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 produced by the XPXP coefficient H, which is $Ho = \frac{\sqrt{G_E \rho_0}}{3}$ for the free 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 structure of the XPXP coefficient for other distributions of matter has led to the conclusions that formulate 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 expand, so that R=Ro e^Hot. The expansion of the matter, however, may be limited in quantity, or inhibited by adjacent expanding matter. This 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.

1. GALACTIC FLOW :

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

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

For the galactic flow:

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

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

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

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 very different than the cosmic flow, although obeying 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.

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

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

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

Externally, the matter in the expansion remains a constant Mo (no matter exists beyond the surface), while the spatial expansion continues with the cube of the radius.

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

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

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 ascertained:

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

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

SPIRAL GALAXIES :

Stars within the Bulge of spiral galaxies provide matter 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 relationship 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) creates a spatial expansion with a constant radial velocity.

Within the Bulge (consistent with the cosmic expansion):

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

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

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

External to the Bulge:

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

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

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”).