# EMBODIMENTS OF XPXP

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The obvious evidence for universal exponential expansion is the Hubble Flow. However, XPXP also applies to local situations which seem to have no relation to an expansion. “Embodiments” of the expansion are shown below. They differ from the cosmic flow in the distribution and amount of matter present. It is proposed that the same process applies to the expansions of concentrated matter and spiral galaxies, as well as the cosmos itself. A significant result is that gravitation is an expansion of the space surrounding a concentrated mass...and does not apply to all distributions of matter.

An exponential expansion coefficient H for each embodiment determines the character of that embodiment. The Hubble constant, Ho, is the coefficient for the universe, and applies only to the universal flow. The parameters forming the cosmic Ho ($G_E$, Mo, Vo, Ro) are those of the universe.

$$Ho = \frac{\sqrt{G_E \rho_0}}{3}$$

While the principles of universal XPXP apply to other (local) forms, the unequal expansion of matter and space create the embodiments of XPXP displayed in the universe. Mo, Vo, To, and Ro are defined for each embodiment, which defines H for that embodiment.

By determining H for a given local expansion situation, then multiplying H by R will produce the radial velocity for the embodiment. The radial velocity thereafter defines the nature of the expansion. This is shown below.

## COSMIC EXPANSION:

### FROM THE HUBBLE/LEMAITRE LAW:

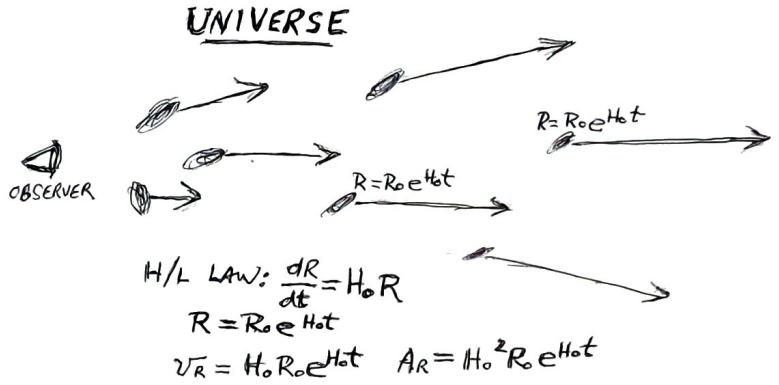
$$R = Roe^{Hot}$$

$$Ho = \sqrt{\frac{G_E\ Moe^{3Hot}}{9\ Voe^{3Hot}}} = \sqrt{\frac{G_E\ Mo}{9 \cdot 4/3\pi Ro^3}} = \sqrt{\frac{G_N\ Mo}{Ro^3}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro^3}} \cdot Roe^{Hot} = \sqrt{\frac{G_N\ Mo}{Ro}} \cdot e^{Hot}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro}} \cdot e^{Hot}$$

This expression shows an exponentially increasing radial velocity for the cosmos, in accord with the Hubble/LeMaitre law and where the radial velocity = HoR.
$G_N$ = Newton's constant. $G_E$ = Universal expansion constant.
Cosmic expansion is "FREE EXPANSION" : i.e. The galaxies have virtually no interaction with other galaxies.
Figure 94-1.




# INTERNAL EXPANSION OF CONCENTRATED MATTER:

MASS DENSITY DECREASES FROM CENTER

Internal matter expands exponentially with the radius, rather than with the radius cubed, due to interaction with adjacent expanding matter until the surface.

$$R = Roe^{Hot} \qquad M = Moe^{Hot}$$

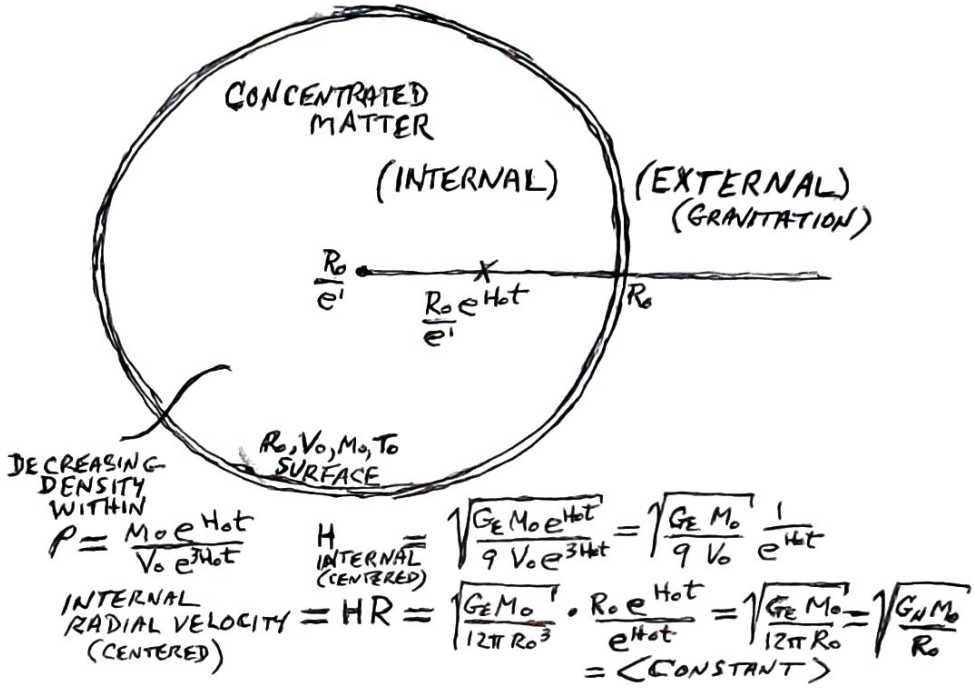
$$H = \sqrt{\frac{G_E\ Moe^{Hot}}{9\ Voe^{3Hot}}} = \sqrt{\frac{G_E\ Mo}{9\ Voe^{2Hot}}} = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{2Hot}}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{2Hot}}} \cdot Roe^{Hot} = \sqrt{\frac{G_N\ Mo}{Ro}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro}}$$

This expression indicates a constant <u>internal</u> radial velocity, equivalent to Newtonian orbital velocity at the surface. Externally, Newtonian gravitation is produced.

Figure 94-2 Internal XPXP of concentrated matter:




# "GRAVITY" IS EXTERNAL SPATIAL EXPANSION OF CONCENTRATED MATTER:

$$R = Roe^{Hot}$$

$$H = \sqrt{\frac{G_E\ Mo}{9\ Voe^{3Hot}}} = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{3Hot}}}$$

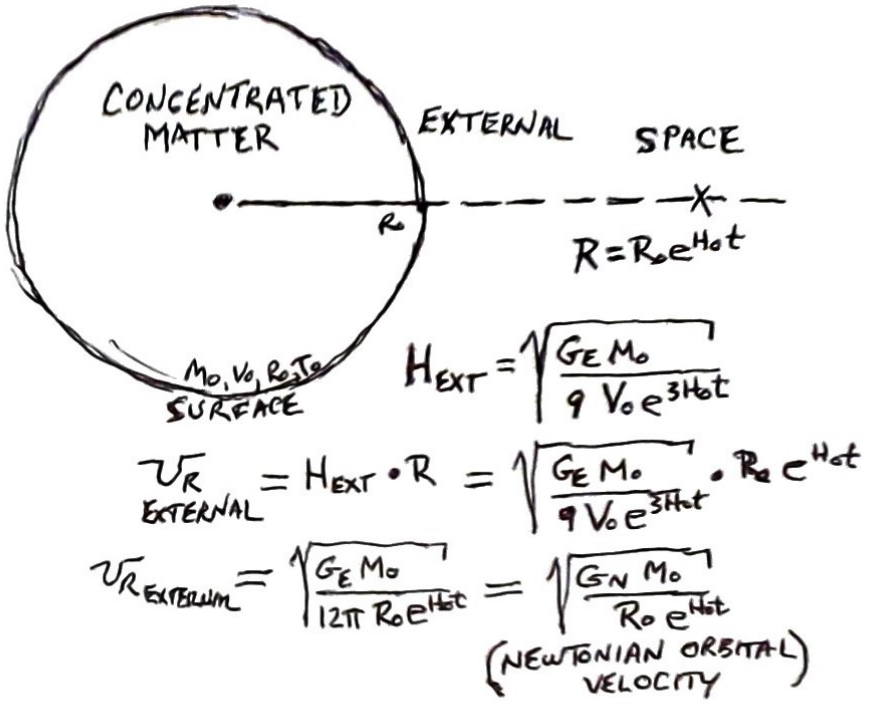
$$v_R = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{3Hot}}} \cdot Roe^{Hot}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Roe^{Hot}}}$$

This expression corresponds to the Newtonian orbital velocity in a gravitational

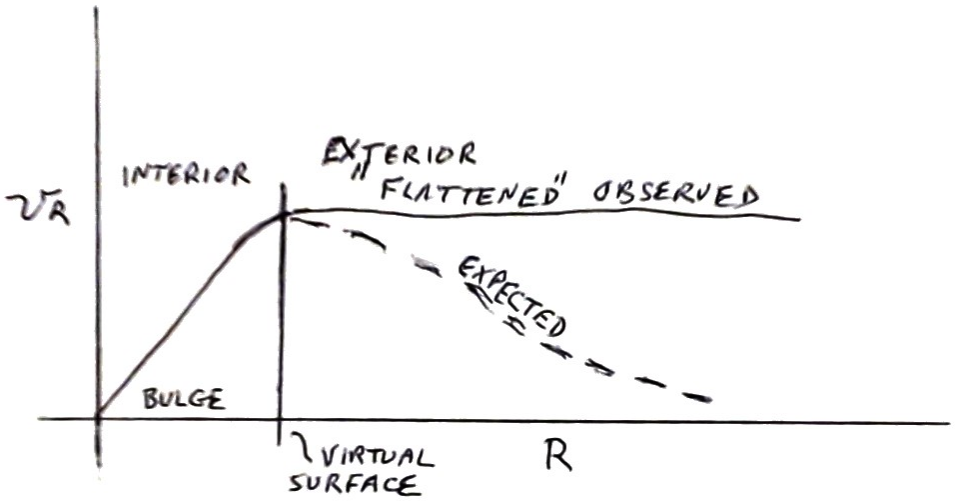
field.

Figure 94-3 External expansion of concentrated matter (Gravity):




Differentiating this radial velocity produces a negative-inverse squared acceleration, in agreement with the "pull" of Newtonian gravitation.
**IN THE STANDARD MODEL, STARS IN THE ARMS OF SPIRAL GALAXIES SHOW AN UNEXPLAINABLE CONSTANT VELOCITY. RATHER THAN SUGGESTING "DARK MATTER", THE XPXP MODEL PROVIDES AN ANSWER.**

Figure 94-4. A velocity vs. distance rendering of a typical spiral galaxy:




According to Newtonian gravitation, the stars beyond the bulge are expected to have a radial velocity that diminishes as the distance from the center increases... just as in the space around planets and stars. Instead, those stars maintain a speed which is equal to the stars at the edge of the bulge. It is proposed in the XPXP model that, rather than abruptly stopping the matter as in a surface, the external stars exponentially add sufficient mass to cause the radial velocity to be constant.

## EXPANSION WITHIN THE BULGE OF SPIRAL GALAXIES:

The stars within the bulge of spiral galaxies are free to move in much the same manner as the galaxies of the cosmos move. There is virtually no interaction between stars. Both the internal mass and volume of the galaxy increase proportionately to the cube of the radius. As shown below, a constant Ho produces an exponentially increasing radial velocity until the (virtual) surface.

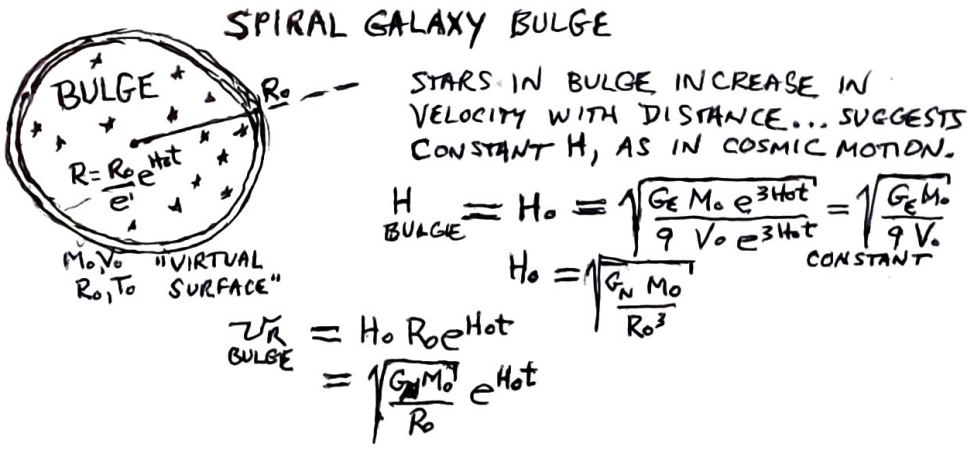
$$R = Roe^{Hot}$$

$$H = \sqrt{\frac{G_E\ Moe^{3Hot}}{9\ Voe^{3Hot}}} = \sqrt{\frac{G_E\ Mo}{9 \cdot 4/3\pi Ro^3}} = \sqrt{\frac{G_N\ Mo}{Ro^3}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro^3}} \cdot Roe^{Hot} = \sqrt{\frac{G_N\ Mo}{Ro}} \cdot e^{Hot}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro}} \cdot e^{Hot}$$

Figure 94-5 XPXP within galactic bulge




# EXPANSION IN THE ARMS OF SPIRAL GALAXIES:

In the bulge of spiral galaxies, both the mass and volume increase proportionately to the cube of the radius. Because the stars have freedom to move, a definitive surface is not created at Ro, as in Newtonian gravitation. Instead, stars exponentially continue to add enough matter to produce an expansion field having a constant radial velocity. Beyond the bulge:

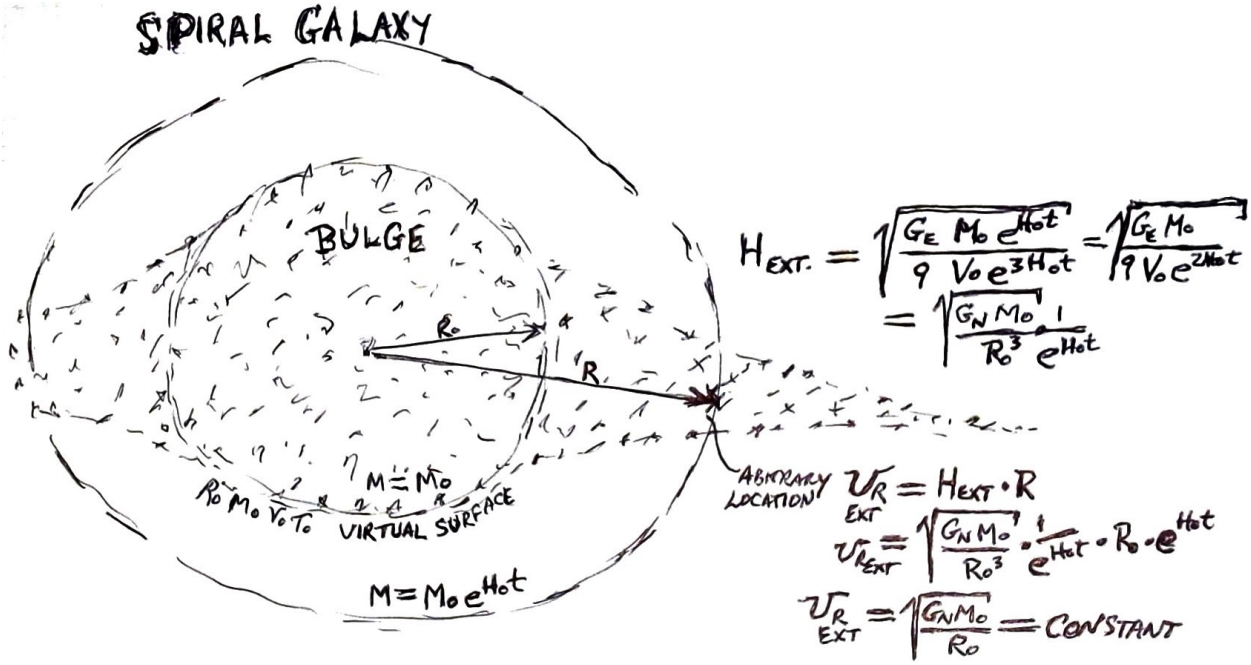
$$M = Moe^{Hot} \qquad R = Roe^{Hot}$$

$$H = \sqrt{\frac{G_E\ Moe^{Hot}}{9\ Voe^{3Hot}}} = \sqrt{\frac{G_E\ Mo}{9\ Voe^{2Hot}}} = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{2Hot}}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro^3\ e^{2Hot}}} \cdot Roe^{Hot} = \sqrt{\frac{G_N\ Mo}{Ro}}$$

$$v_R = \sqrt{\frac{G_N\ Mo}{Ro}}$$

The Expansion field surrounding the bulge contains stars which have the same velocity, and account for the “flattening of the velocity curve” in spiral galaxies. Because the external stars were expected to obey Newtonian gravitational principles, Dark Matter was invented.
Figure 94-6.


SPIRAL GALAXY
BULGE
$R_0$
$R$
$M = M_0$
$R_0\ M_0\ V_0\ T_0$
VIRTUAL SURFACE
$M = M_0 e^{Hot}$
ARBITRARY LOCATION
$H_{EXT.} = \sqrt{\frac{G_E M_0 e^{Hot}}{9 V_0 e^{3Hot}}} = \sqrt{\frac{G_E M_0}{9 V_0 e^{2Hot}}}$
$= \sqrt{\frac{G_N M_0}{R_0^3}} \frac{1}{e^{Hot}}$
$V_{R_{EXT}} = H_{EXT} \cdot R$
$V_{R_{EXT}} = \sqrt{\frac{G_N M_0}{R_0^3}} \cdot \frac{1}{e^{Hot}} \cdot R_0 \cdot e^{Hot}$
$V_{R_{EXT}} = \sqrt{\frac{G_N M_0}{R_0}} = CONSTANT$