Scalar Theory of Everything model correspondence to the Big Bang model and to Quantum Mechanics

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Abstract

We are at a special moment in our scientific evolution that requires the big of cosmology and the small of light and of particle physics be united by a single model. The Scalar Theory of Everything model (STOE) suggests fundamental assumptions with consideration for the successful parts of current models and for the data inconsistent with current models. The STOE is simpler, corresponds to both General Relativity and quantum mechanics, and solves many current mysteries and inconsistencies. Therefore, the STOE is founded on orthodox science. Data analysis in 2011 confirmed predictions of the STOE made in 2006 that no other model suggested.

Big Bang - Quantum Mechanics - Theory of Everything

1 INTRODUCTION

Human kind is at a critical time in the evolution of our understanding of the universe. Cosmology models and elementary particle models are fundamentally inconsistent. Technology advances during the last 30 years have allowed surprising discoveries. These observations indicate that the "standard" models of cosmology and particle physics are likely incomplete. We are ready for the next evolutionary step in understanding the universe. This future model has already been named the "Theory of Everything" (TOE).

Each revolution in physics such as Aristotle's physics, Newtonian mechanics, electromagnetism, and nuclear forces has produced unanticipated and far–reaching consequences. The new physics of each of these revolutions involved a new paradigm, correspondence to several previous models that are inconsistent with each other, an explanation of anomalies to the previous models, and predictions of future observations.

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Before each revolution in thought, observational anomalies accumulate, the accepted models become a patchwork of ad hoc modifications, and a need to unify several academic disciplines seems necessary. The process that led to the Scalar Theory of Everything (STOE) involved studying the data that supports the current standard models and that are inconsistent with the current models. Thinkers such as Democritus, Aristotle, Descartes, and Newton had developed many of the principles of the STOE (Hodge 2012a). The data of the last 200 years is then added to the ideas of these thinkers. Predictions about the Pioneer Anomaly (PA) are starting to be realized.

The simplest structure that can conceptually produce a wide range of differing observations is an interaction of two different types of entities. The simplest form of the small is light. Light in experiments suggests two types of behavior, particle–like and wave–like. Therefore, the STOE posits two components and their interaction produce differing structures, more complex objects, and the diverse behavior observed in our universe. One component that can produce wave–like behavior is a plenum named after Descartes' plenum. The plenum is infinitely divisible and ubiquitous. The density of the plenum produces a scalar potential ρ field.

The particle–like component of our universe is called a hod. The limit of the speed of light implies the hod is two–dimensional because that presents a zero cross section in the direction of travel through the plenum. Hods cause a static[1] warp in the ρ field in accordance with the Newtonian spherical property. "Static" because matter is neither a Source nor a Sink of energy. Matter merely modifies the ρ field. Because the ρ field near hods must attract other hods, the hods decrease the ρ field. Only the divergence of the plenum density acts on only the surface of the hod. The flow of the plenum has no effect on the hod[2]. Therefore, the plenum is not a fluid. The minimum plenum density is zero. Therefore, the hod surface marks a discontinuity in the plenum of zero ρ.

The forces are applied by contact rather than action-at-a–distance. The forces are hod to plenum, plenum to plenum, and plenum to hod.

Supporting this conjecture is the observation that there are two types of physical energy, potential and kinetic. Hods cause potential energy. The plenum causes kinetic energy. The interaction is a third form of force in our universe that may be likened to "spirit".

Matter or bodies are structures of hods and plenum. The divergence of the ρ field on the surface of a hod then causes matter attraction according to established gravitational physics and causes the frequency change of electromagnetic signals.

The two types of matter effects are inertia mass and gravitational mass. The hods' influence on the plenum implies some plenum is "bound" to the hod and causes close hods to be bound to other hods. This structure is matter. The plenum content of matter causes the inertial characteristics. The hods cause the gravitational effects. The equality of potential energy and kinetic energy

[1] "Static" such as caused by a stationary electron in a stationary electromagnetic field.

[2] This is indicated by the Michelson-Morley experiment that is also why the Lorentz Ether Theory and gravitational ether developed.

in matter results in the weak equivalence principle. The STOE speculates the amount of plenum bound to hods depends on the ρ environment of the matter. The relative amount of plenum per hod determines the equivalence principle.

Investigation into the characteristics of and differences between spiral and elliptical galaxies yielded the conclusion that the Sources of the plenum and hods are in the center of spiral galaxies. Sinks are in elliptical galaxies. The ρ field and hods were posited to flow from Sources to Sinks described by the heat equation.

The ρ_{m} at a point in space is the heat equation solution for point sources or sinks in a three dimensional space,

$$\rho_{\mathrm{m}} = -\sum_{i}^{N} K_i S_i / R_i, \tag{1}$$

where N is the number of hods, Sources, and Sinks used in the calculation; K_i is the relative strength multiplier of the type of the i^{th} object, S_i is the strength of the i^{th} object, and R_i is the distance from the center of the i^{th} object to the point where ρ is calculated. The $K_i S_i > 0$ for masses is the gravitational strength of the mass M of a body times the Newtonian gravitational constant G. The S_i of the Source ($K_i < 0$), or the S_i of the Sink ($K_i > 0$) is a function of the luminosity of the object.

The STOE is a self–consistent model that was derived from considerations of galaxy clusters (Hodge 2012a). The STOE explains many mysterious phenomena from diverse observational disciplines. The STOE is simpler and more encompassing than other models, is consistent with QM, and corresponds to GR. An important part of the STOE is to show the correspondence to current models. This allows the successes of the current models to be incorporated into the STOE.

This Paper shows the correspondence of the STOE model developed to date to the fundamental characteristics of the Big Bang model (BB) in section 2 and to quantum mechanics (QM) in section 3. The discussion and conclusion is in Section 4.

2 Big Bang model

BB has made predictions such as the presence of the microwave background radiation and the Hubble Law that relates distance of galaxies with light redshift. Newtonian mechanics was successful in predicting, also. The BB through General Relativity (GR) corresponded to Newtonian mechanics. Therefore, Newtonian mechanics and BB are part of the TOE model. Likewise the STOE corresponds to the BB and explains observational inconsistencies and mysteries the BB doesn't.

The pillars that support BB from a proponent's view are the theory of general relativity, galactic redshift caused by only a velocity Doppler shift, the microwave background radiation (MBR) being cosmic (CMB), and primordial nucleosynthesis.

The theoretical underpinnings of the BB from a proponent's view depend on three assumptions: the universality of physical laws, the cosmological principle, and the Copernican principle. Other assumptions include an adiabatic universe and the strong equivalence principle.

2.1 General Relativity

The space of GR, the gravitational ether of early GR, and Descartes's plenum has the same characteristics as the plenum of the STOE. The term "space" in the context of GR is avoided because it conflicts with the notion of distance and with the mathematical idea of a parameter. The plenum warp corresponds to gravity when the warp is caused by matter or Sinks, to Dark Matter when the warp is caused by Sources, and to Dark Energy when considering galaxy clusters (Hodge 2006a,c,e, 2012c).

Observational evidence suggests GR could be considered limited or in need of modification. GR is thought of as describing only an attractive, gravitational force. The STOE expands the scope of GR. The STOE includes Sources and Sinks in addition to matter to supplement the non-Euclidean geometry. The plenum may induce an outward directed force on matter such as in spiral galaxy's rotation curves (RCs).

Hods traveling in the direction of the hod's edge have no plenum induced resistive force. Therefore, they travel at the highest speed that matter can travel in any environment. This is stronger than the postulate of Special Relativity. Therefore, the STOE allows the speed of light c to change with changing environments (Hodge 2012c).

Information transmitted by hods or matter is limited to the speed of the hods. Therefore, the electromagnetic information transmittal is that of only hods movement and, therefore, is at the speed of light. Information may also be transmitted by the plenum (see section 3) but may be measured by the plenum's effect on hods, only.

2.2 Hubble's Law

The universe on the galactic scale is inhomogeneous and galactic redshift z is less than zero for some galaxies. Current wisdom holds that z is caused by the Doppler shift. However, the determination of the Hubble constant H_{o} has a large uncertainty. The generally accepted value of H_{o} was calculated by Freedman et al. (2001); Macri et al. (2001) using Cepheid variable stars to determine distance for 32 galaxies versus the measured galactocentric redshift z_{m}. The correlation coefficient is 0.80. Further, the correlation coefficient for galaxies beyond 10 Mpc is approximately 0.30. A discrete variations in z was reported by Tifft (1996, 1997), was confirmed by others (Bell et al. 2004; Russell 2005), and remains unexplained by the Doppler model. Also, the redshift elongation of galaxy clusters along our line of sight (sometimes called "the fingers of God") remains a poorly explained mystery.

The STOE redshift model yields the Hubble Law, better correlation to Cepheid galaxy distances, an explanation for the discrete redshift, and an explanation of the fingers of God (Hodge 2006a). Hodge (2006a) suggested that photons traveling between galaxies could loose energy caused by the ρ field. The equation derived is:

$$\frac{1}{z+1} = K_{\min} + \mathrm{e}^{X}, \tag{2}$$

where

$$X = K_{\mathrm{dp}}DP + K_{\mathrm{p}}P + K_{\mathrm{f}}F + K_{\mathrm{vp}}Pv_{\mathrm{e}} \tag{3}$$

where the terms are defined in Hodge (2006a). The K terms are constants, the D is distance the signal travels, the v_{e} is direction dependent caused by the Milky Way, the P is a measure of the amount of ρ the signal travels through, and F is a measure of the inhomogeneity (turbulence) of ρ the signal travels through.

The X term of Eq. (2) predominates and $K_{\min}$ is relatively small for distances less than a few Gpc. Therefore, $z \longrightarrow \exp(-X) - 1 \approx -X$. A plot of D versus X of the redshift calculation for 32 galaxies showed a straight line. The line is

$$\begin{aligned} D &= (-2700 \pm 500\mathrm{Mpc})X - (1.4 \pm 0.8\mathrm{Mpc}) \\ &\approx \frac{c}{H_{\mathrm{spm}}}z \end{aligned} \tag{4}$$

at 1σ and with a correlation coefficient of 0.93. $H_{\mathrm{spm}} = 110 \pm 20$ km s^{-1} Mpc^{-1}.

If the path of the photon passes near a Sink (elliptical galaxy) such as from the far side of a cluster from our viewpoint, the redshift is increased. If the path of photon has a Sink beyond the emission mass such as from the near side of a cluster from our viewpoint, the redshift is decreased. This accounts for both the discrete redshift and the fingers of God.

Therefore, the STOE model reduces to the Hubble Law within limited circumstances.

However, there is a subtlety. The STOE suggests the c changes with ρ (Hodge 2012b) that depends on the intervening galaxies' characteristics. The STOE suggests the proportionality constant is between distance, redshift and the intervening ρ field and not between distance and $\frac{c}{H_{\mathrm{spm}}}$. The BB proportionality is simpler but yields a poor correlation and fails to explain the discrete redshift and the fingers of God.

If redshift is caused by a mechanism other than universe expansion, then the derivations of many features of the BB fail. The finding of a flat or very low curvature of the gravitational ether implies the universe is much bigger than the Doppler Hubble Law allows. The STOE allows a much larger universe and retains the measured distance to redshift relation (Hodge 2006a).

2.3 Nucleosynthesis

The STOE suggests nucleosynthesis occurs from the center of spiral galaxies outward. This accounts for many galaxy observations such as outward flowing

hydrogen and shocked gas clouds near the center of spiral galaxies. Therefore, the infall model of galaxies is not necessary. The infall model has too many inconsistencies most notably in the differences between spiral and elliptical galaxies and in the cooling flow characteristics (Hodge 2006b). Some hydrogen forms stars that create the heavier elements. Denser elements are attracted back to the center of the spiral galaxy. The STOE suggests the observation of the variation elemental types (metallicity) with spiral galactic radius is caused by the ρ field (Hodge 2006a). The stars become denser and eventually supernova, neutron stars, quark stars, and black holes. Thus accounting for the many relations between central mass and disk properties that puzzle BB (Hodge 2006d). Some matter continues outward to become part of the cooling flow to form elliptical galaxies.

2.4 Microwave Background Radiation

The STOE suggests the temperature of the universe is a galaxy cluster issue (Hodge 2006b). Because the STOE suggests the redshift of distant light of the Hubble's Law is not a Doppler shift (Hodge 2006a), the light from very distant galaxies could be redshifted below the temperature of the local galaxy cluster. Thus, the amount of radiation in the very low end of the radiation spectrum should be higher than a black body curve that has been verified by black body experiments on Earth. Instead, the microwave background radiation is an excellent example of blackbody radiation. Therefore, the temperature of the local cluster causes the microwave background radiation. Because radiant energy is exchanged between galaxies, all galaxy clusters approach near equilibrium.

The STOE suggests the hods and plenum flow from Sources to Sinks. The Sink's rate of attracting hods and plenum depends on the size of the Sink, which is indicated by the mass/luminosity around the Sink. The hods and plenum require time to travel from Sources to Sinks causing cooling flows in the process. This creates a feedback mechanism such as a thermostat (the Sink's mass) controlling the temperature (energy density of the cluster) of a room. The temperatures of clusters hunt 2.718 K. The hunting explains both acceleration and deceleration of the expansion of the universe.

2.5 Cosmological, Copernican, and Universality Principles

The Cosmological Principle is false in our local view. GR needs a volume radius of more than 200Mpc to use this principle. The STOE uses the Universality Principle in the form that states universal laws produce physical phenomena at all locations and at all scales in the universe. Further, the STOE rejects the Cosmological and Copernican Principles because they are limited to cosmology. This implies a reductive philosophy.

We are privileged observers in the universe. We are on Earth not in the center of a sun. Yet, our models must include the physics at the center of

suns. The fundamental physical laws of a TOE must apply to account for the environment for all environments in the universe.

Sellwood and Kosowsky (2001) suggested the problem of a single model explaining both galactic scale and cosmological scale observations is fundamental. Linking cosmological scale, galactic scale, solar system scale and Earth scale observations is an even more daunting task. Even more daunting is linking cosmological scale (the big) with QM (the small) while corresponding to Earth scale observations.

For example, the BB considers the observations of z, of the Pioneer Anomaly blue shift z_{p}, and of the frequency shift of light in the Pound–Rebka experiment (Pound & Rebka 1960) are different physical phenomena. The STOE suggests they are the same phenomena of light that also produce interference patterns.

That an unexplained blueshift exists in the radio signal from the Pioneer 10 (P10) and Pioneer 11 (P11) spacecrafts (PA) is well established (Anderson et al. 2002; Toth and Turyshev 2006). The PA is expressed as an apparent acceleration. That the PA is a real acceleration is unproven. The "acceleration" nomenclature is based on the unsupported hypothesis that the frequency shift is caused by a Doppler effect. That the PA is Sun directed is unproven. The PA could be an effect such as a time acceleration (Anderson et al. 2002; Nieto and Anderson 2005) or an effect of an unmodeled effect on the radio signals.

Turyshev and Toth (2009); Hodge (2012b) discussed 12 characteristics of the PA. The common opinion is that cosmic dynamics according to General Relativity has far too little influence in galaxies to be measurable and that the expansion of the universe is negligible for scales up to galactic clusters (Cooperstock et al. 1998; Sellwood and Kosowsky 2001). Further, the expansion of the universe indicated by z has a sign opposite to z_{p}. Several new physics models have been proposed (Anderson et al. 2002; Turyshev and Toth 2009) but fail and ignore most of the characteristics of the PA. Bertolami and Páramos (2004) concluded a scalar field is able to explain the PA.

Turyshev et al. (2012) supported a model suggesting a thermal recoil force was present in the P10. Turyshev et al. (2012) dealt with the P10 only and only the "acceleration" value. Much of the data used to calculate the forces are less well known or supported by other data. Although unlikely, a currently unknown other systematics effect is not entirely ruled out. Although incomplete, the thermal recoil force hypothesis has become strongly preferred by conservative science (ten Boom 2013, and references therein). However, ten Boom (2013) noted John D. Anderson in a recent interview argued "... that the new analysis has mis-modelled (sp) the solar radiation pressure."

Only one model presented to date is consistent with *all* 12 of the characteristics (Hodge 2006e, 2010, 2012a,b, 2013a,b). The STOE (Hodge 2006e) argued that matter causes a warp of the ρ field that causes the PA. The $\rho \propto -R^{-1}$ of the warp induces the H_{o} value and the connection to z observations. That is, the PA is an effect on only the radio signal. Therefore, gravitational attraction, the weak equivalence principle, and the planetary ephemeris remain as described by General Relativity.

Hodge (2006e) applied the galaxy redshift equation (see Section 2.2) to the

PA. The $K_{\rm min}$ term in the equation derived by Hodge (2006e) resulted from the flow from Sources. The $K_{\rm vp}$ term results from the relative movement of galaxies. Therefore, $K_{\rm min} = 0$ and $K_{\rm vp} = 0$ for the static warp field of matter in the Solar System. The resulting equation for the calculated redshift $z_{\rm p}$ for the solar system scale PA is

$$z_{\rm p} = {\rm e}^{-X_{\rm p}} - 1, \tag{5}$$

where

$$X_{\rm p} = K_{\rm dpp} D_{\rm l} P + K_{\rm p} P + K_{\rm fp} F, \tag{6}$$

where the terms are defined in Hodge (2006e), $D_{\rm l} = 2D$ is the distance the radio signal travels, and D is the geocentric distance to the spacecraft.

The STOE obtains the $H_{\rm o}$ value by $z_{\rm p} \longrightarrow \exp(-X_{\rm p}) - 1 \approx -X_{\rm p}$. A plot of $D_{\rm l}$ versus $X_{\rm p}$ shows a straight line The line is

$$\begin{aligned} D_{\rm l} &= (2800 \pm 200{\rm Mpc}) X_{\rm p} + (5 \pm 2) \times 10^{-11}{\rm Mpc} \\ &\approx -\frac{c}{H_{\rm op}} z_{\rm p} \end{aligned} \tag{7}$$

at 1σ and with a correlation coefficient of 0.95. $H_{\rm op} = 106 \pm 8$ km s^{-1} Mpc^{-1}.

Further, the STOE predicted PA observations are (Hodge 2013a):
(1) The data before the flyby encounters were insufficient to detect the PA (Turyshev and Toth 2009). The STOE requires this rather than there was no PA before the encounters as suggested by several other models.

(2) "Although the Earth directed PA is marginally preferred by the solution, the Sun, the Earth, and the spin axis directions cannot be distinguished." (Turyshev et al. 2011, see Table III). An Earth directed PA suggests a signal related cause that the STOE calculates rather than acceleration of the spacecraft that all other models calculate. Anderson et al. (2002) examined commonly accepted models of the impact of various phenomena on the signal and concluded the commonly accepted models do not account for a signal blueshift effect. The STOE model is a model of a signal effect and, therefore, is Earth directed. Because the vast majority of PA papers considers the PA to be Sun directed and because most of the data points are with a Sun-Earth-spacecraft angle of less than 45 degrees or greater than 135 degrees, that the Earth direction is "marginally preferred" is remarkable.

(3) "The data favor a temporally decaying anomalous acceleration with an over 10% improvement in the residuals compared to a constant acceleration model." (Turyshev et al. 2011). Equation (2) and Section 3.4 of Hodge (2006e) suggest the decline is exponential except when the signal passes near a large mass such as during flyby maneuvers. Turyshev et al. (2012) did not study the flyby maneuvers.

The PA and the z of cosmology are the result of the same ρ effect on light. The z follows the Hubble law in the cosmological z calculation if $\rho \propto R^{-1}$. The $z_{\rm p}$ in a gravity well follows the negative Hubble law if $\rho \propto -R^{-1}$. The presence of other galaxies near the path of the light causes P and F variation of z. This

is also the effect of matter close to the line of sight in the PA. The Hubble law and $a_{\mathrm{P}} \approx cH_{\mathrm{op}}$ in the STOE are manifestations of the Newtonian spherical property.

The Pound–Rebka experiment (Pound & Rebka 1960) is modeled to be caused by gravity. The result was confirmed by Pound & Sneider (1964) and Vessot (1980). The Pound–Rebka experiment emitted light over a vertical distance of 22 meters in Earth's gravitational field. The experiment included the source at the top and the source at the bottom of the distance. A blueshift and redshift, respectively, were observed. The two currently accepted models refer to this phenomenon as a "gravitational redshift". The Strong Equivalence Principle model refers to frequency shift of wave–like light caused by the difference in gravity between the top and bottom. The Weak Equivalence Principle model refers to the energy gain or loss, respectively, of particle–like light moving through a potential field. The Strong Equivalence Principle calculation involves a square root of the potential difference. Hence, the "redshift" term in "gravitational redshift". However, a blueshift was also observed. Therefore, the weak equivalence principle model with a photon seems a better model.

The problem with the Universality of physical laws is that some laws may be difficult to measure on Earth. The greater number of pioneer maneuvers, the greater solar pressure on the spacecraft closer to the Sun, and the age of the earlier PA data cause the earlier data that resulted in the thermal model and confirmation of the predictions of the new physics (STOE) model to be of low quality (ten Boom 2013). However, this is more than compensated by the reductionist philosophy of the STOE model. The PA is only one of three sets of different types of observations suggesting the same new physics model. The PA is the galaxy redshift model without the galaxies influence. It has the influence of only the masses of the planets and Sun. The Pound–Rebka experiment is the galaxy redshift model with the influence of only the Earth's mass. Therefore, instead of questioning the viability of the reductive agenda, the STOE model supports a reductive philosophy.

The link between z, z_{p}, and the Pound–Rebka experiment is a case where conservatism should yield to observation and a reductive model that explains the observations.

2.6 Adiabatic universe

The STOE supports a fractal universe philosophy. Although we can make a volume very well insulated and treat that volume as adiabatic, total insulation is only an approximation. The application of the Universality Principle and fractal philosophy suggests the universe is not adiabatic. The adiabatic universe assumption requires the galaxy infall model that is a problem for BB.

The Steady State Model had the feature of Continuous Creation. The STOE also suggests the universe is not adiabatic. The STOE suggests the Sources and Sinks are hunting an average temperature of each galaxy cluster and, therefore, of the universe. Hodge (2006b) calculated the temperature and the theoretical basis for the observed temperature. This suggests the galaxy clusters are hunting

equality of kinetic and potential energy and entropy is constant in the very long term in the universe. The development of life requires more energy than lack of life development. Because the STOE suggests the Sources are continually injecting energy into our universe, the development of suns and life influences only where the energy is expended on its way to the Sinks. This condition is more time efficient than cooling flows. Therefore, the development of life is a valuable part of the evolution of the universe. That is, the development of life may be the rule rather than the exception.

The cooling flow between galaxies is a loss of energy by matter that is too hot for the Sink. The formation of suns and the infall nucleosynthesis serves the same purpose in spiral galaxies. Similarly, life serves this purpose, also.

The Newtonian universe had the uncomfortable feature that if gravity is the only cosmological force and is attractive, then the universe must collapse or is unlimited. GR expanded on this and had the universe curved and closed like a sphere without an edge. Unfortunately, measurement suggests the universe is flat that suggests an edge. The STOE suggests a flat universe with an edge limited by the inward pressure of Sinks.

2.7 Dark matter and supermassive black holes

Dark matter in galaxies is an ad hoc addition to the standard cosmological model to explain a rotation velocity greater than a Keplerian decline in the disk of spiral galaxies. This is usually interpreted as a "flat" RC. Most, but not all, spiral galaxies have flat RCs. Some galaxies have rising RCs. The dark matter model suggests these galaxies have more dark matter (mass). The problem is that rising RCs appear in low mass galaxies - a falsifier to the existence of dark matter. Therefore, the necessary added force of the flat and rising RCs is from the divergence of the plenum density outward from the center of spiral galaxies (Hodge 2006a).

The RCs of spiral galaxies have an asymmetry, also. The standard model poorly explains this observation. The STOE suggests the asymmetry is caused by the contribution of neighbor galaxies to the ρ field.

The STOE suggests the variation of elemental types (metallicity) with spiral galaxy radius is caused by the ρ field (Hodge 2006c). The ρ field acts on the cross section area ($\propto r^2$ where r is the effective radius of the element). The net outward gradient of the ρ field from the Source is balance by the inertial mass ($\propto r^3$) of the matter. Thus, the higher atomic weight elements drift inward to become black holes. The STOE suggests a lower mass relative to Source strength in galaxies with rising RCs.

The stellar observations near the center of spiral galaxies suggest a large net mass attraction within 40 AU of the center of spiral galaxies. Other models have only attractive gravity that implies millions of solar mass size black holes should fall to the center or be flung outward. The STOE suggests (Hodge 2006d) the outward force that causes the flat and rising RCs also supports a hollow shell structure of solar mass size black holes. Further, as a black hole looses momentum it drifts inward to ever higher ρ. Eventually the higher ρ

compresses the black hole into photons and lighter elements that re–radiate outward. This model is consistent with the observation of X–ray bursts from the center of our galaxy. The structure of photons and matter depending on the ρ field is required for the interference of light (Hodge 2012c). The re-radiation is analogous to the cooling flow between spiral and elliptical galaxies. The STOE suggests the universe is ejecting the stuff of our universe from the center of spiral galaxies. Some matter is attracted back to the center only to be re-radiated until it is eventually ejected from spiral galaxies. Then matter is attracted to the Sinks and ejected again until it cools. The size of the Source determines the amount of matter in the Spiral galaxy feedback loop that determines the luminosity of the Spiral galaxy as discussed in the redshift paper Hodge (2006a).

2.8 Strong equivalence principle

Questionable attempts to show the strong equivalence principle have failed or there exists a weak equivalence principle explanation. The STOE rejects the strong equivalence principle. The behavior of photons and bosons in a gravitational field differ. Photons directed toward a mass at least maintain velocity and may actually slow as suggested by the Shapiro delay. The STOE extends the concept of "gravitational" to be the action of the ρ field. Spiral galaxies' RC is also is variation of gravitational effect depending on the constitution of the body. Gravitational motion partly depends on constitution.

2.9 Fine tuning

The STOE rejects "fine tuning" in any form. A negative feedback loop is postulated instead (cause and effect). Further, if the measurements suggest "fine tuning", then a physical mechanism is part of a negative feedback loop. The calculation of the cluster temperature is an example (Hodge 2006b).

3 Quantum Mechanics model

QM has made predictions. The STOE corresponds to QM through the Bohm Interpretation (BI). A mystery of the BI is the origin and nature of the pilot wave that the STOE solves. The STOE suggests BI produces a link to GR. Newton's speculations included a link between GR and the double–slit experiment. He suggested photons (corpuscles) are influenced by an infinitely divisible medium between discrete photons. This is the plenum. Movement and the structure of photons generate plenum waves (gravitation waves) that travel much faster than hods through the plenum. The divergence of the plenum density directs the path of the photons. Wave phenomena of light are caused by the plenum's directing photons. Particle phenomena of light are caused by the photons.

The STOE suggests the fundamentals of matter may be studied by studying the observations of the smallest particle, which is the photon. However, the structure of the photon and the nature of the forces acting on light remains a

fundamental mystery. Some observations reject a particle-like model of light. Other observations reject a wave-like model of light. The forces and structure may be studied by computer simulation of known light phenomena such as interference (Hodge 2012c).

Gravity, dark matter, and dark energy observations are caused by divergence of the plenum density. The other forces are described by the GUT particles. Perhaps this is why the graviton particle remains elusive. It doesn't exist.

Information transmitted by plenum waves is at the speed of the waves that is much greater than the speed of hods (Hodge 2012c). However, measurement is the action of matter on matter. Therefore, the STOE speculates the quantum weirdness and entanglement information transmittal is that of resonance plenum wave action on hods.

4 Discussion and conclusion

The STOE supports the viability of the reductive agenda. The STOE postulates a unification of the standard model's three forces and GR. Physical reality has two distinct domains of hods and of plenum that interact. Further, the STOE principles may be applied to life and survivability (Hodge 2012a).

If the problems of the standard model of galaxies are considered as a whole pointing to a new model and if a combining of the standard model of galaxies and of QM is desired, then the STOE concluded the plenum was sourced at the center of spiral galaxies and obeyed the heat equation. Many other inconsistencies of galaxy observations are also solved.

The STOE suggests the wave behavior and speed of waves in the plenum could be used to form a relationship of the microscopic world and the macroscopic world regarding quantum decoherence and quantum entanglement.

Modern standard models have several observational difficulties. The STOE is less developed. However, the STOE shows how many different phenomena can be included in a single model and to reduce the sample bias (encompass more sample data) such as including rising and falling RCs.

Although the creation of the STOE followed the methods of the creation of most heterodox models[3], the STOE is an orthodox rather than a heterodox model. The current standard models became dominant because they explain more phenomena than alternate models. The STOE corresponds to the BB and QM and explains more data. The STOE holds the BB and QM to be limited not wrong. This suggests the mainstream evolution of models should come to model many of the STOE features.

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