# GRAVITY...
## EXPONENTIAL EXPANSION OF CONCENTRATED MATTER

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The unique character of the theory of exponential expansion (XPXP) is that it provides a general principle that applies to all cosmic phenomena. A convincing aspect of the theory is that it mathematically describes gravitation as an exponential expansion, both internally and externally, of a concentrated mass. But how can that be? Intuitively, since we live on the surface of a concentrated mass, gravity seems to be the opposite of an expansion. It may help to imagine that an "attraction" is really the inability of an object to "keep up with" an unrealized exponential spatial expansion.

Gravitation is one form of XPXP. The cosmic flow and star motion in spiral galaxies are others, also addressed here. (See "Embodiments of exponential expansion"- to see the simple differences between the three.)

Under the λCDM model, there is no direct correlation between the expanding cosmos and gravitation, except that gravitation was predicted by many to be a braking force for the universal expansion. It was a surprising discovery that not only was the universal expansion not slowing, it was actually accelerating. An explanation was suggested that an undetectable "dark energy" exists, which counteracts gravity. An understanding of XPXP will show a logical explanation of universal acceleration that is consistent for both gravitation and universal expansion.

XPXP for the Hubble flow is derived from the Hubble/LeMaitre (H/L) Law, based on Hubble's direct observations of galactic movement in the universe. The exponential nature of the H/L Law has been disregarded because it mathematically conflicts with the established Standard Model. Ho must be constant if the universal expansion is exponential, and everyone "knows" that Ho is not constant. That conclusion is <u>incorrect</u> because it is based upon the math and measurements of the standard model.

In the proposed XPXP model, the spatial expansion created by matter causes acceleration of masses traveling through that spatial expansion. Expanding space may be created by a variety of matter distributions- from the universe as a whole to small masses. In a manner similar to relativity: "Matter creates spatial expansion fields, and spatial expansion fields tell matter how to behave".

Presently, the gravitational laws of Newton and Einstein are considered to be universal, existing wherever matter exists. But the unanticipated discovery of the acceleration of the universe required a correction to the standard model... "dark energy". Additionally, standard model gravitational principles do not explain the constant velocity of stars in the arms of spiral galaxies, requiring… "dark matter".

Consequently, it appears that matter distributions other than concentrated masses fail as valid examples of gravitation. It is unreasonable to assume that the rules derived on the surface of the earth by Newton and Einstein automatically extend to all universal situations.

It should be noted that XPXP analyses of embodiments of an expansion represent instantaneous situations. After any time interval all values change, including those of the observer.

## XPXP APPLIES TO ALL MATTER DISTRIBUTIONS

A postulate of the exponential expansion theory is that XPXP occurs wherever matter is present. The quantity and distribution of the matter determines the nature of the expansion. The general XPXP principles therefore apply to both the cosmic flow and gravity. It is proposed that Newton/Einstein gravitation is a local embodiment of exponential expansion, and "gravity" is present only when matter is concentrated.

The exponential expansion (XPXP) of concentrated matter differs from that of the free galaxies of the Hubble flow. Closely-spaced matter interacts with adjacent, closely-spaced matter. Because matter expands and produces spatial expansion, the expansion of adjacent matter is inhibited and affects the overall expansion of the matter. This conflict suggests that matter confined within a concentrated mass expands at a lesser rate than the volume expands. There are two subsequent internal effects produced: 1) the density within the sphere decreases as the radius increases and 2) the impeded internal matter expansion results in a matter-energy conversion, releasing heat and other forms of energy. This conversion is consistent with Einstein's $E=MC^2$ .

A "surface" is produced when the sphere runs out of matter, and Mo and Vo are defined, beyond which only a spatial expansion occurs. This spatial expansion is "gravity", an exponential expansion of the volume of the surrounding space.

An ideal exponential expansion of a concentrated mass should have several observable characteristics:

- An exponentially expanding sphere having a substantially defined surface.
- A massless space surrounding said spherical mass displaying Newton/Einstein gravitational properties, e.g., a negative inverse-squared radial acceleration
- Internally, volumetric increasing spherical "shells" which decrease in density $\rho$ outwardly, and reach a minimum value $\rho o$ at the surface, representing the average density for the entire sphere.

### THE EXPANSION OF CONCENTRATED MATTER ACTS IN TWO WAYS... INTERNAL (UNTIL THE SURFACE) AND EXTERNAL (BEYOND THE SURFACE)

Exponential math describes both internal and external expansion of concentrated matter. Internal exponential expansion is matter-induced and is analogous to the cosmic flow. But it differs from the cosmic expansion in that the expansion of internal matter is obstructed by adjacent expanding matter. This results in an inhibition of the exponentially expanding mass. Externally, where no further matter exists, the expansion takes a significantly different form: an exponential spatial expansion only, showing the properties of Newtonian/Einsteinian gravitation. It should be again noted that XPXP reveals that "gravitation" is limited to concentrated matter.

Exponential expansion solves the galaxy rotation problem without adding (mythical) dark matter. The discovery of the "flattening of the velocity curve", wherein the stars move at an unexpected constant velocity in the arms of spiral galaxies is seen as evidence for "dark matter" under the standard model. A dark matter halo seemingly explains the anomalous speed of those outer stars... but such dark matter cannot be detected (and does not exist, per XPXP).

## PART 1 - INTERNAL XPXP OF CONCENTRATED MASSES

An examination of the exponential expansion of a concentrated mass begins with a comparison to the cosmic flow.

The Hubble flow: M=Mo e^3Hot

V = Vo e^3Hot therefore:

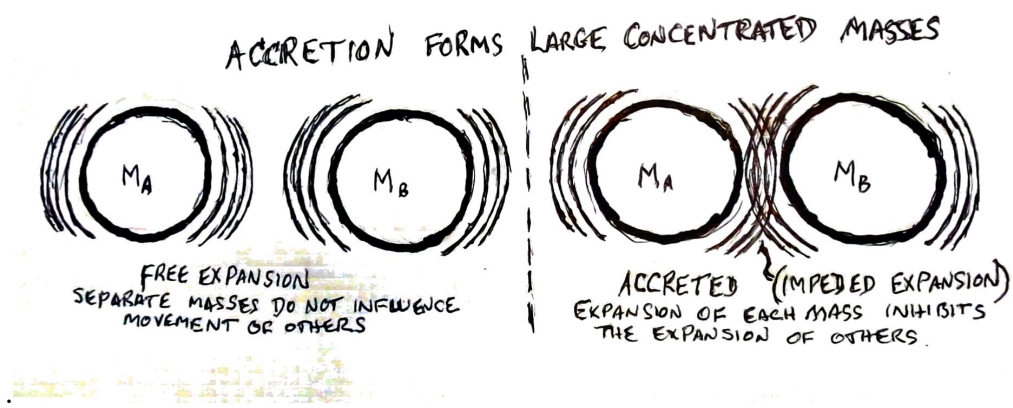
density is constant = Mo/Vo

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

The logic and math of the equations of motion in the Hubble flow also pertain to both the internal and external expansion of concentrations of matter. However, concentrated matter is distinguished from other matter distributions in that internal matter is in close proximity to adjacent internal matter. It is proposed that all matter within a body creates an exponential volumetric expansion, just as the matter of the universe creates the accelerating volumetric spatial expansion field of the Hubble flow. In the universe, particles (galaxies/stars) of the XPXP universe have substantially no effect on each other. In this cosmic "free expansion", the volume and mass of the universe both expand unimpeded, thereby creating a constant universal density on a large scale.

But within a concentrated mass, accreted matter particles create spatial acceleration fields which conflict with expansion fields of adjacent matter. Figure 90- 1. shows this process, wherein the spatial acceleration fields created by two particles are in conflict and therefore the particles accelerate toward each other and eventually accrete to form a larger mass. Devoid of any other forces, the combined masses continue to expand and remain together and the accelerative forces offset. This process accounts for the accretion of matter to form planets, etc., and the interaction is wrongly interpreted as being caused by a pull of gravity. It can be imagined that an observer who is not aware of an expansion, could consider the effect an "attractive" force. It is difficult for humans to imagine an expansion, instead of a simple "pull" of gravity.

FIGURE 90-1




The exponential expansion process continues in all directions but is impeded by surrounding matter. This resistance affects the expansion of the total mass, while the expansion of the volume is unimpeded. This process produces a radially decreasing internal density.

The spatial volume of concentrated matter exponentially expands in the same manner as the universal expansion, i.e. proportionally to $R^3$.

In the Hubble flow the galaxies do not interact, and therefore are in "free expansion" and

the expansion of matter is proportional to the cube of the radius, while the spatial volume also expands proportionately to the cube of the radius. This relationship produces a constant universal density, wherein $\rho o = Mo/Vo$ and therefore produces a constant Ho. The effect of particle interaction creates a distinct difference between the Hubble Flow expansion and the expansion of a concentrated mass.

## ENERGY-MASS RELATIONSHIP IN XPXP

Before analyzing the internal expansion of concentrated masses, it should be noted that the obstruction of the expansion of concentrated matter appears to produce a mass-energy conversion. It is known that temperature and pressure increase when descending into planets and stars. On earth, the mantle and core are clearly at higher temperatures and pressures than the crust. There is reason to believe that it is true for all concentrated universal bodies.

A simple Newtonian calculation below shows XPXP consistent with E=MC^2. It is proposed that a mass/energy conversion occurs within concentrated masses accounting for the high temperatures and pressures observed. The XPXP theory maintains that both matter and space expand as a natural process. Equations of Newtonian mechanics may be applied to create a situation that causes a mass to differ from the cosmic expansion. Energy must be applied to a mass which is expanding within the proper flow to prevent that mass from moving in accordance with the flow. That energy is interpreted as the energy of the motion, and bringing it to "rest" is a method to determine the total energy of the motion. The "free expansion" of the Hubble flow provides a model that is as simple as possible. Imagining the work (energy) necessary to stop an object from expanding in the Hubble flow produces an expression showing a relationship between energy and mass as seen below:

**NEWTONIAN EXPRESSIONS**: (Second Law) $\mathbf{F = M \cdot A}$

Force = Mass x Acceleration

(Work = Energy) $\mathbf{E = F \cdot D}$

Energy = Force x Distance

$E = (M \cdot A) \cdot D$

The corresponding expressions in XPXP:

R = Distance = Roe^Hot

M = Mass = Mo e^ 3Hot

A = Acceleration = $Ho^2Ro$ e^Hot = HoCo e^Hot

C = Light Speed = Co e^Hot = HoRo e^Hot

The energy of a properly moving mass may therefore be shown to be:

E = Energy = $(M \cdot A) \cdot D$

E = (Mo e^ 3Hot · $Ho^2Ro$ e^Hot) · Roe^Hot

E = (Mo e^ 3Hot) · ($Ho^2Ro^2$ e^2Hot)

E = (Mo e^ 3Hot) · ($Co^2$ e^2Hot)= (Mo e^ 3Hot) · (Co e^Hot)$^2$

$\mathbf{E = M \cdot C^2}$

Thus, the energy needed to "stop" an exponentially expanding mass in the cosmic flow suggests Einstein's famous mass/energy relationship. It is proposed that the inhibited expansion of matter internal to planets and stars includes some conversion of matter to energy.

When familiar with the exponential mathematics of this model, it is seen that matter creates an expanding spatial field which affects the movement of other matter through it. An object

moving through an accelerating spatial field may change direction or magnitude, as the space through which it moves expands. It is said of relativity that "matter bends spacetime and spacetime tells matter how to move". It may be said of the XPXP model that "matter creates accelerated expansion fields, and accelerated expansion fields tell matter how to move". The XPXP acceleration fields account for "gravitational attraction", orbits, and accretion of matter.

## A MATHEMATICAL EXPRESSION FOR THE INTERNAL EXPANSION OF A CONCENTRATED MASS.

In formulating a mathematical expression for the expansion <u>within</u> a concentrated mass, some observations and assumptions must be made:

- Both matter and volume of a concentrated mass exponentially increase as a function of time.
- Mass and volume increase as radius increases, but the density decreases, implying a mass increase less than a volume increase.
- Because of the proposed internal interaction between closely-spaced expanding matter particles, the exponential spatial expansion (volume) and the exponential matter expansion increase at different rates. The spatial expansion continues as in free expansion, while the expansion of the matter is impeded by surrounding expanding matter, and therefore does not increase equivalently to the volume. This situation explains an exponentially reducing density until the surface.
- Matter increases in direct proportion to the radius (an assumption...yet to be verified), while volume increases as $R^3$.
- The expansion is "local", e.g. Mo is the mass of the concentrated object, not the universe.
- Internal "shells" or spheres can describe the internal expansion, and all matter external to a particular shell does not affect the expansion of the shell. (consistent with Newton et al.)
- Exponential expressions describe the matter and volumetric expansions of an internal shell.

A review of the cosmic expansion should be a starting point for relating to the expansion of concentrated masses (See Hubble-LeMaitre Law). A <u>universal</u> sphere in the cosmic expansion expands exponentially and has a radius of Ro, and a Hubble constant Ho as a factor :

**FOR UNIVERSE:**

$$A_V = G_E M_0 e^{3H_0 t} \qquad where \qquad Ho = \frac{\sqrt{G_E \rho_0}}{3} = \sqrt{\frac{G_E M_0}{12\pi R_0^3}}$$

$$\upsilon_R = \frac{G_E M_0 e^{3H_0 t}}{4\pi R^2 Ho} \; where \; Ho = \frac{\sqrt{G_E \rho_0}}{3} = \sqrt{\frac{G_E M_0}{12\pi R_0^3}} \; and \; R = R_0 e^{H_0 t}$$

$$Then \; \upsilon_R = \sqrt{\frac{G_E M_0}{12\pi R_0}} e^{H_0 t} = Ho R_0 e^{H_0 t}$$

REM: $G_E = 12\pi G_{(Newton)}$ and Ho differs from the Ho of the standard model .
When $t = T_o$ the surface of the sphere is defined (where $T_o = 1/Ho$).

Note: In the Hubble universal expansion, because of the vastness of space, matter in galaxies does not significantly interact with matter in other galaxies.

If the principles of the general expansion equation for the free expansion of the universe apply to gravitation, Ho cannot be constant. $G_E$ certainly cannot be a variable, because it is a

statement for the spatial expansion caused by <u>any</u> matter. The density in H must be non-constant. A proposed expansion coefficient, H, where the density is exponentially decreasing will produce an embodiment of the expansion differing from the cosmos (see "short"- exponential expansion embodiments). H accounts for gravitation and spiral galaxies. Hubble's constant, Ho, is a special case of the general expansion coefficient H.

The <u>spatial</u> expansion (volume) within a concentrated mass increases with $R^3$ (as it does in the Hubble flow), while it is proposed that the <u>matter</u> increases with R. This combined expansion suggests the accretion of matter and other properties of expanding concentrated masses.

It may be difficult to envision the process, but realizing the exponential increase in volume Vo e^3Hot in time t, the matter within the volume increases to Mo e^Hot. In this manner, the expansion of concentrations of matter differs from the free expansion of the universe.

Therefore, **INTERNALLY**, for any sphere of mass Mo:

$$V = V_0 e^{3H_o t} \quad \text{and} \quad M = M_0 e^{H_o t}$$

leading to the revelation that the <u>density</u> of internal spheres will decrease until the surface. Once again, it is proposed that the <u>expansion of matter is proportional to the radial expansion</u>, while the <u>spatial expansion remains proportional to the cube of the radius</u>. This unequal expansion of the matter and volume continues until reaching a "surface", where M=Mo and V=Vo, after which no further matter is added. But space continues to expand beyond the surface, and defines gravitation as we know it. The general principles for <u>universal</u> exponential expansion apply to the expansion of concentrated matter.

A further aspect of the concentrated matter embodiment of exponential expansion:

To be consistent, the expansion within a sphere must have an origin such that in time To, the surface forms a sphere of volume Vo and of mass Mo. By mathematically adjusting the origin of expansion to Ro/e^1, the calculations are consistent , i.e., the radius of the sphere becomes Ro (at the surface) etc. (See Short: "centering the expansion")

$$R = \frac{R_0}{e^1} e^{H_o t} \qquad and\ M = M_0 \frac{e^{H_o t}}{e^1} \qquad and\ V = V_0 \frac{e^{3H_o t}}{e^3}$$

The time, t, defines the expansion extending from Ro/e^1 to Ro and all positions in between.

For most purposes, mathematically omitting this adjustment has not presented any problems, since it is simply a multiplication by a constant and there is no "special" location in the universe.

However, an origin for the XPXP of concentrated matter simplifies the understanding of that expansion. The origin of the expansion of concentrated matter is centrally located within a sphere of radius Ro. The values for Vo, and Mo <u>at the surface</u> of the sphere are therefore also defined, as is Ho.

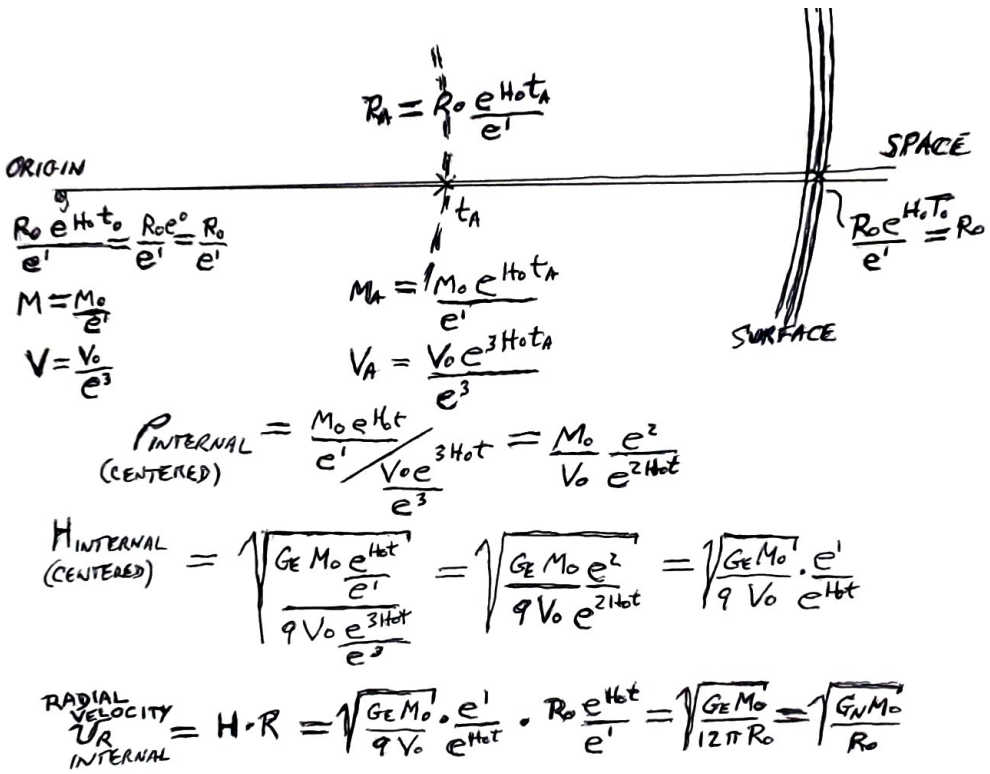
Earthly values for Mo and Ro are used to calculate the radial velocity at Earth's surface, and the result agrees with the Newtonian orbital velocity at the surface of the earth. Additionally, the radial velocity may be calculated for any interior "shell".

The principles of exponential expansion are the same for concentrated masses as in cos-

mic free expansion, except that Ho must refer to the parameters of the object, rather than those of the universe. Therefore, using exponential principles, a complete description of the instantaneous internal values for the position, velocity, and acceleration for any location within the sphere may be calculated, shown in Figure 90-2.

For depths within the earth, seismic evidence has established that the density (and pressure) increases with depth, consistent with this exponential model.

Figure 90-2. INTERNAL XPXP OF CONCENTRATED MASSES




Note that <u>all</u> values of radial velocity are the Newtonian (surface) orbital velocity, $\sqrt{G_N M_0 / R_0}$

because $\mathbf{G_E = 12\pi G_{(Newton)} = 12\pi G_N}$

This applies to any internal position, so that the internal radial velocity is constant.

This process for finding the radial velocity for <u>any</u> expansion is to first determine the coefficient, H, for the particular expansion, then multiply by R.

From Figure 90-2, the <u>internal</u> expansion of concentrated masses may be determined. This expansion is dependent upon the unequal expansions of matter and space caused by that matter. The spatial expansion is proportional to $R^3$, while the matter expansion is proportional to R.

The expansions are exponential, where M = Mo e^Hot and V= Vo e^3Hot. The density at any position is then ρo /e^2Hot, and reduces with time, until the surface.

By centering the origin of the expansion so that R=Ro/e^1, the surface is located at Ro. ("centering the expansion")

The radial velocity within a concentrated sphere is constant at all distances because, within the sphere, H = Ho e^1/ e^Hot and when multiplied by R =Ro e^Hot/e^1, the exponential factors cancel out. The radial velocity at any internal position, therefore, is the Newtonian orbital velocity at the surface.

## PART 2 - GRAVITATION:
## EXPANSION OF SPACE SURROUNDING A CONCENTRATED MASS

The space surrounding a concentrated mass exhibits what was described as "Gravitation" by Newton. Newton described the properties of gravitation, but could produce no real reason for its existence. General relativity proposes that masses bend "spacetime", and passing masses will be governed by that bent spacetime. Relativistic gravitation cannot explain several aspects of cosmic phenomena, including the universal acceleration and the flattening of the velocity curve in spiral galaxies. In the late 20th century, when universal acceleration was discovered, an explanation for that acceleration called for dark energy. Rather than clarifying standard model, it became more complicated.

By envisioning an expanding sphere of mass Mo,then applying the general philosophy of the universal expansion (i.e. matter induces a spatial expansion), a mathematical analysis of such an expansion can be accomplished. But, before looking at an exponential expansion for the sphere, it is suggested that an examination of constant volumetric acceleration of $G_E$Mo and standard mathematics may produce some insight. It is seen below that the equations of such an expansion describe Newtonian gravitation. (See Table 90-1.) The "coincidental" connection between gravitation and volumetric expansion prompted this investigation of XPXP.

Table 90-1:

| | |
|---|---|
| **Volumetric Acceleration** ($m^3/sec^2$) $A_{vc} = G_E M$ (2) | **Radial Acceleration** ($m/sec^2$) $A_{RC} = -\frac{G_E M}{12\pi R^2}$ (7) (Newton's Law where $G_E = 12\pi G$) |
| **Volumetric Velocity** ($m^3/sec$) $V_{vc} = dV/dt = V_{vco} + G_E M t$ (3) $V_{vc} = dV/dt = 4\pi R^2 (dR/dt)$ (4) | **Radial Velocity** ($m/sec$) $(dR/dt) = V_{RC} = \frac{V_{vco} + G_E M t}{4\pi R^2}$ (8) $(dR/dt) = V_{RC} = \sqrt{(G_E M)/(6\pi R)}$ (9) (Newtonian Escape velocity) |
| **Volume** ($m^3$) $V = V_o + V_{vco} t + \frac{1}{2} G_E M t^2$ (5) $V = 4/3\,\pi R^3$ (6) | $R = \sqrt[3]{\frac{3 G_E M_o t^2}{8\pi}}$ (KEPLER) $R^3 \propto t^2$ |

Table 90-1. shows data for a **non-exponential** expanding imaginary sphere. The mathe-

matics (differentiation and integration) of expansion of this illustrative sphere is assigned a constant volumetric acceleration of $G_E M_o$, where $G_E$ is some proposed universal expansion constant and Mo is the matter present to induce the expansion. The values derived from the basic premise of a constantly accelerating volumetric expansion of a mass show an obvious connection to Newtonian gravitation. (The expression for radial velocity ($V_R$) differs from the radial velocity of XPXP by sq.rt. 2). This non-exponential math shows a Newtonian character for an acceleration field.

Observations from Table 90-1:

***Conventional equations (non − XPXP) for volumetric expansion***

*Imagine a sphere of mass* $\boldsymbol{M_0}$ *which is expanding with a constant volumetric acceleration*:

*Volumetric acceleration*: $Av = f(t) = constant = \boldsymbol{G_E M_0}$

*Integrate to find volumetric velocity*: $Vv = \boldsymbol{G_E M_0}\ t$

*Integrate to find volume*: $V = \mathbf{1/2}\ \boldsymbol{G_E M_0\ t^2}$

*Volume identity*: $V = \mathbf{4/3}\boldsymbol{\pi R^3}$

*Equating the two expressiions*: $\mathbf{1/2}\ \boldsymbol{G_E M_0\ t^2} = \mathbf{4/3}\boldsymbol{\pi R^3}$

*It can be seen that this relationship between time and radius is that of Kepler's Laws*

*Through differentiation and substitution, important expressions for radial velocity and radial acceleration can be derived*:

$$V_R = \sqrt{\boldsymbol{G_E M} / 6\boldsymbol{\pi} R} \qquad \text{and} \quad A_R = -\boldsymbol{G_E M} / 12\boldsymbol{\pi R^2}$$

*These are the Newtonian escape velocity and acceleration.*

*XPXP values should correspond to these values.*

Although a volumetric expansion of a sphere of mass Mo exhibits Newtonian characteristics, it will be shown that an <u>exponential</u> expansion of a such a sphere is a better fit.

To see the correspondence between Newton's gravitational equations and equations for exponential gravitational expansion (both are positions beyond the surface of the sphere), the spatial field must display certain properties:

- A positive radial velocity which decreases as R increases, where R is the distance from the center of the sphere to the measurement position.
- A negative radial acceleration field which begins at the surface of the sphere, decreasing by $1/R^2$ thereafter.

Standard mathematical practices apply... e.g. the derivative of the exponential expression of radial velocity produces a radial acceleration. Motion of an object through the expansion field <u>appears</u> to be affected by a "pulling" force, but it is not. (GR and XPXP)

It is proposed that, in a concentration of matter, that the internal expansion of matter during a time interval is less than the expansion of the volume (space) during that time interval. This

suggests an outwardly decreasing density. But beyond the surface (the boundary where no further matter is added), the surrounding space continues to expand. The radial velocity and acceleration at any position in this space may be determined as a function of R. It is noted that both the external velocity and external acceleration are greater when a position is closer to the surface, and reduce as R increases. "Gravity", as we know it, begins at the surface.

In the XPXP model, the XPXP (unrecognized) earthly sphere produces an accelerated expansion of space beyond the surface having a character that seemingly is a pulling force. It is proposed in XPXP that a "pulling force" is actually a situation in which an observer sees an unrecognized spatial expansion field and an object in the expansion field seems to decelerate. This is seen as "falling" in gravitational situations. Beginning with the general principles of the universal exponential expansion, and assuming differences in concentrated matter, an XPXP expression for gravity may be formulated.

Because an acceleration field expands radially from a spherical mass, an object passing by the sphere will appear to change both velocity and direction...the closer to the surface, the greater the change. What we call gravity is the result of this accelerated expansion of space. It appears to have an effect which is the reverse of the cosmic expansion, in that the character of the cosmic expansion shows galaxy speeds increasing with distance. In gravitation, the expansion of space causes matter to appear to be accelerated toward a center of mass. The dynamic properties of the sphere and the surrounding space are determined by the amount of matter present. Matter accretes because of exponential expansion, forming rocks to planets to stars.

To formulate an expression for XPXP gravitation, it is necessary to recognize differences between the free expansion of the Hubble flow and an inhibited internal expansion of concentrated matter. In both situations the expansion is produced when matter is present...and both have positive radial velocity. But accretions of concentrated matter eventually "run out of matter", creating a boundary after which an exponential spatial expansion occurs. This situation defines gravitation, and suggests that the rules of Newtonian/Einsteinian gravitation is limited to concentrations of matter.

At the surface of a concentrated mass, the form of the expansion changes dramatically. Internally, the mass of the exponentially expanding sphere increases in proportion to the radius, while the spatial volume exponentially expands with the cube of the radius. Because matter ceases to exist after the surface, the matter-induced expansion diminishes exponentially. Below, an exponential expression for the expansion of the space <u>surrounding</u> a sphere of <u>radius Ro</u> is shown.

In any XPXP, an expansion coefficient H must be determined. Ho, Hubble's constant, pertains to the universe, but not all XPXP situations. We have seen that density determines the character of an expansion...constant in the cosmic flow and internally decreasing in concentrated matter. The density of matter at a position in the space surrounding a sphere of concentrated matter has a constant mass, Mo, and a volume which increases exponentially. The combination produces an expansion coefficient H which is not constant.

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

It is seen that H reduces with increasing R. The second expression is the Newtonian H (where $\mathbf{G_E = 12\pi G_{(Newton)} = 12\pi G_N}$). This makes the radial velocity more recognizable.

The radial velocity is simply the product HxR . In Newtonian terms:

$$\boldsymbol{v}_R = \sqrt{\frac{G_N M_0}{R_0{}^3 e^{3H_0 t}}} R_0 e^{H_0 t} = \sqrt{\frac{G_N M_0}{R_0 e^{H_0 t}}}$$

This is the Newtonian orbital velocity, but with an exponential denominator. The radial velocity decreases as R increases, agreeing with what is astronomically observed.

Differentiating the XPXP radial velocity will give the radial acceleration:

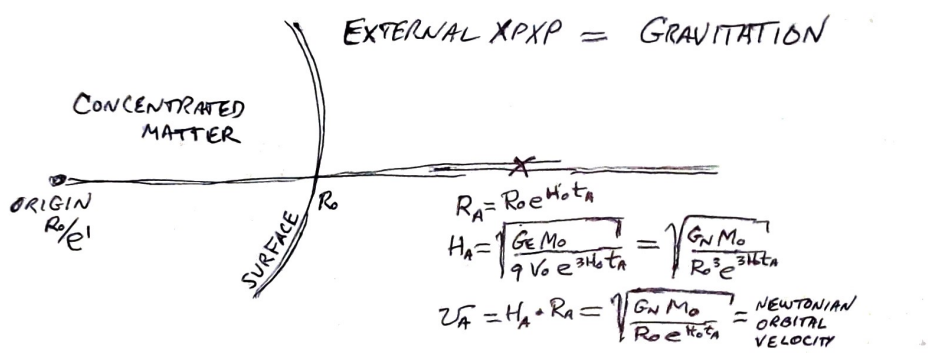
$$\boldsymbol{v}_R = \sqrt{\frac{G_N M_0}{R_0 e^{H_0 t}}}$$

$$\boldsymbol{a}_R = d/dt \sqrt{\frac{G_N M_0}{R_0 e^{H_0 t}}} = \sqrt{\frac{G_N M_0}{R_0 e^{H_0 t}}} \cdot d/dt\,(e^{-H_0 t}) = \sqrt{\frac{G_N M_0}{R_0 e^{H_0 t}}} \cdot (-Ho\, e^{-H_0 t})$$

$$= \sqrt{\frac{G_N M_0}{R_0 e^{H_0 t}}} \cdot (-\sqrt{\frac{G_N M_0}{R_0{}^3 e^{3H_0 t}}} \cdot (e^{-H_0 t}) = -\frac{G_N M_0}{R^2{}_0 e^{2H_0 t}} \cdot (\frac{1}{e^{H_0 t}})$$

The radial acceleration is negative and inverse squared...agreeing with Newtonian gravitation.

Figure 90- 3. XPXP Gravitation




The values for the radial velocity and radial acceleration therefore agree with observed gravitational values.

These exponential expressions define a local external spatial expansion caused by a concentration of matter. This implies that such an external expansion occurs only for concentrated matter, and Newton/Einstein gravitation principles cannot be applied to other distributions of matter. A passing object will experience what is now considered to be an “attractive” force toward the mass (or bent space-time). In actuality, the exponentially expanding spatial acceleration fields produced by XPXP affect matter in a manner similar to “curved space-time” of general relativity.

## SPIRAL GALAXIES

In XPXP gravitational principles do not apply to all distributions of matter, as evidenced in spiral galaxies. Within the "bulge" of the galaxy, stars move at an exponentially increasing radial velocity - an expansion having the same character as the universe as a whole.

But it has been discovered that the outer stars in spiral galaxies (beyond the bulge) all move at the (approximately) same speed, contrary to the expected decrease in speed called for in Newton/Einstein gravitation. This "flattening of the velocity curve" in the arms of spiral galaxies produced a problem for astronomers which has been solved with the creation of mysterious "dark matter". In typical fashion, rather than questioning the accepted theory, an addition to the theory seems to resolve the problem. To date, there has been no evidence to prove that dark matter exists.

The XPXP model provides an alternative solution. The expansion of a spiral galaxy applies the same rules as that of a concentrated mass, but differs in that there is no interaction between the stars occupying both the bulge and the arms. Because of this free expansion, galaxies do not possess a surface. The transition from the bulge to the arms is determined by the distribution of the stars, and is limited by the mass of the stars available. By providing additional matter (stars) beyond the bulge, a spiral galaxy appears to reach a state of equilibrium, wherein the stars move with the same radial velocity. The distribution of the matter external to the galactic bulge cancels the exponential decay the of spatial expansion that is seen beyond the surface of concentrated matter. The galactic matter in these stars geometrically increases as the radius, while the spatial expansion increases as the radius cubed. When this occurs, a constant radial velocity exists in the spatial expansion field (math shown previously).

## SUMMATION OF XPXP OF CONCENTRATED MASSES

XPXP provides a mathematical explanation for the expansion of concentrated matter that uses the same principles as the universal model. Internally, impeded expanding matter produces a conversion of matter to energy, resulting in an outwardly decreasing internal density. This produces a constant radial velocity for the expansion within the sphere. Externally, a negative inverse-squared acceleration field is created.. Beyond the surface, the effect of a constant mass and a continuing volumetric expansion field produces the effect that we call "gravitation".

Presently, in the standard model, "gravitation" (Newtonian and GR) is considered to be a universal concept, with corresponding expectations . But XPXP contends that gravitation is valid only for the space surrounding concentrated masses such as planets and stars. Gravitation fails when applied to distributions of matter in forms other than concentrated masses. Specifically, standard model gravitational principles do not explain the constant velocity of stars in the arms of spiral galaxies and the unexpected acceleration of the universe as a whole. Rather than creating mythical modifications (like dark matter and dark energy) to justify such major problems, there must be a realization that A GREAT MISTAKE WAS MADE. A return to the very basis of the universal model is necessary...and XPXP becomes the solution.

# CORRELATION BETWEEN UNIVERSAL XPXP AND GRAVITATION

It has been established that the exponential volumetric acceleration ($A_V$) and radial velocity ($V_R$) of an ideal universal sphere are:

$$(UNIVERSE)$$

$$A_V = G_E M_0 e^{3H_0 t} \qquad where \qquad Ho = \frac{\sqrt{G_E \rho_0}}{3} = \sqrt{\frac{G_E M_0}{12\pi R_0^3}}$$

$$and \;\; G_E = 12\pi \; G_{NEWTON}$$

$$v_R = HoR_0 e^{H_0 t} = \sqrt{\frac{G_E M_0}{12\pi R_0}} e^{H_0 t}$$

$G_E$ is the universal expansion constant.

After substitutions and conversions, it is seen that the exponential expression for universal radial velocity agrees exactly with the Newtonian gravitational expression for circular orbital velocity in all but the exponential expansion factor.

It is proposed that gravitation and the cosmic expansion are two expressions of the same principles... one in which Ho is constant (cosmos) and the other in which H is not constant (gravity). This difference limits the existence of "gravitation" to concentrations of matter.

$$(NEWTONIAN\ GRAVITATION)$$

$$EXPRESSION\ FOR\ CIRCULAR\ VELOCITY\ IS:$$

$$V_R = \sqrt{G_{NEWTON} M_O / R} = \sqrt{\frac{G_E M_0}{12\pi R}}$$

Of course, the substitution values for mass and radius for the universe differ from the local values for gravitational objects. Universal values produce a (constant) density significantly less than the density of concentrated matter. **It should be noted that the expansion constant, $G_E$, is consistent in both equations.**

It is also presented in this model, (shown in "gravity-xpxp of concentrated matter"), that the internal volumetric expansion of concentrated masses is exponen-

tial and expands with a positive radial velocity, corresponding to that of the cosmic expansion, but with a critical difference.

For universal radial velocity

$$v_R = \sqrt{\frac{G_E M_0}{12\pi R_0}}\, e^{H_0 t}$$

Equations for internal volumetric expansion of concentrated matter (as shown in "gravity-xpxp of concentrated matter") and free volumetric expansion (as in the Hubble flow) have the same form, but the internal expansion of the mass of concentrated matter does not increase equally with the volume expansion. This causes an internal radial decrease in the mass density and causes the radial velocity within concentrated matter to be constant, where:

$$v_R = \sqrt{\frac{G_E M_0}{12\pi R_0}} = \sqrt{\frac{G_N M_0}{R_0}}$$

until reaching Ro. This expression is recognizable as the Newtonian orbital velocity at the surface. At the surface,the limit of the mass, Mo, is reached. Beyond the surface, no further matter exists, resulting in an expansion with the character of gravitation. Gravitation and the Hubble flow are embodiments of exponential expansion. Another embodiment of XPXP is that of spiral galaxies, and explains the "flattening of the velocity curve" problem.

The correlation between the cosmic expansion and gravity- that gravity is actually part of an exponential expansion of a sphere of concentrated matter- implies that principles of exponential expansion exist on all scales. It is illogical to assume that the particles of matter (such as subatomic) do not expand in a manner corresponding to the larger masses that they form. This suggests that exponential expansion is a unifying principle between the cosmic standard model and the quantum standard model... a "theory of everything". A great amount of work is anticipated, but it is hoped that it will be verified eventually.