre (H/L) law.

The H/L law is an exponential growth equation. At a local level, the expansion is unrecognized because e^Hot ~ 1

The Hubble flow of the universal galaxies is produced by an equal exponential expansion of matter and volume, resulting in a constant density and therefore a constant Ho. It constitutes a “free expansion”, in which the radius, velocity, and acceleration are exponentially increasing. Ho has been determined:

$$Ho = \frac{\sqrt{G_E \rho_0}}{3}$$

Because Ho is constant, the H/L law shows a universe which is eternally exponentially accelerating. where

$$R = R_0 e^{H_0 t},\ v_R = HoR_0 e^{H_0 t},\ A_r = H_0^2 R_0 e^{H_0 t}$$

For the galactic flow:

$$\rho = \frac{M_0 e^{3H_O t}}{V_0 e^{3H_O t}} = \frac{M_0}{V_0}$$

$$Ho = \frac{\sqrt{G_E \rho_0}}{3} = \sqrt{\frac{G_E M_0 e^{3H_0 t}}{9V_0 e^{3H_0 t}}} = \sqrt{\frac{G_E M_0}{9V_0}} = \sqrt{\frac{G_N M_0}{R_0^3}}$$

$$v_R = HoR_0 e^{H_0 t} = \sqrt{\frac{G_N M_0}{R_0^3}} R_0 e^{H_0 t} ==== \sqrt{\frac{G_N M_0}{R_0}} e^{H_0 t}$$

REM: $G_E = 12\pi\, G_N$ **radial velocity**

2. CONCENTRATED MATTER :

The accretion of matter creates masses such as planets and stars that exponentially expand with characteristics that appear very different than the cosmic flow, although they obey the same principles.

INTERNALLY, the expansion is governed by an H wherein the exponential expansion of matter is less than that of the spatial expansion. The expansion of adjacent matter causes an interaction which prevents free expansion and it is assumed that matter is transformed to energy in the process. This accounts for a decreasing density until the surface, thereby modifying H until reaching the surface. Mathematically, a constant internal radial velocity is the result.

$$\rho = \frac{M_0 e^{H_0 t}}{V_0 e^{3H_0 t}} \qquad H\,(\text{internal}) = \sqrt{\frac{G_E M_0 e^{H_0 t}}{9R_0^3 e^{3H_0 t}}} = \sqrt{\frac{G_N M_0}{R_0^3 e^{2H_0 t}}}$$

$$v_R = HR_0 e^{H_0 t} = \sqrt{\frac{G_N M_0}{R_0^3 e^{2H_0 t}}} R_0 e^{H_0 t} = \sqrt{\frac{G_N M_0}{R_0}}$$

This **radial velocity** is constant, and is the Newtonian orbital velocity at the surface.

EXTERNALLY, the matter in the expansion remains a constant Mo (matter is not present beyond the surface), while the spatial expansion continues with the cube of the radius.

$$\rho = \frac{M_0}{V_0 e^{3H_0 t}} \qquad H\,(\text{external}) = \sqrt{\frac{G_E M_0}{9V_0 e^{3H_0 t}}}$$

$$v_R = H \cdot R = \sqrt{\frac{G_E M_0}{9V_0 e^{3H_0 t}}} \cdot R_0 e^{H_0 t} = \sqrt{\frac{G_N M_0}{R_0 e^{H_0 t}}}$$

This is the Newtonian gravitational radial/orbital velocity for any position R in the spatial field surrounding a concentrated mass.

If the radial velocity is differentiated, the acceleration is determined:

$$A_r = -\frac{G_N M_0}{R_0{}^2 e^{2H_0 t}}$$

Which is the familiar negative inverse-square expression for the Newtonian acceleration of gravity!

<u>SPIRAL GALAXIES</u> :

Stars within the Bulge of spiral galaxies provide matter that accounts for an expansion which is substantially identical to that of the cosmos. But, the available matter is limited. A velocity vs. distance graph shows a direct proportionality between the two. It is assumed that the movement of the stars do not interact, as implied by observations of the stars in our milky way galaxy. At the position where a surface might form (as in concentrated matter), the freedom of movement of the stars produce a significantly different effect. Rather than empty space creating gravitational characteristics, an external matter distribution (of stars in the arms) creates a spatial expansion having a constant radial velocity.

<u>Within the Bulge</u> (consistent with the cosmic expansion):

$$Ho = \frac{\sqrt{G_E \rho_0}}{3} = \sqrt{\frac{G_E M_0 e^{3H_0 t}}{9V_0 e^{3H_0 t}}} = \sqrt{\frac{G_E M_0}{9V_0}} = \sqrt{\frac{G_N M_0}{R_0{}^3}}$$

$$v_R = HoR_0 e^{H_0 t} = \sqrt{\frac{G_N M_0}{R_0{}^3}} R_0 e^{H_0 t} ==== \sqrt{\frac{G_N M_0}{R_0}} e^{H_0 t}$$

Other than G_E and G_N, the terms in these expressions are local values.

External to the Bulge:

$$\rho = \frac{M_0 e^{H_0 t}}{V_0 e^{3H_0 t}} \qquad H\,(\text{external}) = \sqrt{\frac{G_E M_0 e^{H_0 t}}{9V_0 e^{3H_0 t}}}$$

$$v_R = H \cdot R = \sqrt{\frac{G_E M_0}{9V_0 e^{2H_0 t}}} \cdot R_0 e^{H_0 t} = \sqrt{\frac{G_N M_0}{R_0}} = v_R$$

The exponential expression for the mass after the bulge indicates that the mass increases, but at a rate less than the volume. This differs from the expression for gravity, which has a constant Mo. The radial velocity in the arms of spiral galaxies is therefore constant (without “dark matter”).

EMBODIMENTS OF XPXP

94AA M.D.Earl 2023

The obvious evidence for universal exponential expansion is the Hubble Flow. However, XPXP also applies to local situations which seem to have no relation to an expansion. “Embodiments” of the expansion are shown below. They differ from the cosmic flow in the distribution and amount of matter present. It is proposed that the same process applies to the expansions of concentrated matter and spiral galaxies, as well as the cosmos itself. A significant result is that gravitation is an expansion of the space surrounding a concentrated mass...and does not apply to all distributions of matter.

An exponential expansion coefficient H for each embodiment determines the character of that embodiment. The Hubble constant, Ho, is the coefficient for the universe, and applies only to the universal flow. The parameters forming the cosmic Ho (G_E, Mo, Vo, Ro) are those of the universe.

$$Ho = \frac{\sqrt{G_E\,\rho_0}}{3}$$

While the principles of universal XPXP apply to other (local) forms, the unequal expansion of matter and space create the embodiments of XPXP displayed in the universe. Mo, Vo, To, and Ro are defined for each embodiment, which defines H for that embodiment.

By determining H for a given local expansion situation, then multiplying H by R will produce the radial velocity for the embodiment. The radial velocity thereafter defines the nature of the expansion. This is shown below.

COSMIC EXPANSION:

FROM THE HUBBLE/LEMAITRE LAW:

$$R = Roe^{Hot}$$

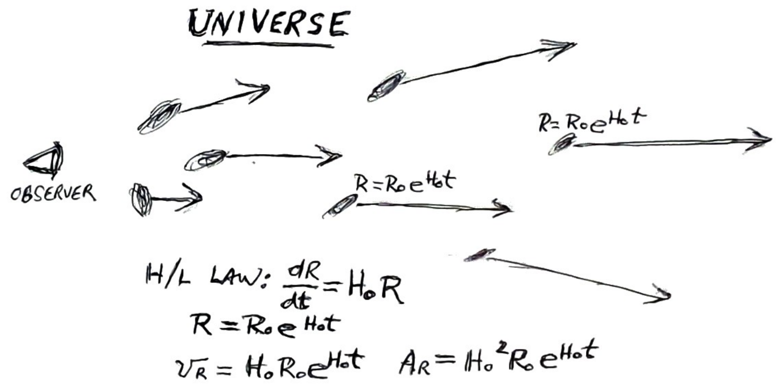
$$Ho = \sqrt{\frac{G_E\,Moe^{3Hot}}{9\,Voe^{3Hot}}} = \sqrt{\frac{G_E\,Mo}{9 \cdot 4/3\pi Ro^3}} = \sqrt{\frac{G_N\,Mo}{Ro^3}}$$

$$v_R = \sqrt{\frac{G_N\,Mo}{Ro^3}} \cdot Roe^{Hot} = \sqrt{\frac{G_N\,Mo}{Ro}} \cdot e^{Hot}$$

$$v_R = \sqrt{\frac{G_N\,Mo}{Ro}} \cdot e^{Hot}$$

This expression shows an exponentially increasing radial velocity for the cosmos, in accord with the Hubble/LeMaitre law and where the radial velocity = HoR.
G_N = Newton’s constant. G_E = Universal expansion constant.
Cosmic expansion is “FREE EXPANSION” : i.e. The galaxies have virtually no

interaction with other galaxies.
Figure 94-1.



<u>INTERNAL EXPANSION OF CONCENTRATED MATTER</u>:

MASS DENSITY DECREASES FROM CENTER

Internal matter expands exponentially with the radius, rather than with the radius cubed, due to interaction with adjacent expanding matter until the surface.

$$R = Roe^{Hot} \qquad M = Moe^{Hot}$$

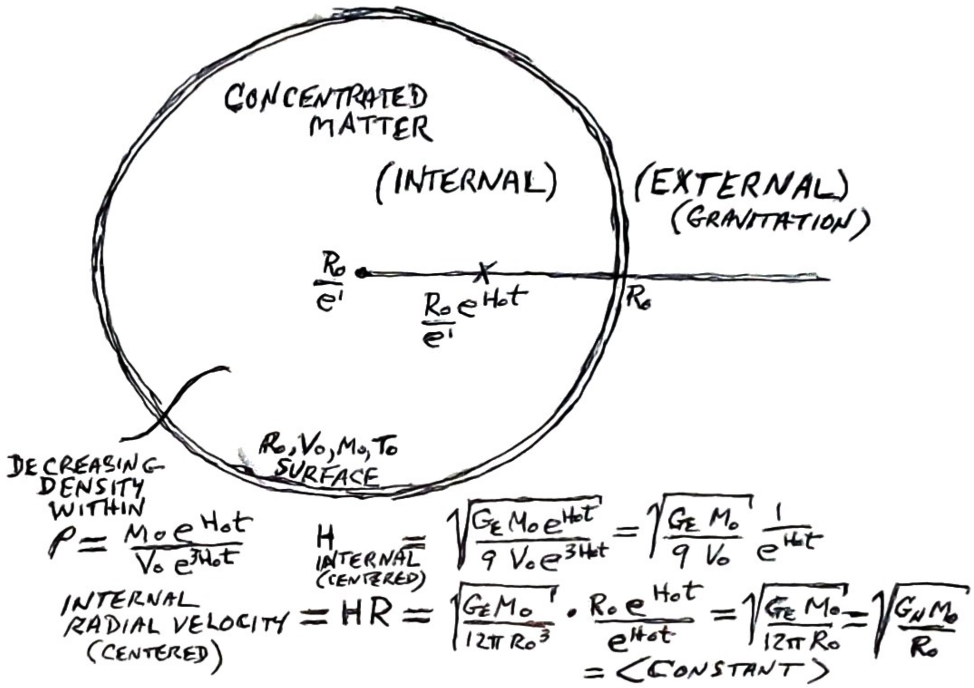
$$H = \sqrt{\frac{G_E\ Moe^{Hot}}{9\ Voe^{3Hot}}} = \sqrt{\frac{G_E\ Mo}{9\ Voe^{2Hot}}} = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{2Hot}}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{2Hot}}} \cdot Roe^{Hot} = \sqrt{\frac{G_N\ Mo}{Ro}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro}}$$

This expression indicates a constant <u>internal</u> radial velocity, equivalent to Newtonian orbital velocity at the surface. Externally, Newtonian gravitation is produced.

Figure 94-2 Internal XPXP of concentrated matter:



"GRAVITY" IS EXTERNAL SPATIAL EXPANSION OF CONCENTRATED MATTER:

$$R = Roe^{Hot}$$

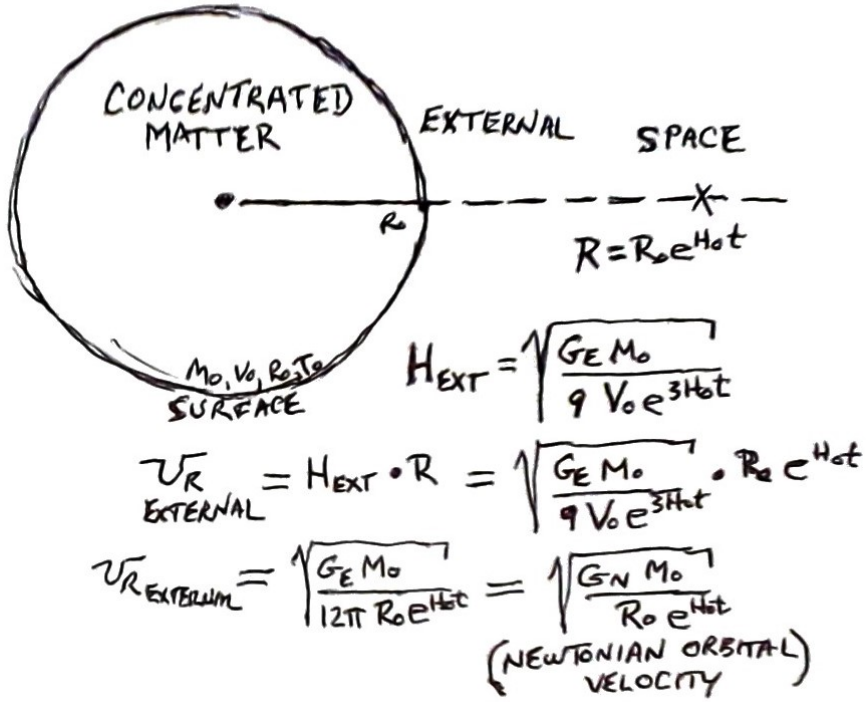
$$H = \sqrt{\frac{G_E\ Mo}{9\ Voe^{3Hot}}} = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{3Hot}}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{3Hot}}} \cdot Roe^{Hot}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Roe^{Hot}}}$$

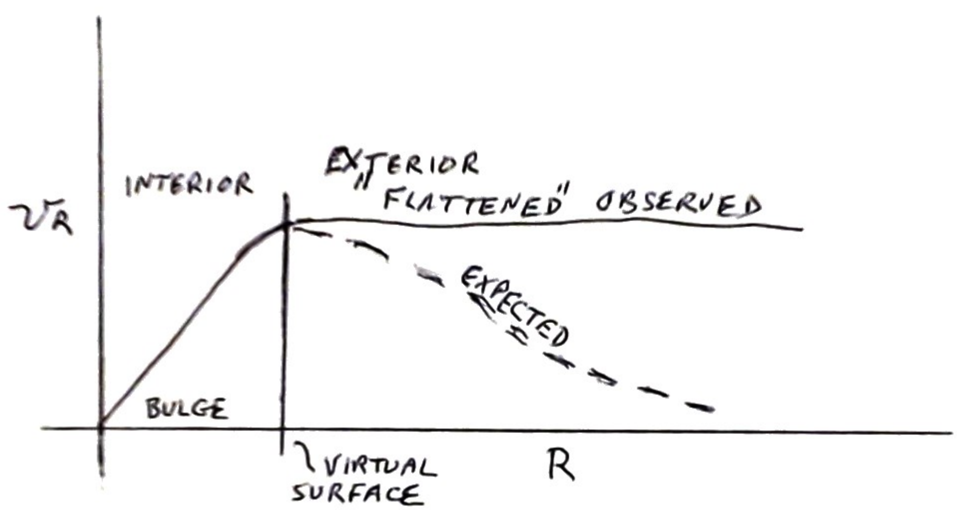
This expression corresponds to the Newtonian orbital velocity in a gravitational field.

Figure 94-3 External expansion of concentrated matter (Gravity):



Differentiating this radial velocity produces a negative-inverse squared acceleration, in agreement with the “pull” of Newtonian gravitation.
IN THE STANDARD MODEL, STARS IN THE ARMS OF SPIRAL GALAXIES SHOW AN UNEXPLAINABLE CONSTANT VELOCITY. RATHER THAN SUGGESTING “DARK MATTER”, THE XPXP MODEL PROVIDES AN ANSWER.

Figure 94-4. A velocity vs. distance rendering of a typical spiral galaxy:



According to Newtonian gravitation, the stars beyond the bulge are expected to have a radial velocity that diminishes as the distance from the center increases... just as in the space around planets and stars. Instead, those stars maintain a speed which is equal to the stars at the edge of the bulge. It is proposed in the XPXP model that, rather than abruptly stopping the matter as in a surface, the external stars exponentially add sufficient mass to cause the radial velocity to be constant.

EXPANSION WITHIN THE BULGE OF SPIRAL GALAXIES:

The stars within the bulge of spiral galaxies are free to move in much the same manner as the galaxies of the cosmos move. There is virtually no interaction between stars. Both the internal mass and volume of the galaxy increase proportionately to the cube of the radius. As shown below, a constant Ho produces an exponentially increasing radial velocity until the (virtual) surface.

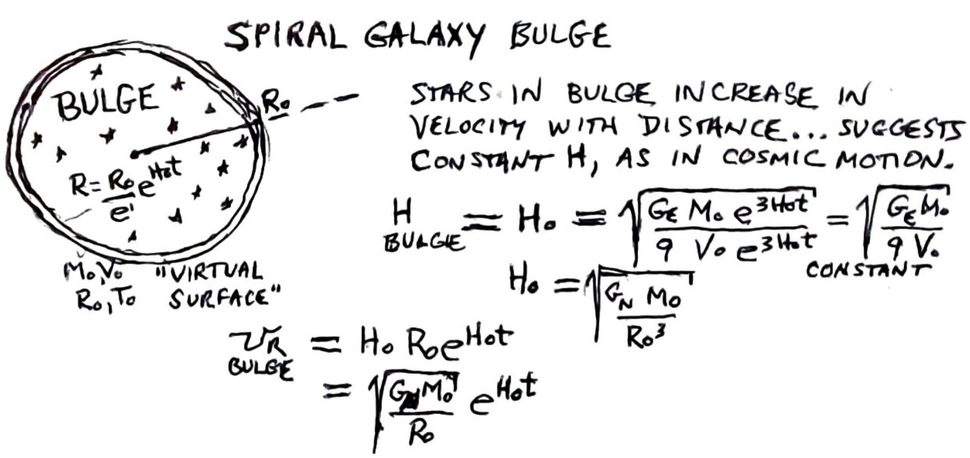
$$R = Roe^{Hot}$$

$$H = \sqrt{\frac{G_E\ Moe^{3Hot}}{9\ Voe^{3Hot}}} = \sqrt{\frac{G_E\ Mo}{9 \bullet 4/3\pi Ro^3}} = \sqrt{\frac{G_N\ Mo}{Ro^3}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro^3}} \bullet Roe^{Hot} = \sqrt{\frac{G_N\ Mo}{Ro}} \bullet e^{Hot}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro}} \bullet e^{Hot}$$

Figure 94-5 XPXP within galactic bulge



EXPANSION IN THE ARMS OF SPIRAL GALAXIES:

In the bulge of spiral galaxies, both the mass and volume increase proportionately to the cube of the radius. Because the stars have freedom to move, a definitive surface is not created at Ro, as in Newtonian gravitation. Instead, stars exponentially continue to add enough matter to produce an expansion field having a constant radial velocity. Beyond the bulge:

$$M = Moe^{Hot} \qquad R = Roe^{Hot}$$

$$H = \sqrt{\frac{G_E\ Moe^{Hot}}{9\ Voe^{3Hot}}} = \sqrt{\frac{G_E\ Mo}{9\ Voe^{2Hot}}} = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{2Hot}}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{2Hot}}} \cdot Roe^{Hot} = \sqrt{\frac{G_N\ Mo}{Ro}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro}}$$

The Expansion field surrounding the bulge contains stars which have the same velocity, and account for the "flattening of the velocity curve" in spiral galaxies. Because the external stars were expected to obey Newtonian gravitational principles, Dark Matter was invented.

Figure 94-6.