

EQUATIONS OF MOTION OF THE UNIVERSE:

PERCEIVED UNIVERSAL H_0 DECELERATION OF PECULIAR OBJECTS IN THE EXPONENTIALLY EXPANDING (XPXP) UNIVERSE

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It was discovered in 2010 that two pioneer space probes were decelerating at app 10^{-10} m/sec². This value seemed to be coincidentally very close to H_0 , the Hubble constant times light speed. To this day it remains a coincidence. But the XPPX model explains this “coincidence” as an expected result of a peculiar object moving through XPPX space. After several years of unsuccessful attempts at solutions to the “pioneer anomaly”, an explanation was accepted...an on-board recoil force produced by a combination of factors.

The XPPX theory refutes that explanation because the universal acceleration in the theory exactly matches the deceleration of the probes. The incredible coincidence is not a coincidence at all.

The movement of virtually all galaxies conforms to the Hubble/LeMaitre relationship. A precept of the exponential expansion theory (XPPX) is that it occurs on all scales. But it goes unrealized by the scientific community. This is because, although XPPX exists in everyday life, the expansion coefficient is very close to 1 under “normal” conditions. The most basic formulas (including relativistic) mistakenly attempt to present an inertial explanation for cosmic events.

It should be recognized that most motion that we observe under ordinary conditions is “peculiar” with respect to the proper expansion of the cosmos. Recent technological improvements in astronomy and the space program have shown anomalies. Some scientists question whether a new physics is necessary. XPPX is that new physics.

Exponential expansion is observable in the Hubble flow, where the exponential coefficient in the Hubble/Lemaitre Law, $e^{H_0 t}$, becomes significant. For short time intervals, (where $t \ll T_0$) inertial math is an adequate approximation, and forms the basis for our laws of physics. But inertial math cannot be successfully applied to distant cosmic events. When considering the universe as a whole, the Hubble expansion is the only verified condition, and theories should aim to be consistent with it, rather than the reverse. In this regard, the XPPX theory will show that the cosmic laws apply locally, but the inertial laws of local situations (those derived on the earth) do not necessarily apply to the universe.

The standard model is unable to explain many “anomalies” in the velocity and position of space probes during flybys and deep space explorations. This is because it relies upon non-exponential (inertial) mathematics. Although some explanations have been generally accepted, explanations fall short of the true nature and many of the scientific community remains skeptical.

As such, those well-versed in the principles of relativity are actually at a disadvantage when attempting to grasp the principles of XPPX. It should be expected that a stubborn resistance to such a new concept will be seen in those who have substantially dedicated their academic careers to the belief in the principles of relativity.

Visualizing actions within an XPPX universe is difficult, because we are so attuned to our inertial roots. Only a radical deviation from the current philosophy can recognize a different cosmos. Young people, without preconceptions, are more capable of comparing XPPX to the standard model. Experts in relativity are less willing to be objective when comparing XPPX to the Λ CDM model.

PECULIAR MOTION:

The mathematical description for position, velocity and acceleration of peculiar objects 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. The XPPX theory does not suggest a preferred direction, so an arbitrary direction is adequate.

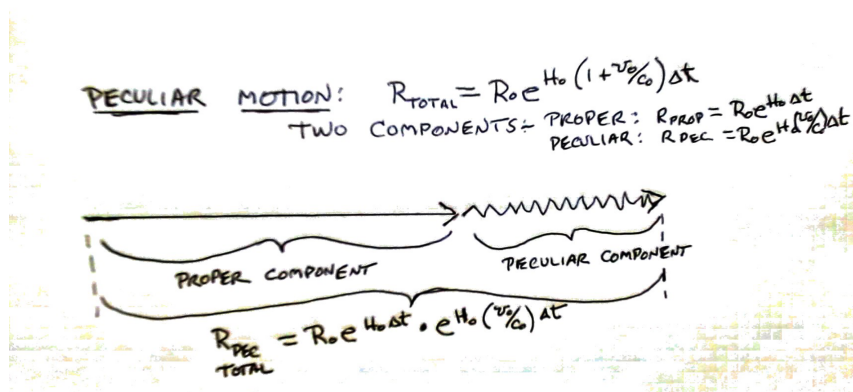
Positions and velocities of light, proper spatial expansion and peculiar objects are given below:

	POSITION	VELOCITY
<u>Proper motion:</u>	$R_0 e^{H_0 t}$	$H_0 R_0 e^{H_0 t}$
<u>Light motion:</u>	$R_0 e^{2H_0 t}$	$2H_0 R_0 e^{2H_0 t}$
<u>Peculiar motion</u> (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
<u>Peculiar motion</u> (peculiar component...WRT Hubble flow)	$R = R_0 e^{H_0(v_0/c_0)t}$	$H_0 R_0 (v_0/c_0) e^{H_0(v_0/c_0)t}$

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 proper 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, exponential expressions in an XPPX universe are multiplicative:

$$R_0 e^{H_0(1)t} e^{H_0(v/c)t}$$

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



The acceleration of the universal expansion is greater than that of a peculiar object moving at a velocity less than light speed. This is shown by comparing the second time derivative for each expression. The peculiar object moves with respect to the flow. A calculation reveals that a small discrepancy will appear only in large distance and time measurements. An acceleration difference on the order of 10^{-10} m/sec² occurs as an unexplained deceleration because the current philosophy does not recognize an XPXP universe.

Acceleration of the proper

spatial expansion:

$$H_0^2 R_0 e^{H_0 t} = H_0 c_0 e^{H_0 t}$$

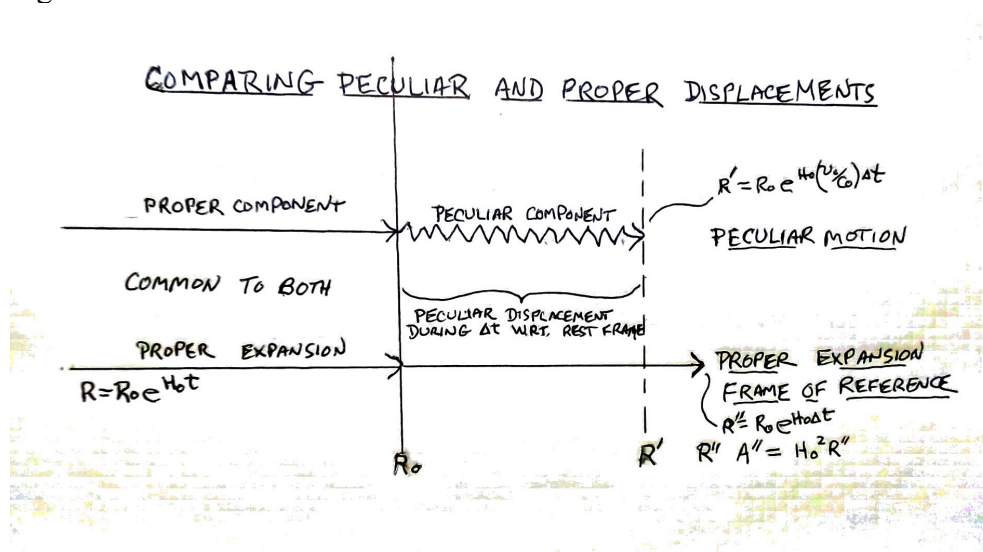
Peculiar acceleration (component)

$$A_R = H_0 v_0 (v_0/c_0) e^{H_0(v_0/c_0)\Delta t} = (v_0^2 / R_0) e^{H_0(v_0/c_0)\Delta t}$$

By comparing displacement from an arbitrary initial proper position, the motion of a peculiar object moving through the exponentially expanding space that it occupies will express 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 the only moving element, and it appears to be infinitesimally decelerating.

Currently, a distance measurement to a space probe is simply $c_0 \Delta t$, where c_0 is constant (speed of light), and the exponential expansion of space is unrecognized. A “light-year” is a measure frequently used to describe a distance in space. The XPXP theory contends that $c_0 \Delta t$ is an approximation of the true distance, since the spatial frame expands as time progresses. For most intents and purposes, this approximation suffices, but more precise measurements of distant objects 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 R_0 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 R_0 to R'' .

The expectation, in the standard model, is that the peculiar object will reach R' after a time interval of $(c_0/v_0) \Delta T$, where ΔT is the light-time distance to R' . ΔT does not change, since R_0 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:

$$v_0 \Delta T_{\text{probe}} = c_0 \Delta T_{\text{light}}$$

$$\Delta T_{\text{probe}} = (c_0 / v_0) \Delta T_{\text{light}}$$

The XPPX distance from R' to R'' is $R' e^{H_0 \Delta t}$. This indicates that the proper frame is accelerating (second time derivative) at $H_0 c_0 e^{H_0 t}$ (the cosmic acceleration), compared to the acceleration $(v_0^2 / R_0) e^{H_0 (v_0/c_0)t}$ of the peculiar object. A “standard model” observer in the proper frame measures an anomalous minuscule shortfall in the expected position of the peculiar object, interpreted as a deceleration of the peculiar object. This phenomenon is presently measurable only at large distances and speeds (such as in deep-space probes) and has yet to be recognized.

Figure 51-3.

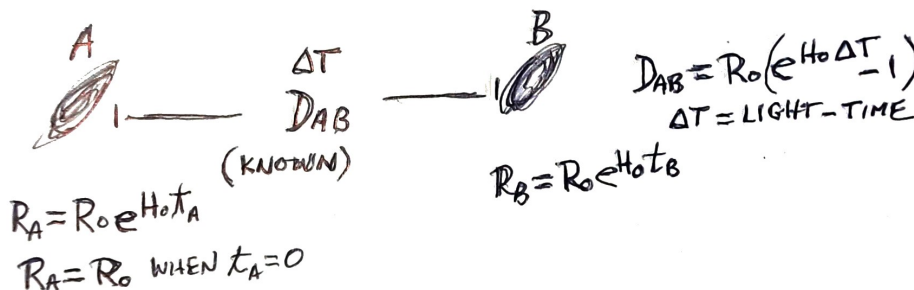


Figure 51-3, shows an object located at an instantaneous position B, measured to be a distance $D_{AB} = c \times \Delta T_{\text{light}}$. D_{AB} away from an observer at position A by a light signal detected as being ΔT_{light} . The λ CDM model considers the light-travel time to the object as constant, because an unaccelerated Distance does not change. Accordingly, at some Δt later, the distance should remain unchanged.

In the XPPX model, the framework of space expands properly over time, so that D_{AB} increases by $D_{AB} \times e^{H_0 \Delta t}$ after Δt .

$\Delta t = (c_0 / v_0) \Delta T_{\text{light}}$ is the predicted time interval that the probe needs to arrive at the target in the λ CDM model. But Δt is less than the actual time necessary for the probe to reach the target according to the XPPX model, since the target distance is expanding during the flight time of the probe.