

# EQUATIONS OF MOTION OF THE UNIVERSE:

42AAR revised 6/25

M.D. Earl 2023

## XPXP REDSHIFT AND PECULIAR $\lambda$ 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 expanding at light speed with respect to a stationary universe. It will be shown that this XPXP relationship produces the effect such that a proper observer measures a constant light speed. 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. A valid exponential mathematical expression for a light wave is derived by applying exponential principles, rather than standard inertial principles currently used.

Because the wavelength shift appears to correspond to the Doppler effect that we see on earth, the expansion or contraction of light waves is attributed to the Doppler effect in the  $\lambda$ CDM 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 is described as the change of light wavelength (and therefore frequency) at the detector. According to the XPXP model, the expansion (or contraction) of a light wave is twofold.

First, because wavelength increase is a distance measurement, and it increases as a function of the propagation time during which the wave moves between the emitter and the detector, it causes the proper redshift. The  $\lambda$ CDM Doppler effect is a function of relative velocity; in XPXP the travel time determines the effect. The light-time interval between proper galaxies is unchanging (shown previously), and accounts for the cosmic redshift. It predicts that the universe will look the same in the future as it does now. To 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 may be an effect produced by peculiar motion, evidenced by relative motion of the source and detector. An example of such a peculiar shift occurs in the arms of spiral galaxies. The proper light-time interval to these galaxies determines the redshift of the galaxy as a whole, while the movement of the stars in the arms continuously changes

relative to the galactic center, creating a blue or red shift. This peculiar motion of the stars changes their light-time interval and represents an exponential vo/co time adjustment, to be shown below.

#### LIGHT AND PROPER MOTION:

As light propagates through space, it expands at a rate that greatly 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” WRT a stationary universe). The relationship between light and proper motion is shown in these equations:

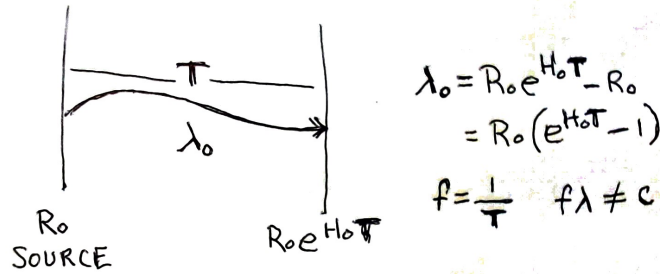
$$\begin{aligned} \text{Proper velocity relative to a stationary universe} &= H_o R_o e^{H_o t} \\ \text{Light speed relative to a stationary universe} &= 2H_o R_o e^{2H_o t} \\ \text{Light speed relative to the proper flow} &= H_o R_o e^{H_o t} \end{aligned}$$

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

Universal proper and peculiar expansion rates are governed by an exponential expansion factor  $e^{H_o t}$ , wherein (Hubble) **H<sub>o</sub>** is a **constant** coefficient of exponential expansion. Light, however, has a constant coefficient of exponential expansion of  $2H_o$ , and therefore an expansion factor of  $e^{2H_o t}$ . 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. A very important alternative to a postulated constant universal light speed in the  $\lambda$ CDM.

The wavelength of light increases while propagating **with respect to the proper cosmic flow**, 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 XPPX wavelength increase differs from the relativistic Doppler calculation which is currently used to determine the velocity and distance of remote galaxies. It may be noted that present measurements of great distances in the  $\lambda$ CDM model are not verified, except by other  $\lambda$ CDM calculations.

FIGURE 42-1. XPXP creation of a light wave from the perspective of a proper observer and source.



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.

$\tau$  is the period of the wave

$f = 1/\tau$  is the frequency of the wave

To simplify, the light emission begins at  $R_0$  where  $t = 0$

From FIGURE 42-1, the 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  $\lambda$ CDM equation for light in this manner:

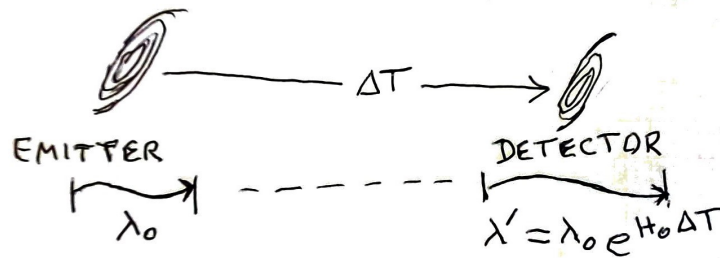
$$\lambda_0 \approx R_0 (H_0 \tau + 1 - 1) \approx H_0 R_0 \tau \approx C_0 \tau$$

After a wave is produced, it propagates at light speed relative to the proper frame,

thereby continuously increasing by a factor of  $e^{H_0 \Delta t}$  where  $\Delta t$  is the “time of flight”. A detector located in the proper frame detects a modified

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

FIGURE 42-2. XPXP expansion of light wave



In the XPXP model, the expansion of a wave during its “flight” accounts for the cosmic redshift in an exponential universe, seen in FIGURE 42- 2. A determination of a time interval,  $\Delta t$ , (shown below) gives a distance measurement.

The  $\lambda$ CDM 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 it proposes that all things are expanding exponentially, and the observer’s view of the universe will also expand exponentially, causing a substantially unchanged universe over time.

Furthermore, evidence for the XPXP model appears logically to be an eternal “expansion from within” and a “big bang” is improbable.

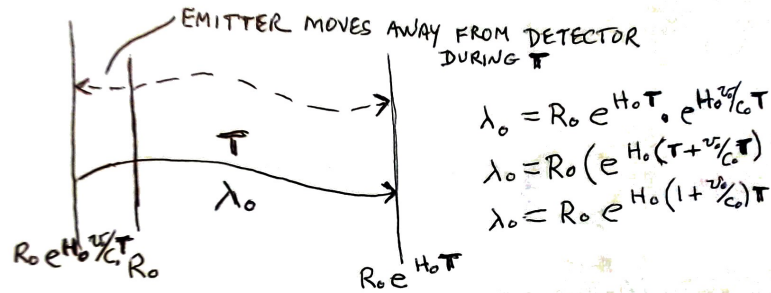
## EXPONENTIAL RATIONALE FOR DOPPLER EFFECT

Consideration must be given for light transmission which occurs with the relative peculiar motion of the source and detector. The cosmic expansion of light causes a 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. A proposition 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  $\tau$ , the source wave length 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 relative to the proper cosmic frame.

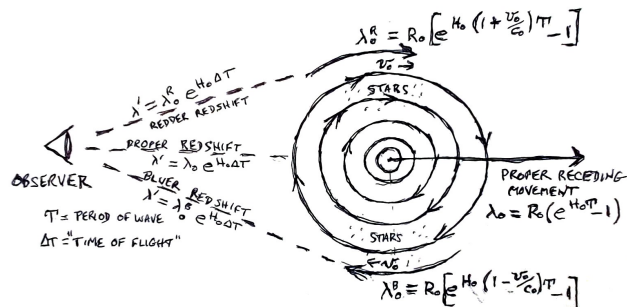
FIGURE 42-3. Peculiar source moves away from detector.



For a source moving toward the detector,  $(v_0/c)$  is exponentially subtracted, resulting in a shortened wavelength, therefore a shift toward the blue. It can be seen that the XPXP 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 of the galaxy 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 (in the arms) of these galaxies unexpectedly moved at a constant velocity, therefore leading to a supposition of the existence of “dark matter”. The XPXP model requires no such supposition.

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 current methods of measurement in astronomy are self-consistent, but are flawed in their approaches, which revert to their inertial roots. Constant light speed,  $c$ , is a coefficient for distance measures, and velocities are determined with standard or relativistic Doppler calculations. When examining these astronomical procedures, it can be seen that they are incorrect in view of XPXP.

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

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

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

The relativistic Doppler frequency equation may be 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  $\lambda$ CDM model. It is therefore proposed that the relativistic Doppler shift is incorrect, and is a reason why the Hubble/LeMaitre law does not conform with the distance/velocity plot of known remote galaxies.

### GENERAL 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  $\Delta t$  = “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.

$$\begin{aligned}
\lambda' &= \lambda_0 e^{H_0 \Delta t} \\
R &= R_0 e^{H_0 \Delta t} \\
\frac{\lambda'}{\lambda_0} &= \frac{R}{R_0} \\
z &= \frac{\Delta \lambda}{\lambda_0} = \frac{\lambda' - \lambda_0}{\lambda_0} = \frac{\lambda'}{\lambda_0} - 1 = \frac{R}{R_0} - 1 \\
z + 1 &= \frac{\lambda'}{\lambda_0} = \frac{R}{R_0} \\
\frac{R}{R_0} &= z + 1 \\
R &= R_0 (z + 1)
\end{aligned}$$

The velocity of this galaxy is the time 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  $\lambda$ CDM model.