

CENTERING THE EXPANSION

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The exponential expansion model (XPXP) of the universe is described in the Hubble/LeMaitre (H/L) law wherein, for the “proper” galactic flow:

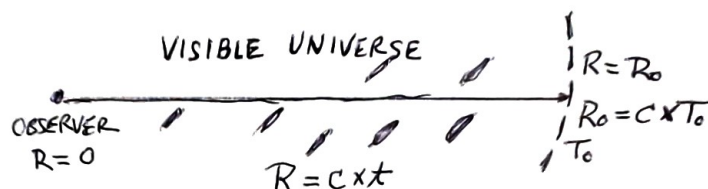
$$R = R_0 e^{H_0 t}$$

This describes a proper expansion...with respect to a stationary universe. It proposes a cosmic radial velocity and cosmic radial acceleration and provides a general description of the volumetric expansion. The same process applies to “local” expansions such as concentrated masses (gravitation) and galaxies. R_0 is a cosmic constant which may be derived from universal $H_0 R_0 = C_0$. It may be imagined to be the radius of the visible universe, but is inconsistent if $R = R_0$ when $t = 0$. The universal radius should be R_0 when the Cosmic Hubble time is T_0 ... where $H_0 = 1/T_0$. But that gives an XPXP value for R of $R_0 e^1$.

The (H/L) law is valid from the perspective of any observer located within the proper cosmic flow. A “zero position” is actually that of the observer, and the observer sees the distances according to the H/L equation. Another XPXP observer located at another position sees a different universe, but it obeys the same principles. There is no special universal center.

Figure 1. Shows a λ CDM expanding universe, according to the present philosophy, where the distances to the galaxies are defined by a simple multiplication of (relativistic) time and light speed. After some Δt , the distances increase, predicting a future separation which will eventually produce a dark sky. The observer is located at distance 0 at $t = 0$.

Figure 1. λ CDM Universal Radius



The Hubble time is presently considered to be the age of the universe, i.e. the time necessary (after the big bang) for light to reach the observer from the most distant source. Since $c \times T_0 = R_0$ in the standard model, using R_0 as the radius of the universal sphere suggests a universal volume of $\frac{4}{3} \pi R_0^3$.

Figure 2. shows cosmic **XPXP**, having an exponentially expanding radius, R , which obeys Hubble's equation from the origin of the expansion to the boundary where T_0 is the "Hubble time" and R_0 = radial constant of the universe. $H_0 = 1/T_0$

Figure 2. XPXP cosmic expansion with origin R_0

We have seen in XPXP that the proper light-time separation of the galaxies is unchanging, therefore the light-time distance to the farthest reaches of the universe are eternally a constant (T_0) from the observer. But if $t=0$, $R=R_0$, according to XPXP, the universal radius then becomes $R_0 e^{-1}$ (not R_0).

Figure 3. Adjusted **XPXP** center:

By mathematically adjusting the origin of expansion to R_0/e^{-1} , the calculations are consistent. This is particularly useful in describing local XPXP embodiments like concentrated matter and spiral galaxies which have a radial distances, from the origin, of:

$$R = \frac{R_0}{e^{-1}} e^{H_0 t}$$

The time dependent expansion then extends from R_0/e^{-1} to R_0 .

Omitting this adjustment the cosmic flow has not presented any problems as yet, since it is simply an adjustment by a constant. An origin of expansion for gravitation and for galaxies works well to describe their internal expansion, and define the expansion fields externally thereafter.

An "origin" for the XPXP of concentrated matter (gravity) and galaxies simplifies the understanding of those expansions. The origin of the expansion is centrally located within a sphere of radius R_0 . The values for V_0 , and M_0 at the surface of the sphere therefore define H_0 . (See XPXP gravitation and spiral galaxies) The universe does not suggest a center of origin for the Hubble Flow, and it is conceivable (yet to be investigated) that R_0 does not define an end to the galactic flow, since light from more distant sources moves at twice the proper speed.