EQUATIONS OF MOTION OF THE UNIVERSE:

PECULIAR DECELERATION IN THE EXPONENTIALLY EXPANDING (XPXP) UNIVERSE

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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- $D = v_o \Delta t_{object}$

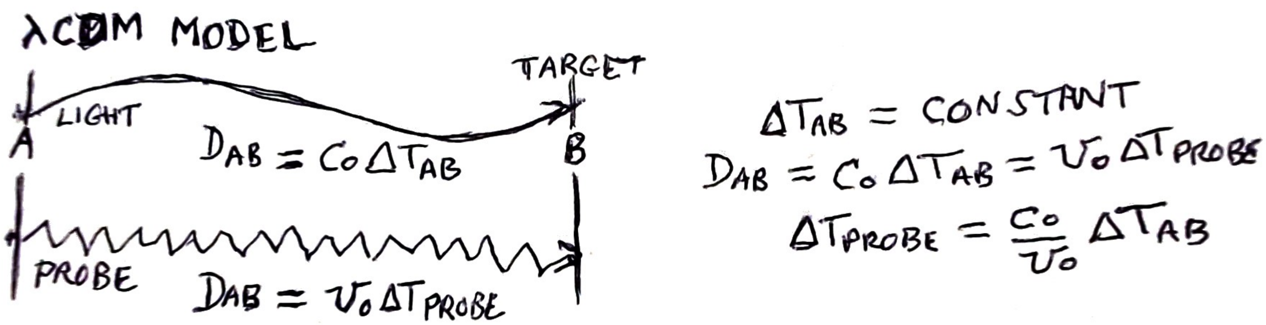
To find a λCDM comparison between the time it takes for light to reach a position and the time for an object to reach the same position:

equate distances: $c_o \Delta t_{light} = v_o \Delta t_{object}$

solve for peculiar time: $\Delta t_{object} = (c_o / v_o) \Delta t_{light}$

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 $H_o c$ in the λCDM model. This will be shown, but a further understanding of XPXP peculiar motion is necessary.

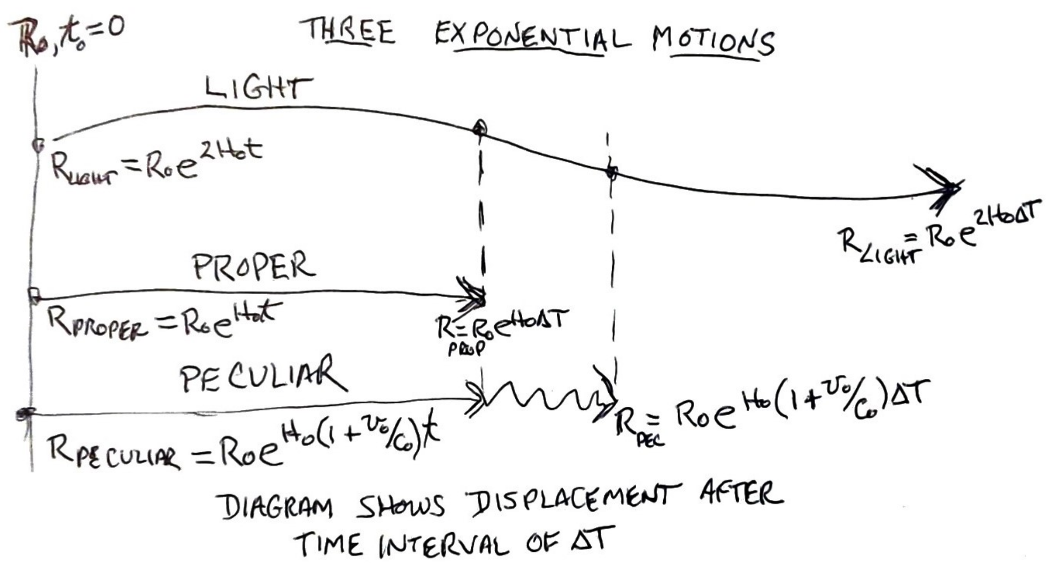
THE THREE TYPES OF XPXP MOTION

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



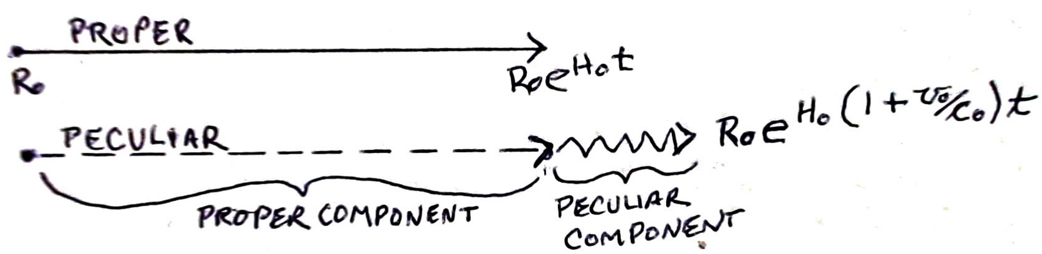
It has been established in the XPXP math of the cosmic flow, that the light-time distance between proper galaxies is unchanging. (see “time separation of proper galaxies”) Likewise, the light-time distance between proper spatial positions is constant, i.e., the space between galaxies is expanding exponentially. 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 total peculiar motion is:

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

It is comprised of two multiplicative components:

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

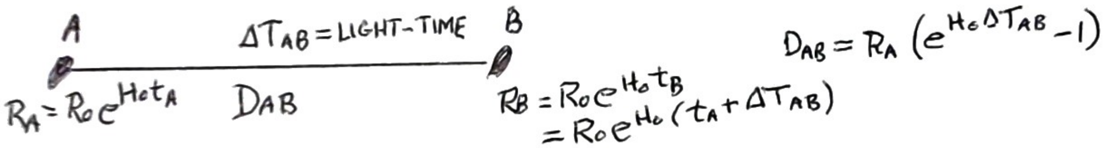
proper component ***peculiar component***

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 $H_oC_oe^{H_ot}$ 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

$$\Delta t = (C_o / V_o)(\Delta T_{AB}).$$

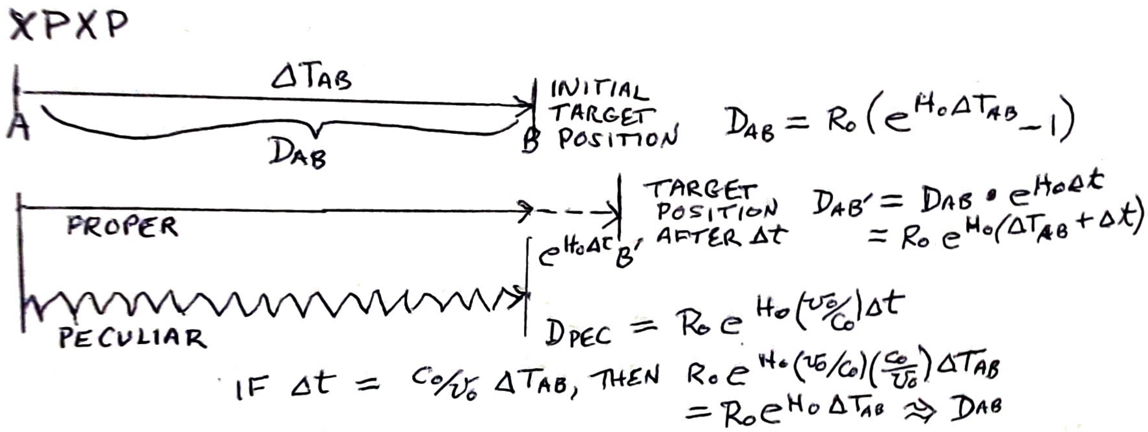
(see above)

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) · (ΔT_{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 positions 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 - ((v_o /c_o) H_ot) - of the universal expansion exponent H_ot. 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 position is distinguished from distance 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 distance 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) ΔTAB.

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 **ΔTAB** - 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′ = ΔTAB. Standard math cannot justify the constant proper separation time of the XPXP model.

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

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

$$R_0\, e^{H_0 (v_o/c_o)(c_o/v_o)\Delta T_{AB}} = R_0\, e^{H_0 \Delta T_{AB}}$$

, 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 HoCo $e^{H_0 \Delta t}$ 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

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

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

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

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 appear 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 Hoc acceleration, which is attributable to the unrealized cosmic acceleration rather than a mysterious "deceleration".