Gravity -->Unification <- Inertia

Inertial bodies resist acceleration, whether isotropic or unidirectional. Formulas devised to predict counter actions, provide no causal exposition. The known fact is, relative acceleration between a body **B** and the universe will result in counter action proportional to its inertial mass $\mathbf{M_B}$

Standard Theory teaches **G** to be a fundamental constant not composed from other factors. Contrary wise said Tweedle Dee. The resulting analytically determined **G** (volumetric expansion per unit mass) follows directly from Friedmann's expression for Hubble density $\boldsymbol{\rho_U}$. That the puzzlement of the misnamed gravitational constant **G** dissolves forthwith in the face of verifiable numerical predictions, should not be confused with the idea of a locally expanding earth. **Gravity is inertial reaction created by cosmological expansion.**

$$\boldsymbol{\rho_U = 3H^2/4\pi G} \tag{1-a}$$

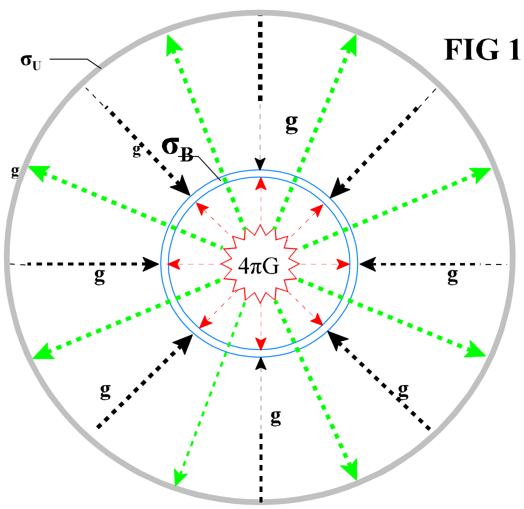

FIG 1

substitute **c/R** for **H**, and Hubble mass $\mathbf{M_U}$ over Hubble volume **V** for $\boldsymbol{\rho_U}$ and get::

$$\mathbf{G} = \frac{3[c/R]^2}{4\pi M_U/[\frac{4}{3}\pi R^3]} = \frac{Rc^2}{M_U} \tag{1-b}$$

Revealed alas, what should be a shock to the constabulary, **G** is simply Hubble volumetric acceleration [$\mathbf{Rc^2}$] divided by Hubble mass $\mathbf{M_U}$, a profundity known as the mystery ratio:[1]

$$\mathbf{M_U G/Rc^2 = 1} \tag{2}$$

Unnoticed, the ratio of Hubble mass to Hubble surface area is approximately one kg per meter^2. Thence, the area density $\boldsymbol{\sigma_U}$ following a volume to surface transformation *a la* Gauss's theorem is:

$$\boldsymbol{\sigma_U = M_U/4\pi R^2 \approx 1\ kg/m^2} \tag{3}$$

That $\boldsymbol{\sigma_U}$ must be "be "one kg/m^2" to conform with Newton's 2nd Law, is discussed infra. For present purposes, it will be taken ≈ one, which leads to an alternative expression for **G:**

$$\mathbf{G} = \frac{Rc^2}{4\pi R^2 \sigma_U} = \left[\frac{c^2}{R}\right] \mathbf{x} \frac{1}{4\pi\sigma_U} \tag{4}$$

The action feature of **G** is contained in the **c^2/R** term, which is aka Einstein's cosmological **term ΛR/3 when** Λ equals $\mathbf{3H^2}$, and at once, it is also the dilation rate of the Hubble for a **q = -1** universe. From (4)

$$\mathbf{4\pi G}\ \mathrm{x}\ \boldsymbol{\sigma_U} = \mathbf{c^2/R} \tag{5}$$

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[1]Long puzzled over by Carl Brans and Robert Dicke in their search for a scalar-tensor theory of gravity. Why should the ratio of [Hubble Mass times G]/[Hubble scale x $\mathbf{c^2}$] equal 1?

In **Fig 1**, Hubble space and mass have been separated into two parts 1) an expanding empty volume and 2) an encompassing shell density $\boldsymbol{\sigma}_U$. In making a Gaussian transformation from volumetric density to surface density, some gravitational energy is lost. That the internal field stress energy remain unchanged, a 5/6 adjustment to the size of the Hubble shell is required. As developed below, the Hubble stress field for gravitational and inertial purposes is determined by its area density rather than its volume density. In brief, we arrive at natures way by emulating field intensity using the same mass $\mathbf{M}_U$ with reduced Hubble radius.[2]

Herein shell density will be approximated as one kg/m^2 and **R** is reduced to 5/6 $\mathbf{R}_H$. Thence from (5), interior pressure P_S

$$\mathbf{P_S = -\ [c^2/R]}\boldsymbol{\sigma}_U \tag{6}$$

It will be convenient for predicating earths surface **g** field, to make a 2nd volume to surface transform, which for earth"s mass (6×10^{24}kg) and radius (r = 6.37×10^6 meters) –> (1.173 kg/m^2) .

$$P_E = [\mathbf{c^2/R}]\boldsymbol{\sigma}_E = [9 \times 10^{16}/1.08 \times 10^{26}] \times 1.173 \times 10^{10} = 9.8 \text{ ntn/m}^2 \tag{7}$$

To express the **g** field of any mass in terms of Newton's 2nd law, we write both sides of the equation in terms of Mass x acceleration per unit area. One side represents the universe, the other a local mass such as the earth - we want both sides to be expressed in terms of pressure for that is the modus operandi used by nature to convert "*acceleration x mass*" to "*force/mass*."

$$\left[\frac{\mathbf{M_B}}{\mathbf{meter^2}}\right]\alpha = \left[\frac{\mathbf{M_U}}{\mathbf{meter^2}}\right]\gamma \,--> \frac{\mathbf{M_B}}{\mathbf{m^2}}\, x\, \alpha = \frac{\mathbf{M_U}}{\mathbf{m^2}}\,\mathbf{x}\,\gamma \,--> [\sigma_B]\alpha = \sigma_U[\gamma] \tag{8}$$

where $\mathbf{M_U/m^2}$ is the Hubble area density $\boldsymbol{\sigma}_U$, and $\mathbf{M_B/m^2}$ denotes the area density $\boldsymbol{\sigma}_B$ of a body **B** such as the earth.[3] The primary acceleration [**α**] is 3-d **(**that created by the $\mathbf{c^2/R}$ radial dilation rate of the Hubble), in which case" **γ**" represents the total '**g***' field created by $\mathbf{c^2/R}$ acting upon $\boldsymbol{\sigma}_B$. In the alternative [**α**] can represent unidirectional acceleration applied to $\mathbf{M}_B$, in which case **γ** will represent cosmological counter acceleration (the reactionary acceleration produced by momentum inflow.

The gamma factor **γ** is the response of the universe (ntn/kg) to a change in momentum of an isolated inertial mass **M**. Momentum flow (aka pressure) into or out of **M**, can be the result of a change in **M**'s motion or ongoing spatial accelerations associated with the expanding universe.

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[2]The difference between the gravitational energy of a 3-sphere and a 2-sphere is 5/6. The shell model of the Hubble will have an operative scale **R** equal to 5/6 the Hubble scale $\mathbf{R}_H$ **(**which is approximately 1.3×10^{26} meters), The 2-sphere model of the hubble as a functional scale is 1.075×10^{26} meters

[3]The Hubble sphere is operatively an area density for purposes of gravity and inertial response, ergo it requires scale adjustment to compensate for energy lost in transformation from 3-sphere reality to 2-sphere functionality. By contrast, individual masses such as earth, act as a passively inert inertial objects. Transformation of earth's mass to its surface is a convenience, but it does not change part played by earth as inertial reaction. rction.

Fig 1 illustrates the geometric relationship between a body **B** such as the earth having its mass transformed to its surface (blue shell) and the Hubble sphere (having its mass transformed to its surface (gray shell). Earths center is taken as the coordinate reference point for radial spatial expansion. Space can considered to be expanding outward from every point - e.g., earth's center:

$$\mathbf{[\alpha] = c^2/R = 4\pi G\sigma_U}$$

From (8),

$$\gamma = \frac{\sigma_B}{\sigma_U}[\alpha] = \frac{\mathbf{1.173\ x10^{10}\,(kgm/m^2)}}{\mathbf{1kg/m^2}}\left[\frac{\mathbf{9\ x10^{16}}}{\mathbf{1{,}08\ x10^{26}}}\right] = \mathbf{9.8\ m/sec^2} = \mathbf{g} \qquad (9)$$

Without more, (9) could be interpreted as expanding mass, due to internal spatial pressure. There is, however, no evidence masses expand as a result of cosmological expansion. Moreover, cosmic pressure $\mathbf{P_S}$, whether considered a consequence of expansion or as the cumulative gravity field of the masses somehow independently created, will be negative and equal in magnitude to the positive $\mathbf{Mc^2}$ energy of the Hubble content (at least for a null "*zero energy universe*")in order to balance positive $\mathbf{Mc^2}$ energy. Consistent therewith, (9) and (10) are included in support thereof.

The energy in the Hubble volume from (6) is:

$$\mathbf{E = \ 3P_SV} =- -\mathbf{3\ [c^2/R]\sigma_U}V \qquad (10)$$

Thence from (3)

$$\mathbf{E = -3[c^2/R]M_U/4(\pi)R^2[4/3]\pi R^3 = -\ M_U[c^2]} \qquad (11)$$

A bold interpretation of (11) credits spatial expansion as the source of all $\mathbf{Mc^2}$ inertial energy. That the mass equivalent of gravitational field energy $\mathbf{Mc^2}$ contains the same inertial factor **M**, raises the specter that the real cause of inertia, like $\mathbf{Mc^2}$ energy, lies not in deep recesses of matter, but in the remoteness of distant matter in an expanding universe.

Adverting again to **Fig 1**, earth's mass [depicted as an porous shell (blue)] is premised in somewhat of a pedestrian fashion to partially obstruct the free expansion of space. However, there is at present, no way to know whether space has a reality of its own. We have no idea how mass modifies interferes or slows spatial expansion - our description at this point is placeholder for a verifiable theory that predicts just how an at rest inertia moderates volumetric expansion of space. We have the numbers, but we are missing the means. What is claimed is that "*acceleration x area density*" gives correct answers, the rest is metaphorical, illustrated physiologically as interrupted flow lines (red) and unblocked flow lines (green). Gravitational inflow momentum (black) from the Hubble surface (gray) is shown terminating at the endpoints of the blocked spatial flow lines (red).

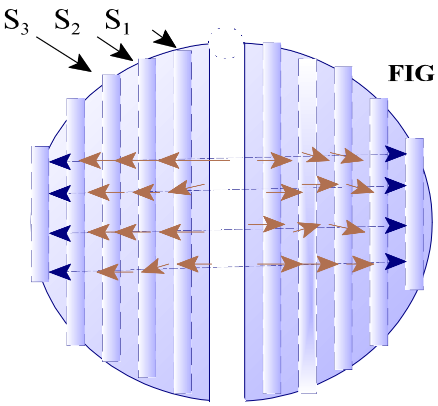

FIG 2:

Fig 2: Neither earth nor Hubble can physically exists as a 2-sphere. But both can be functionally modeled as such Herein is good reason to consider function over form While internal field intensity can be derived from the 3-D density $\boldsymbol{\rho}_U$, one then has to imagine the Hubble pre-sliced into a plenum of virtual planes (such that the gravitational field lines of all planes are parallel and hence additive). An imaginary set of planes is required for each direction. A body at rest at the center of its own Hubble sphere would experience the gravity field of a set of planes in every direction. Viewed as volumetric density $\boldsymbol{\rho}_{U,}$ (taken for present purposes as 3 x 10^{-26} kg/m^3), the Hubble is a near perfect vacuum. But on the large scale it functions inertially as a plenum of planes.

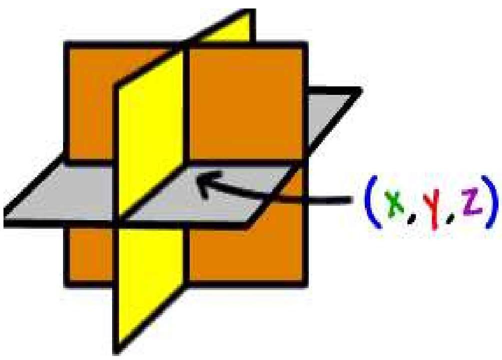

Fig 3 illustrates an alternative transformation from $\boldsymbol{\rho}_U$ to area density defined by the surface area density of three orthogonal planes. This effectuates he same impedance as a 3-sphere to 2-sphere transformation where the side length L is taken as R.

$$M_U = \rho_U \frac{4}{3}[\pi R^3] = 4\pi R^2 \sigma_U \therefore \sigma_U = \rho_U \frac{R}{3} \quad \text{and} \quad \rho_U[L^3] = 3L^2 \sigma_S \therefore \sigma_S = \rho_U \frac{L}{3} \qquad (12)$$

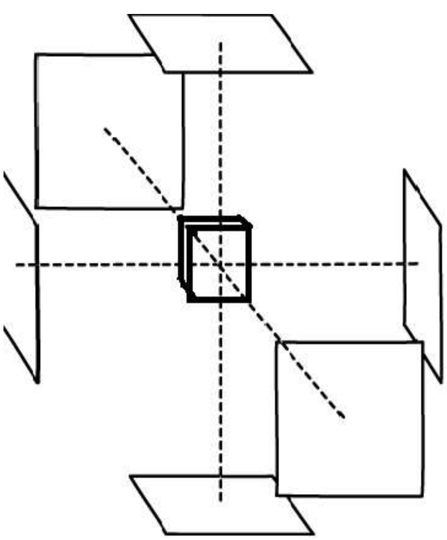

Fig 4 imagines the Hubble sphere reduced to a functional utility defined by a set of three pairs of planes spaced apart by twice the Hubble scale. Opposite planes are defined the area density $\boldsymbol{\sigma}_U/2$ which is determined by the mass available in the space between their faces. Each pair of planes is deemed receding at "**c**" from the common intersect (crossing of the dotted lines), which for purposes herein, defines the location of an inertial mass **M** centered thereon. The receding planes create negative pressure stress $\boldsymbol{\sigma}_U[\mathbf{c}^2/\mathbf{R}]$ per (9), but no net force is experienced by any interior object irrespective of the size, shape or configuration thereof. This speaks for the proposition local **g** fields are the reactionary consequence of the isotropic global G field.

What is discovered in attempting to model the Hubble as a 3-sphere for gravitational and inertial purpose, is that the acceleration intensity γ can only be explained if the Hubble acts as an infinite plane or a virtual plenum of planes (one set of virtual planes for each spatial dimension):
.

$$\boldsymbol{\gamma = [c^2/R] = 4\pi G\sigma_U} \tag{13}$$

If the inertial force is to be explained as a consequence of Hubble parameters, it will be necessary to alter the geometry of the 3-sphere in a manner that emulates it's large scale behavior as an area density. We are obliged to objectify as real, the imagined slicing of the Hubble into planes which are not real. In fact, it is this characteristic of the Hubble, that is key to decoding the mystery of instantaneous inertial reaction, specifically the means by which the Hubble coverts the mass **M** of an accelerated body **B** (of any shape) to a force proportional to said mass **M** x Acceleration .

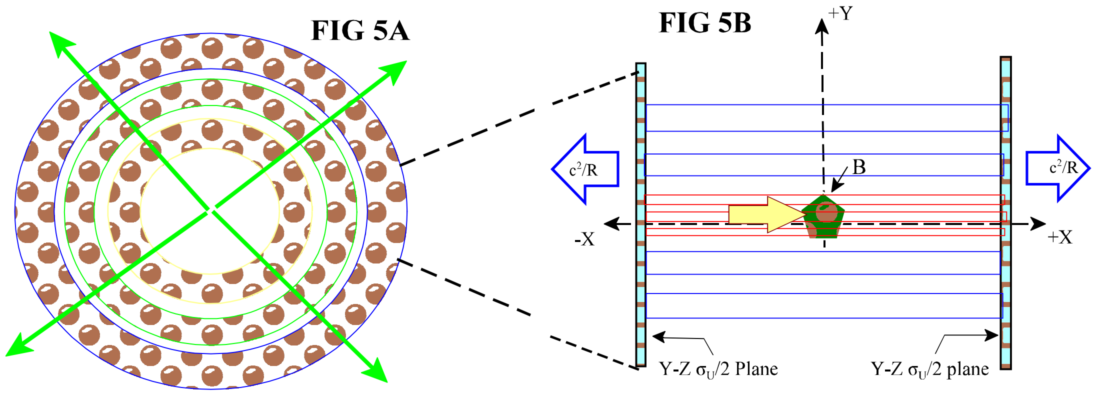

Fig 5A depicts the Hubble divided into expanding nested shells. Each shell is considered an equal area density "*mass/space*" amalgamation receding at a velocity $\mathbf{v_S} = \mathbf{H \times r}$. Although widely spaced apart galaxies are the primary inertial ingredient of Hubble recessional flow, the shells contain sufficient mass to collectively create a reasonably uniform pressure due to area density momentum divergence **f**low$\mathbf{[c^2/R]\sigma_U}$ [where $\boldsymbol{\sigma}_U$ = one kg/m^2]. Accelerated masses (green arrows) leave negative pressure **g** fields $\mathbf{\sigma_U[c^2/R]}$ in their wake. That the acceleration is $\mathbf{c^2/R}$ for all shells, they can be modeled collectively as a single shell for purposes of determining reactionary consequence thereto. We identify this as the background **g** field of the Hubble in that it creates the same negative pressure as that obtained from Gauss's law of gravity.

Fig 5B transforms the shells to a pair of parallel planes receding from each other at $\mathbf{2[c^2/R]}$. As with the concentric shell model (Fig 5A), this creates negative pressure $\mathbf{[c^2/R]\sigma_B}$ as illustrated by the red lines]. When an acceleration "**a**" is applied to body **B** (yellow arrow), gravitational tension stress on a right facing surface of **B** is reduced whereas tension stress on a left facing surface is enhanced.

$$\gamma\sigma_{\mathbf{U}} = \left[\frac{\sigma_{\mathbf{B}}}{\mathbf{2}}\right]\left[\frac{\mathbf{c}^2}{\mathbf{R}} + [\mathbf{a}]\right] - \left[\frac{\sigma_{\mathbf{B}}}{\mathbf{2}}\right]\left[\frac{\mathbf{c}^2}{\mathbf{R}} - [\mathbf{a}]\right] = \sigma_{\mathbf{B}}[\mathbf{a}] \tag{14}$$

Therefore:

$$\boldsymbol{\gamma = [\sigma_B/\sigma_U][a]} \tag{15}$$

The net gravity field [+$\mathbf{c^2/R}$– $\mathbf{c^2/R}$] is still zero. But there is an inertial counter reaction acceleration γ per (15) that is inversely dependent upon σ_U and directly proportional to [$\mathbf{M_B}$ **x a**]. Gravitational tug on body **B** (whatever its shape, density and nonuniformity], produces no net force. Reformation of Newton's 2nd law as a pressure equation is set forth in (16). Cosmic counter pressure $\gamma\sigma_U$ is thus a consequence of expansion. Similar to, but unlike the situation encountered by the inertial effect of earth's mass upon spatial expansion, recessional flow of matter enhances negative cosmological pressure. Applying $\mathbf{c^2/R}$ to the masses *a la* the Hubble shell per (14).

$$\mathbf{F = Ma} ---> \mathbf{A}\frac{M_B}{\mathbf{meter}^2}\,\mathbf{x}\,[\mathbf{a}] = \mathbf{A}\gamma\sigma_{\mathrm{U}} \qquad (16)$$

Where "**A**" is the common interersect area and the γ factor represents earth's **g** field derived by considering spatial expansion within the earth's interior as partially restrained by the shell density σ_B, deemed for purposes herein to create greater interior negative pressure. From **Fig 1** and (16)

$$\gamma = [\sigma_B/\sigma_U][\mathbf{a}] \qquad (17)$$

which is the same as (15) where $\mathbf{M_U/m^2 = \sigma_U}$ and $\mathbf{M_B/m^2 = \sigma_B}$. It follows therefore, cosmological acceleration γ will equal [a] = when $\sigma_B/\sigma_U = 1$. Thence if $\mathbf{a = 1\ m/sec^2}$ and $\mathbf{M_B}$ **= one kg**, then

$$[\mathbf{a}]\ \mathbf{x}\ \sigma_{\mathbf{B}}[\mathbf{A}] = \gamma\left[\frac{n\ (\mathbf{kg})}{\mathbf{m}^2}\right][\mathbf{A}] = \mathbf{1\ ntn} \qquad (18)$$

where [**A**] is the common area of interaction and "***n***" is a number which represents the {**kg per** $\mathbf{m^2}$} operative Hubble density σ_U. From (17), the counter acceleration factor γ needs to equal $\mathbf{M_B}$ **x [a]**. For the situation involving a mass [$\mathbf{M_B = 1\ kg}$] accelerated at [**a** = one $\mathbf{m/sec^2}$] the left side of (18) will equal "**one ntn**."This satisfies the condition γ = [**a**]$\mathbf{M_B}$. In the particular case where [$\mathbf{M_B}$ = **1 kg**] and [**a** = one $\mathbf{m/sec^2}$], γ will equal **1 ntn**. When the common area "**A**" area is cancelled on both sides of (18) the expression will represent equal pressures if the value of "**n**" is fixed at "**1**", ergo:

$$\sigma_U = \mathbf{1\ kg/meter^2} \qquad (19)$$

The gamma factor [γ] standing alone on the right hand side of (18), will have units of force equal **one ntn**, If γ is thence multiplied by a **one kg**, gamma will have dimensionality of acceleration. Having established ,in the first instance γ equals one **ntn** standing alone, what then is the effect of introducing σ_U in the form "[$\mathbf{n(kg)/m^2}$] by cancelling the common Area **A**? Since the left side of (18) is one **ntn**, the right side of (18) must also be one **ntn**, hence "n" equals one and therefore σ_U = 1.

$$\frac{\mathbf{M_B}}{\mathbf{meter}^2}\,\mathbf{x}\,[\mathbf{a}] = \frac{one\ kg}{\mathbf{meter}^2}\,\mathbf{x}\,[\gamma]$$

RECAPITULATION

Fig 5C re-emphasizes the state of affairs created by receding matter on the cosmological scale as it effects the inertial impedance of local inertial entities. The projection of the odd shaped body **B** upon the idealized flat **YZ** plane(s) defines the area [**A**] over which the passive resistance of the $\boldsymbol{\sigma}_U/2$ planes are engaged. All communication with respect to motion of **B** parallel to the **X** axis, must take place within "**[A]**." Passive impedance can only communicate over the area "[**A**]" defined by the rate of change of momentum at the instance of its occurrence. For convenience, we artificially consider changing momentum of a body as projected upon a $\boldsymbol{\sigma}_U$ inertial plane, in reality, all area density planes exists virtually at the coincidence of every elemental mass of an accelerated body along the line of action that corresponds to the projection of **B** upon $\boldsymbol{\sigma}_U$ Changing momentum is opposed locally at the instance of each elemental mass undergoing a change in motion, at the address thereof. Whether $\boldsymbol{\sigma}_U$ is considered "*one area density plane with parallel field lines*" or a "*plurality of area density planes (coextensive with the diameter of the Hubble)*," each contributing to the inertial area density total, the result for an incremental elemental of mass is the same. Subliminal virtual area density is always present, auspicious of the negative pressure stress, upon which $[\mathbf{c^2/R}]\boldsymbol{\sigma}_U$ depends.

FIG 5C

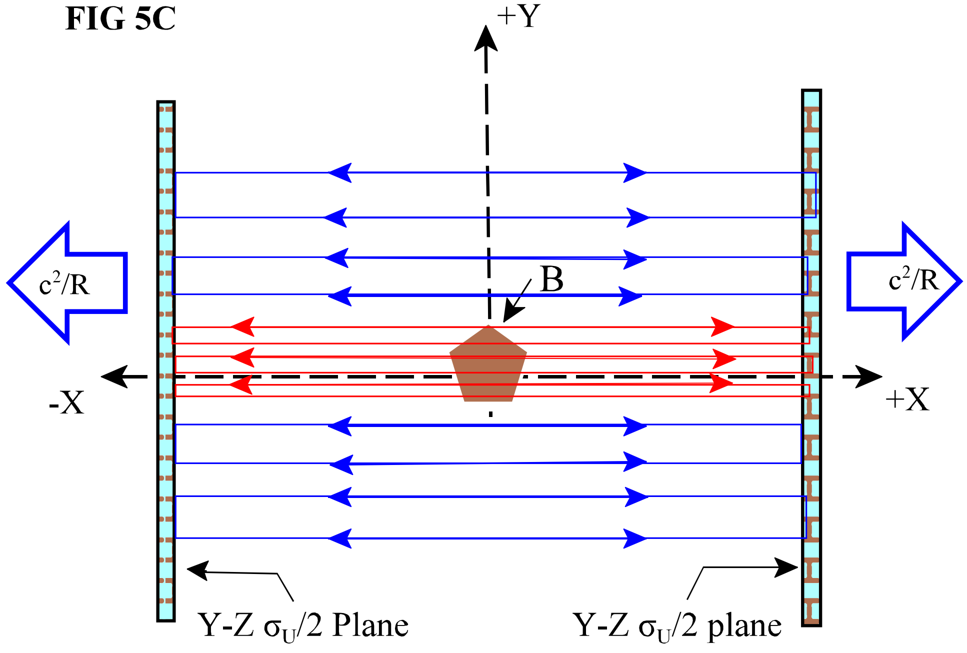

Fig 5D depicts the state of stress when **B** is accelerated parallel to the **X** axis. It will be observed that acceleration of **B** at a rate "**a**" in the direction of the + **X** axis will increase the positive force on the right surface (brown arrows) to $\mathbf{(1/2)(a - c^2/R)M_B}$ while at the same time increasing the negative force (brown arrows) acting upon the left face **B** to a value of $\mathbf{(1/2)(-a - c^2/R)M_B}$. Net force is therefor

$$\mathbf{F = (1/2)(a - c^2/R)M_B \; - \; (1/2)(-a - c^2/R)M_B = [a]M_B}$$

Net gravitational force is still zero, but reactionary force is [$\mathbf{a \times M_B}$]. How does the universe convert "*mass x acceleration to force*?" Forces created by individual inertial elements withing an accelerated body are individually opposed by the local presence of the $\boldsymbol{\sigma_U}$ factor. That there is an equal and opposite force imposed upon the universe by each $\boldsymbol{\sigma_U}$ encounter with an accelerating inertial element, these are felt by the universe at the point of action, thence summed over the volume of **B** where the action took place. Because the lines of reactionary force are parallel, they can be considered as visited upon a single common $\boldsymbol{\sigma_U}$ plane of the universe for purposes of calculating total reactionary force outputted by the universe. Even though the inertial area density field $\boldsymbol{\sigma_U}$ acts individually upon the elemental masses separately to oppose the acceleration thereof (throughout the volume of **B**), the total reaction of the universe is reflected in the total reactionary force created for the entire body. To repeat: The counter force imposed upon each elemental mass is instantly summed with all other counter forces created within the bounds of an accelerated body. The volume of the counter force projected to any $\boldsymbol{\sigma_U}$ area density plane reveals as pressure. When pressure is summed over the area defined by the projection of **B** upon $\boldsymbol{\sigma_U}$, reactionary counter pressure $\gamma\boldsymbol{\sigma_U}$ force is obtained

FIG 5D