Observations that Seem to Contradict the Big Bang Model While at the Same Time Support an Alternative Cosmology

Forrest W. Noble

Timothy M. Cooper

The Pantheory Research Organization
Cerritos, California 90703
USA

Abstract

This research paper summarizes many very distant observations made by many groups of astronomers over a number of years, primarily utilizing the Hubble Space Telescope (HST) and ground radio astronomy observations, observations which are thought to contradict or question the standard Big Bang (BB) and Lambda Cold Dark Matter (LCDM) models, along with a listing and discussion of generally known and lesser-know problems with Big Bang cosmology. Also presented is an alternative cosmology and arguments contending support for this alternative model where the standard BB model seems to be deficient.

Keywords: Big Bang Problems, Contradicting astronomical observations, Alternative Cosmology

Introduction

The purpose of this paper is to illustrate that there have been many observations that appear to contradict the standard Lambda Cold Dark Matter (LCDM) model but, for the same reasons, seem to support alternative cosmologies. This paper is timed to increase awareness of alternatives to the BB and LCDM models so that its predictions and expectations can be compared to observations produced by the new long-baseline radio telescope Atacama Array in Chile and the James Webb Space Telescope (JWST) when it is successfully operating. For this reason the authors herein offer a particular cosmology that they believe will fit past and future observations much better than any other cosmology currently available. The observations in question are, for the most part, distant observations made by the Hubble Space Telescope (HST), the Spitzer Space Telescope (SST), and long-baseline radio telescope arrays. Some of these observatories, like the HST, have operated for decades and have made the same high-quality observations that can be made with them today.

The alternative cosmology being presented herein is called the "Pan Theory" and is preferred by the authors to explain the observations being presented for two reasons: it requires no ad hoc hypotheses like the standard BB model (Inflation, dark matter, and dark energy), and it is believed to be better supported by observational evidence presented here and elsewhere.

1. Discussion

The discussions of this paper will center on a list of perceived "problems" with BB cosmology**,** and for some of these problems we have presented listed observations that exemplify these problems. The list is given below to quickly introduce the reader to the scope of this paper's arguments. Following the list, each problem is discussed in turn, describing why it is a continuing problem with the BB model and why certain alternative cosmologies would not share these same problems.

The list of Big Bang problems to be considered are as follows:

(1.1) The Horizon Problem
(1.2) The Flatness Problem
(1.3) The Density Problem
(1.4) Galaxy Emergence and Universe structure Formation Problem
(1.5) The Anachronistic Galaxy Problem
(1.6) The Anachronistic Black Hole Problem

(1.7) The Metallicity Problem
(1.8) The Gravity Problem
(1.9) The Distance/ Brightness Problem

1.1 The Horizon Problem

Although this problem is believed by theorists to be somewhat "mitigated" by the Inflation hypothesis, theoretical problems still remain as will be explained. From cosmic microwave background data, background radiation temperatures vary no more than .01% in all directions from us; any patterns in this variance describe differences of a very low order of magnitude. This homogeneity is mirrored in the appearance of galaxies in all directions. Roughly, this was/ is the basis of the horizon problem**.**

Arguments**:** In a BB scenario, these regions of the cosmos could never have been in direct contact with one another after the beginning of the universe, so how could these uniformities of temperatures and galaxy appearances exist at opposite ends (i.e. horizons) of observation? Ad hoc explanations to fit the BB theory to the facts ended up collectively making up the Inflation hypotheses proposing superluminal universal expansion immediately following the BB. This superluminal expansion allowed the size of the actual universe to well exceed the size of the observable universe, which would act to homogenize conditions both by dilution (spreading a set amount of matter over a very large volume) and isolation (where any outlier mass concentrations would become likely to be far away from observable volumes).

This homogenization accordingly led to the universe we observe today. As matter did not exist during the Inflation period, this expansion must have carried with it some form of energy that later condensed into the basic units of matter. The fundamental energies that we know of today—those unrelated to the energy of relative motion — are forms of electromagnetic radiation that involve wavelengths, Zero Point energy, or hypothetical dark energy. Wavelengths involved in the superluminal expansion of space would seemingly "stretch out" beyond recognition or dissipate during a rapid expansion of space, and the energy carried by electromagnetic radiation is a function of its wavelength. Hyperinflation could therefore logically lead to comparative energy deficits.

Other horizon problems concern the matter of what actually was expanding during inflation. If it was only space, then initial conditions could never have mixed (since they would be spatially getting farther away from each other; one can't mix things by separating them) and caramelized into homogeneity outside of the diffusion of observation, which would mean that our vantage point is not necessarily mundane (the assumption of banality) and therefore our observations cannot be considered average. This would effectively eliminate cosmology as a meaningful study into the nature of things beyond the observable universe altogether, as the assumption that our observations are not particularly special are fundamental to being able to draw general conclusions from them. If anything else expanded and multiplied during the inflationary period, then there would be new creation from nothing, which is explicitly not permitted by the assumptions of the BB theory.

Another general criticism of Inflation is that the theoretical physics used to explain it are functionally "invented" and have no counterpart in observed reality. These physics can therefore never be tested, and newer physics can always be invented and proposed if the other models fail to explain a particular phenomenon. Valid hypotheses must be testable. The Inflation hypotheses are untestable speculation that can only claim observational support by its own implications.

Why the Alternative Model Better Explains these Observations

The Pan Theory might be described as a type of quasi-steady-state model (but not infinite) and as such lacks a horizon problem. (From this point forward, we will not use the quasi-steady-state term to describe this model so as not to confuse it with the prior quasi-state model of Hoyle, Narlikar, Belinger, et. al. by that name.) No steady-state model would have a horizon problem since there would be a constant density in the universe, with no Inflation. The Pan Theory model is not an eternal universe model, but the universe would be much older than conventional cosmology asserts and therefore there would be much more time for the universe to homogenize and evolve into the vast and complicated structures we observe today. If energy travels at the speed of light but the universe functionally expands much more slowly, then there can be sufficient energy transfer over time to ensure homogeneity and support the assumption that our observations are indeed representative of the way things are in the observable universe as a whole.

Additionally, by not requiring new physics, the Pan Theory can be rather easily tested: if we continue building better telescopes and seeing further away and keep seeing the same sorts of galaxies that we have been seeing so far, galaxies that interact in ways we would predict modern galaxies to, then that lends support to a steady-state theory. If, on the other hand, with better telescopes like the JWST and the Atacama Array, we start seeing phase shifts, seeing only small, young-appearing blue galaxies at the farthest observable distances or, perhaps, nothing at all, then these observations would contradict all steady-state theories with no chance of them being salvaged on an *ad hoc* basis.

1.2 The Flatness Problem

According to observations and the predictions of General Relativity, the amount of matter in the observable universe is greater than one tenth but less than ten times the critical density needed to stop the predicted expansion of the universe. This two-orders-of-magnitude range of matter density, and an equivalent ranging energy density, leads the topology of the universe to be "very nearly flat." With the changing density of an expanding universe, why should the density today—which, again, should not be a special point in time if we are to reliably make predictions off of our observations—be so close to the critical density? Also substantial variation from this critical density would, according to General Relativity, deform space in such a way that it should be observable. There seems to be no curvature of the observable universe which would indicate we are close to the critical density; this is the continuing flatness problem.

As with the horizon problem, the inflation hypothesis was also invented to help explain the flatness problem. According to this hypothesis the critical density of the universe just after the BB was theoretically close to the critical density, then stayed about the same during Inflation, and has decreased little since then. This seems illogical because as space expands, and the gravitational influence of a given mass diminishes over a greater volume, one would expect the critical density near collapse would change while the actual density of the universe would decrease. The differing ratios between density and critical density would result in the topology being different from time to time, even if the rates of change between the ratios were small. That would make the current observation of "very nearly flat" a special case, which means we are extraordinarily lucky to see it at this point. If we are extraordinarily lucky to see it, general conclusions we draw from it must naturally come under question because the assumption of banality is violated. If something is being created from nothing to maintain the observed density this is also a theoretical problem as explained concerning the Horizon problem, and the physics of the Inflation hypotheses.

Why the alternative model better explains these observations: Steady-state models lack a flatness problem also as they all propose that the density of the universe has always been effectively constant. The Pan Theory proposes a very slow decrease in the size of existing matter combined with the 'creation' of 'new' matter from the decrement, which leads to a constant matter density. While explained in more detail below, it can be readily described using the analogy, that after countless eons an object of static volume and mass could be split in half repeatedly: the numbers of objects increase, and the volume and mass of each object decreases, but the total mass, density, and volume of the system remains constant. From the viewpoint of slowly shrinking yardsticks, the total system appears to be getting bigger. As such, although space would appear to be expanding, instead matter and scales of measurement would very slowly be getting smaller. This would explain the observed redshifts of galaxies and other cosmic entities from our perspective.

1.3 The Density Problem

The density problem is similar to the flatness problem, but has proven resistant to being explained by Inflation. Based on the standard model of an expanding universe and the volume of a sphere, when the universe was half its present age (and diameter), it would have been eight times denser with matter, primarily observable as galaxies. At a quarter its age (and diameter), it would have been 64 times more dense compared to now, based upon a relatively constant rate of expansion since that time. An even larger difference would be observable if expansion were accelerating. These are not small differences. Since the HST has detected galaxies from calculated distances of ~13.2 billion years ago in a ~13.8 billion year old universe, such great differences in densities should be observable if the standard model were valid. Inflation hypotheses can not change this since expansion has accordingly continued at observed rates after Inflation ended. But deep-field studies have not observed greater densities.

Indeed, we appear to see the opposite: observed galactic density decreases the farther away (and back in time) one looks. The presently accepted explanation for why this is so is summarized in this excerpt from an astronomy website (Springbob, 2003).

Why does the density of galaxies seem to steadily fall off with distance on large scale galactic maps?

The short answer is that it's harder to see things that are farther away. So while we can see almost all the galaxies nearby, we can only see the very brightest ones far away. This effect overwhelms everything else, and is responsible for the density of galaxies in those maps dropping off at large distances. So if you look at one of those maps, you can imagine that there are actually many more galaxies on the outskirts, but we just can't see them.

The above is true, but smaller, less luminous galaxies cannot explain the comparative paucity of galaxies in the universe around seven billion years ago when, as stated above, matter and galaxies should be about eight times denser, as well as more galaxy mergers should be observable. Adjusting for estimates of the opacity of the intergalactic medium, there still should have been many times as many bright-enough galaxies, as they do not take billions of years to form based upon present observations of the most distant galaxies. These observations instead appear to indicate that the density of galaxies falls off with distance; that the universe was *less* dense in the past than it is now.

Another common answer is that astronomers cannot easily measure density with only a telescope. Angular separations inside telescopes cannot be used to measure the mass inside any significant volume. This explanation is also valid, but also dodges the question since there's no reason to assume that bright stars in the past were of appreciably different mass than they are now, nor alter the appearance of a photograph like the Hubble Ultra Deep field, a collective of hundreds of the most distant galaxies that appears the same as a local photograph of such a collective. Still another explanation invokes Inflation mechanics and suggests that the further back one looks the more that dark energy— the force proposed for causing Inflation in some models— would push galaxies farther apart. Both proposals ignore that regardless of expansion rates at any given point in time, if the universe has been expanding steadily for more than 13 billion years, from a denser past, then this greater density should be detectable from large-scale galaxy surveys. Even if the average galaxy in the past may have been smaller and relatively farther apart from each other, there should have been more of them—corrected for intergalactic medium opacity—than now. This is not what is being observed.

Another answer suggests that by the standard model most galaxies would not have formed yet. This is logical on its face, though the Earth's four-billion year history up to now being almost a third of the entire universe's age—and with Sol not even being a first-generation star—seems to suggest that galaxies would need to have formed comparatively quickly to be consistent with a universe of only 13.8 billion years. Additionally, by the standard model, the most distant galaxies should be young, blue immature galaxies that have not yet differentiated. Instead, astronomical observations find, at twelve billion light years' distance, some galaxies they identify as large spiral and elliptical galaxies functionally identical to the Milky Way, without the greater star production which might be expected if interstellar hydrogen densities were indeed greater.

Why the alternative model explains these observations: steady-state models, true to their name, predict a roughly constant galactic density that leads to a decreasing observed galactic density following the inverse square law of illumination and any effects of the opacity of the intergalactic medium. This appears to be exactly what is being observed, which is contrary to what would normally be expected with the BB model as described above. Most previous steady-state models, however, lack an origin and invoke infinity; the Pan Theory instead posits an age of the universe so great that the observable universe is effectively uniform and steady-state whilst avoiding the quandary of simply 'having always been.'

Although decreasing galactic densities looking backward in time contradict the BB model, it supports the Pan Theory in that galaxies in the past would have been of equal density, but space in the past would appear to us as being larger than it really was because of the diminution of matter resulting in our changing scales of measurement.

1.4 The Galaxy Formation Problem

The non-uniformities that would be produced by an expanding universe—either by inflation or expansion alone—do not seem to be sufficient to allow enough time for galaxies, clusters, webs of galaxies, and all of the intergalactic structures that have been observed, to have formed within the limited time allowed by the BB model. Due to the nature of expansion, all of these structures would effectively have to form *in situ* with limited opportunity for mutual influence and self-ordering. Based upon the rate of assumed universal expansion, gravitational attraction would be too slow to form galaxies if expansion resulted in a reasonable level of turbulence.

As such, "the question of how the large-scale structure of the universe could have come into being has been a major unsolved problem in cosmology" (Trefil, p. 63, Daily Galaxy, 2010)(Problems in Cosmology, 2012). To explain this problem, theorists have been compelled to look at a theoretical period before one millisecond after the BB to form hypotheses explaining the observable existence of galactic and intergalactic-scale structures by one means or another. To be blunt, this is pure theory with no counterpart in immediately observable reality or any means to test the theory except by computer modeling, and the weakness of validation-by-model is that if the model is incorrect, it can be tweaked until it is "correct." Even then, there is always the risk that new structures—such as the Large Quasar Group four billion light-years across discovered using the HST in 2013 (Klotz, 2013)—was observed which required fine-tuned model addendums, in a continuing process of fine-tuning and changes in fine tuning, but with continuous surprises rather than predictive power.

Why the alternative model better explains these observations: The Pan Theory proposes a much older universe which provides ample billions (or even trillions) of years to form the large scale structures of the universe that we can now observe, but does not involve the philosophical problems of a temporally infinite universe as do most other steady-state models.

1.5 The Anachronistic Galaxy Problem

This may be the most obvious problem with the Big Bang model at this time since there have been a great many observations by many different groups of astronomers that have come to the conclusion that some of the most distant galaxies appear to be very old and mature, rather than young appearing as the Big Bang model would require. This is exemplified by the sampling of such observations shown below.

In a universe 13.8 billion years old, it stands to reason that the most distant and therefore first-to-form galaxies should be young galaxies: small, with young blue mostly first-generation stars within them. This is not what has been observed, and as such constitutes the greatest weakness of the BB model. There have been many large, old-appearing galaxies at the farthest distances that we have been able to see, observed many times by several different groups of astronomers. Some appear to be filled with old, red stars; others appear to be large spirals and ellipticals, like the Milky Way and our surrounding galaxies.

Observations in Support of Statements

1.5.1 Old Galaxies Observed Ten Billion Light Years Away by the Ultra-Deep Survey

The purpose of the Ultra-Deep Survey (UDS), "an image containing over 100,000 galaxies over an area four times the size of the full moon," (Massey, 2008) was to "allow astronomers to look back in time over 10 billion years, producing images of galaxies in the Universe's infancy." Doctor Foucaud of the UDS project said first that "our ultra-deep image allows us to look back and observe galaxies evolving at different stages in cosmic history, all the way back to just 1 billion years after the Big Bang," and then "we see galaxies 10 times the mass of the Milky Way already in place at very early epochs."

Further analysis of the UDS had surprising results, paraphrased below**:**

The distant galaxies identified are considered elderly because they are rich in old, red stars, not because the light from these systems has taken up to 10 billion years to reach Earth. They are seen as they appeared in the very early Universe, just four billion years after the Big Bang. The presence of such fully-evolved red-appearing galaxies so early in the life of the cosmos is hard to explain and has been a major puzzle to astronomers studying how galaxies form and evolve. (University of Nottingham, 2008).

For fairness, dark matter was invoked to explain how these ancient galaxies could have evolved into supermassive modern ones, but this leaves unanswered the question of how they became supermassive so quickly at the beginning stages of the universe and at the same time appear so "elderly" in the first place.

1.5.2 Massive Distant Galaxies Observed in the HST's Ultra Deep Field

Similar to the UDS, the Ultra Deep Field was an effort to use the HST to detect distant galaxies and then follow up observations with the Spitzer Space Telescope and the European Southern Observatory Very Large Telescope (USO VLT). One galaxy, HUDF-JD2, was seen "as the universe was only about 800 million years old" (Britt, 2005). Nahram Mobasher of the European Space Agency had this to say about it: "It made about eight times more mass in terms of stars than are found in our own Milky Way today, and then, just as suddenly, it stopped forming new stars. It appears to have grown old prematurely."

The article reporting this goes on to say**:** The leading theory of galaxy formation holds that small galaxies merged to gradually form larger ones. But the newfound galaxy is so massive at such an early epoch that astronomers now think that at least some galaxies formed more quickly in a monolithic manner.

What would be a large galaxy today would be phenomenally huge in the early days of an expanding universe, having to form rapidly *in situ* rather than coalescing from smaller galaxies. Whether it would have had time to do either is questionable under the BB model.

1.5.3 Very Distant Red Galaxies Challenge Theory

The Spitzer Space Telescope discovered four extremely red galaxies. Jiasheng Huang of the Harvard-Smithsonian Center for Astrophysics, lead author on the discovery, said "We've had to go to extremes to get the models to match our observations" (Aguilar, 2011); the authors here note that this is a dangerous statement to make since it is suggestive of having to force models to fit data. An article reporting on this discovery explains:

Galaxies can be very red for several reasons. They might be very dusty. They might contain many old, red stars. Or they might be very distant, in which case the expansion of the universe stretches their light to longer wavelengths and hence redder colors (a process known as redshifting). All three reasons seem to apply to the newfound galaxies. All four galaxies are grouped near each other and appear to be physically associated, rather than being a chance line-up. Due to their great distance, we see them as they were only a billion years after the Big Bang - an era when the first galaxies formed (Aguilar, 2011).

In terms of probability, it seems unlikely that these ultra-red galaxies should exist at all at these great distances and therefore unsurprising that current computer models had to be forced to the data in an attempt to provide explanations. If more of these galaxies are observed (as expected and predicted by the Pan Theory), then they must accordingly be more common, and 'extremes' of a model are insufficient to explain them, since such 'extremes' should be either non-existent or very rare.

1.5.4 Distant Anachronistic Galaxy Cluster Contradicts Theory

A group of scientists used the USO VLT, the XMM-Newton telescope, and the Chandra X-Ray observatory to analyze the CL J1449-0856 galaxy cluster and stated that its "properties imply that this structure could be the most distant, mature cluster known to date and that X-ray luminous, elliptical-dominated clusters are already forming at substantially earlier epochs than previously known" (Gobat, 2010). In their conclusions, they state:

Our results show that virialised clusters with detectable X-ray emission and a fully established early-type galaxy content were already in place at $z > 2$, when the Universe was only ~3 Gyr old. While it took us several years of observations to confirm this structure, upcoming facilities like JWST and future X-ray observatories should be able of routinely find and study similar clusters, unveiling their thermodynamic and kinematic structure in detail. The census of $z > 2$ structures similar to CL J1449+0856 will subject the assumed Gaussianity of the primordial density field to a critical check.

As continuously more of these mature galactic clusters are detected in a theoretically young universe—and, most importantly, if they are detected farther away—then this would even more strongly contradict the BB model.

1.5.5 Most Distant Galaxy Cluster Contradicts Theory

A research team lead by Andrew Newman confirmed "that JKCS 041 is a rich cluster and derive a redshift z=1.80 via the spectroscopic identification of 19 member galaxies, of which 15 are quiescent" (Newman, 2014). This indicates a large, ancient galactic cluster past the peak of its star-forming period.

There were other notable observations:

- "We construct[ed] high-quality composite spectra of the quiescent cluster members that reveal prominent Balmer and metallic absorption lines." Young, early-generation stars (as should be expected in young, early-generation galaxies) should not have notable metallicity.
- "We find no statistically significant difference in the mass/radius relation or in the radial mass profiles of the quiescent cluster members compared to their field counterparts." Galaxies in clusters are expected to be larger than isolated galaxies, due to their increased opportunity to coalesce. This does not seem to be the case here; both cluster and field galaxies grew at the same rate.

It must be noted that as-yet unobserved Population III stars have been hypothesized to explain metallicity, but there is currently no explanation for galaxy clustering not leading to larger galaxies. Again, the large number of mature, quiescent galaxies at approximately 9.9 billion light years away emphasizes the limited amount of time available for this to occur, and therefore such observations remain anomalous.

Why the alternative model explains these observations without contradiction: For the Pan Theory and other steady state models, old-appearing galaxies at increasingly greater distances are not only predicted but are expected and required by these models since the portion of old appearing galaxies would accordingly have been about the same portion throughout the observable universe. Such theories can immediately explain observations such as the above since they match predictions. On the other hand, if we observe a 'hard limit' that we cannot see beyond, and at these distances observe no old appearing galaxies, but only small, blue, young appearing galaxies as in BB predictions, then seemingly all these alternative models would be discredited and disproven, as would the Pan Theory.

1.6 The Anachronistic Supermassive Black Hole Problem

According to the BB model, black holes form from matter within a galaxy and grow alongside it: the bigger the galaxy gets, the bigger the central black hole. Very large black holes in extremely distant galaxies is akin to the problem of Milky Way-sized (and larger) galaxies being observed near the theoretical beginning of the universe. The Milky Way itself is theorized to be approximately twelve billion years old, for comparison's sake.

1.6.1 Particularly, Submillimeter Array observations of 4C60.07 "now suggest that such colossal black holes were common even 12 billion years ago, when the universe was only 1.7 billion years old and galaxies were just beginning to form" (Aguilar, 2008). One of the galaxies seems quiescent, the other active; both "are about the size of the Milky Way." As can be seen, such observations extend the anachronistic galaxy problem.

Why the alternative model explains these observations: For all cosmologies proposing a much older universe than the standard BB model, large black holes should be found equally in large distant galaxies as well as local ones, which is what is being observed.

1.7 The Metallicity Problem

Metals—are characterized in astronomy as being anything heavier than hydrogen and helium. Anything other than hydrogen can be produced by nuclear fusion inside of stars. Late-generation stars are made up of the ejecta of earlier generation stars that underwent nova and supernovae processes that expelled these heavier elements into interstellar space. Logically, this means that early-generation stars should be metal poor, and the hypothesized Population III stars (first generation stars) are theoretically metal-free, as suits the first stars in the universe. Stars should become more metallic—in other words, their metallicity should increase—the later they form. Therefore, distant galaxies, being part of a younger universe and an earlier generation, should have stars of lower metallicity than today.

1.7.1 The quasar SDSS J1148+5251 is "hyperluminous" and resides within "a high metallicity galaxy in the early universe" (Galliano). A redshift of 6.42 would make this quasar, by the Hubble equation, about 13.4 billion years old. This means that the quasar and galaxy can be, at most, 400 million years old, which is the average lifetime of a large metal-producing star. However, "various metal tracers, like the [FeIII], [MgII], and [CII] lines, as well as the large amount of CO and dust emission, indicate a nearly solar metallicity." The Sun is a Population I star about 4.5 billion years old; its metallicity should not resemble that of a quasar at almost the beginning of the universe.

The quasar's dust content and metallicity can therefore only be explained conventionally by a huge population of supermassive, short-lived stars and almost "instantaneous" recycling. The researchers also estimated that "previous studies overestimated the star formation rate [of this galaxy] by a factor of 3-4."

Why the alternative model explains these observations: For steady-state models such as the Pan Theory, the metallicity of distant galaxies, on an average, should be the same as those found in local ones. According to these models no matter how near or far one would look s back in time there should be galaxies of all ages, points in their evolution, and metallicities – which is what is being confirmed by observations such as this one. The difficulty of such observations of metallicity at these great distances will remain a problem in their observation, regardless of the model being considered.

1.8 The Gravity Problem

For a long time now it has been known that the Milky Way and its surrounding dwarf galaxies present anomalies that cannot be accurately explained by computer modeling. In a resent study it was confirmed that the dwarf galaxies surrounding the Milky Way appear "preferentially distributed and orbit within a common plane" (now being called the Magellanic Plane)

1.8.1 (Pawlowski, 2014) around a "vast polar structure (VPOS)… globular clusters and stellar and gaseous streams appear to preferentially align with the VPOS too." M31 appears to have a similar satellite system, "and aligned systems of satellites and stellar streams are also being discovered around more distant galaxies." This is "a challenge for the standard Λ-cold dark matter cosmological model" because it is "incompatible with the planar VPOS." In short, most objects around the Milky Way orbit in the same direction and in a roughly-aligned plane, but because the dark matter halos that galaxies should form from are first-order isotropic, there should be no preferred orientation within them. Likewise, the distribution of sub-halos is also isentropic so if there are follower galaxies, they should be widely distributed and moving in random directions.

Pawlowski *et al* essentially performed a Monte Carlo simulation using the standard cosmological model(s) to try to replicate the ordered structures seen around the Milky Way and M31: the structures could be flukes. However, the models predicted far more random systems and reduced the likelihood of 'vast structures' to a very low order of probability. Pawlowski then went on to suggest that these satellite galaxies are tidal dwarf galaxies caused by galactic collision debris, which would have to have a signature on the Local Group scale, and says that he "discovered that the non-satellite galaxies in the Local Group are confined to two thin and symmetric planes" (Pawlowski, date unknown). Professor Pavel Kroupa, a co-author of the paper, went further: "There's a very serious conflict, and the repercussion is **we do not seem to have the correct theory of gravity**" (bold added) (Luntz, 2014).

Why the alternative model better explains these observations: The Pan Gravity model predicts galaxy formation and similar rotation curves for spiral galaxies by way of simple vortex mechanics in such cases where the majority of mass is not centrally located. To do this, it proposes a kind of "curved momentum" (not unlike the alleged lines of warped space but using Euclidean geometry) for stars in spiral galaxies so that an extra gravitational force inward would not be needed to maintain the higher stellar velocities that have been observed. It also hypothesizes admittedly *ad hoc* electromagnetic influences that could produce spiral galactic bars, and mechanisms that could explain a wall of tidal galaxies perpendicular to a large spiral like the Milky Way. Alternative galaxy-formation models and gravity theory involving outside-the-box explanations, such as the Pan gravity theory, might also be considered (if experimenters are aware of such a theory and of its details) and investigated as a possibility if known models of galaxy formation have failed, as indicated by the above related observations and attempted computer modeling using presently accepted theory.

About the Pan Gravity model: The Pan Gravity model is a mechanical 'pushing gravity' model with similarities to Newton's Pushing Gravity model, in his second edition of *Optics* (1717). Unlike his first explanation, he proposed a mechanical pushing aether explanation of gravity whereby the aether would get progressively thinner (less dense) when approaching celestial bodies (wikipedia, Mechanical explanations of gravity, Newton, Static Pressure). A similar explanation is proposed by the Pan Gravity model.

1.9 The Distance/ Brightness Problem

The conventionally accepted method of calculating cosmological distances involves redshifts and is based upon the Hubble formula. The results tend to result in Type 1a supernovae—generally considered to be equivalent to standard candles concerning their relatively constant brightnesses—being brighter or dimmer than expected and thus resulting in a parabolic curve of brightnesses vs. redshifts. This unexpected result was thought to necessitate the proposal dark energy.

It should also be noted that if one is using the wrong equations to calculated distances and brightnesses, one would come to the wrong conclusion concerning the appearances of cosmic entities in the past. The conclusion that cosmic entities in general were different in the past could be totally wrong for this reason. This was one of the two conclusions that put the Big Bang model into prominence. The other conclusion was that the cosmic microwave background radiation and its uniformity could be best explained by the Big Bang epoch of Recombination, rather than steady-state explanations of the time.

The problem comes from the belief that the Hubble distance formula, also called the Hubble Law, calculates distances correctly based upon redshifts. Based upon Hubble calculations type 1a supernova as standard candles do not act as one would expect from them—their luminosity does not diminish as expected with distance—increasingly complex models that can only be justified mathematically, and even then the mathematics can be, and have been adjusted to account for newer observations. This is not necessarily a bad thing; despite Occam's Razor. There is nothing that says that the cosmos must operate in the simplest possible way. However, these models are evangelized with the ring of truth, which ignores that they are models: as Korzybski said, "the map is not the territory." Models, as assumption-based analytical predictors of future observations, should be as pragmatically simple as necessary to make predictions. Continuous adjustment to them is generally indicative of some flaw that some different model with a different context would explain more simply**:** the complex helical planetary movements from a geocentric model simplify to ellipses in a heliocentric model, for example. Truth value aside, the *ad hoc* adjustment (and some would say foundation) of current models leave room for other models with better predictive power, if they exist and are available.

Why the alternative model explains these observations: As related to the present authors' previous paper: *The Pan Theory proposes new formulas for calculating cosmic distances and brightnesses based upon slowly shrinking matter rather than an expanding universe*.

The Pan Theory proposed a complete replacement of the Hubble formula and has added an additional brightness formula based upon the theory, the results being very well-supported by observations of type 1a supernova. The Hubble formula is based upon the tenets of an expanding universe. These alternative equations were derived instead from the diminution of matter concept and in the authors' previous paper, as indicated below, which matched observations of supernova very well without the need for hypothetical dark energy.

1.9.1 The alternative distance equation was/is proposed to replace the existing Hubble formula directly below (Noble, Cooper 2014):

$$r_H = \frac{v}{H_0} = \frac{\beta c}{H_0} = \left[\frac{(z+1)^2 - 1}{(z+1)^2 + 1}\right]\frac{c}{H_0}$$

The new proposed formula is linear and was derived based upon the Pan Theory premise, the diminution of matter:

$$r_1 = 21.2946 \log_{10} [.5((z+1)^{.5} - 1) + 1] (z+1)^{.5} P_0$$

Where r_1 is distance, z is the observed redshift, *and* P_0 is a constant = 1,958.

Based upon the rate of the diminution of matter, and an additional formula is needed to calculate brightnesses, since matter would appear to have been larger and brighter in the past. This increased brightness would be wholly diminished by increased distances. The brightness formula is:

$$\Delta L = 2.512 \log_{10} [[((z+1).5t - 1)).5t + 1](z+1)]$$

Where ΔL is the calculated brightness, z is the observed redshift, and t is the calculated quantitative timeframe based upon the rate of the diminution of matter in "doubling periods," which is a function of the observed redshifted wavelengths:

$$t = 9.966 \log_{10}[(z+1)^{.5}]$$

The alternative cosmology is based upon the changing scale of matter (matter diminution) so the formulas are linear and the results at great distances, very different. This proposal succeeded in forming the distance/brightness trend line to an approximate constant resulting in a straight-line graph, as would be expected from a standard candle without dark energy (Noble, Cooper 2014). This does not require invoking any phenomena that cannot be either directly observed or immediately disproved: as the diminution rate is constant and all mathematical operations in the model have explicit mechanical explanations, it cannot be 'tweaked' to force flatness. The mathematics of the alternative model are, for the most part, simpler and its assumptions involve the diminution of matter rather than the expansion of space. From a relative perspective they might be considered the same thing, but the ramifications of each result in different mathematical formulations and implications.

2. Summaries of the Above Problems

The Horizon, Galaxy Formation, Anachronistic Black Hole, Metallicity, and Gravity Problems all relate to the limited age of the universe (13.8G years) required by the Hubble formula concerning the BB model. Any cosmology of a much older universe would not have these same problems.

The Flatness and Density Problems are common to all cosmological models that do not propose a steady-state condition of the universe. Steady-state or quasi-steady-state models would not have these problems.

The Gravity Problem relates to any cosmology like the BB model that proposes the standard model of gravity, with or without dark matter. Cosmologies that can explain galaxy formation as presently observed, along with galaxy rotation curves, whether right or wrong, would not have this problem.

The Distance/Brightness Problem occurs in ~~an~~ expanding universe models like the BB and Hoyle's steady-state models, or any other model that uses the Hubble formula to calculate distances and brightnesses. The problem shows up as unexpected brightnesses and sizes of distant cosmic entities. The researchers and authors of this paper believe that so far only the Pan Theory has, from its basic tenets, derived the correct distance and brightness formulations and therefore is the only model able to correctly calculate distances, brightnesses, and angular sizes of galaxies and other cosmological objects accurately, especially at the greatest distances.

3. Explaining of the Pan Theory

The Pan Theory is a type of **steady-state theory** which proposes that, as far as we could ever observe, a constant cosmological density, and that **the universe as a whole is much older** than is currently thought. Unlike most previous steady-state models, the Pan Theory does not propose that the universe is of infinite age or size; there was a beginning point in time prior to which the question of 'what happened before' would not be a valid question (much like the initial version of the BB model). The universe would be a much simpler place.

It is a scale-changing theory that proposes that rather than space expanding, matter very slowly gets smaller over time. Matter would decrease in size about 1/1000 part every 8 million years. This is a similar perspective to expanding space since space would appear to be expanding from our perspective. This slow decrease in the size of matter is accordingly enough to explain the observed redshift of galaxies and other cosmic entities.

It is also a single-force theory evidenced by the particle spin of fermions. Particle spin would be real, in this model, not just angular momentums as in present theory. **It is an aether model** involving a universal medium (a physical background field) believed to be evidenced by the Zero Point Field. EM radiation would be density waves of aether particles. Electro-magnetism would be explained by aether flow similar to Maxwell's aether model, and a pushing theory of gravity also based upon aether flow, with its own equations explaining stellar velocities in the discs of spiral galaxies, there being no need for the existence of non-baryonic dark matter, excepting as non-matter aether particulates.

The authors submit the Pan Theory for consideration based upon the evidence submitted above and observations in general, with the understanding that reality always trumps theory. If its predictions are not borne out or, more importantly, specified counter-evidence comes to light, then it would be fundamentally in jeopardy of being disproved as would any model continuously contradicted by evidence, such as the BB model, and not worthy of consideration or continued support.

Certain aspects of the Pan Theory are presently considered controversial, such as **pushing gravity** rather than the warped space of General Relativity and dark matter. **It proposes the diminution of matter** resulting in ~~a~~ the changing scale of measurement, rather than the expansion of space, and **proposes real waves in an aetherial background field** rather than pure energy waves or probability waves of Quantum Theory. Two of these controversial tenets will now be discussed.

3.1 Proposing a new Aether

As mentioned above, the Pan Theory is an aether model. There have been a number of proposals on an ongoing basis, explaining and/or proposing a "new aether" (Mingst, 1997)(Wikipedia, 2014, Superfluid Vac.)((Scientific American, June 2014; Spacetime Superfluid).

The Pan Theory proposes the following**:**

A background aether-like field of particles forms into coiled strings (3 dimensional) of like particles. There is only one fundamental particle that makes up everything, including matter and aether field particles, all of reality. Space is the volume the matter and the aether occupy without any other meaning to it. These particles are called Pan (as in "everything"), which are hypothesized to be much smaller than either proposed dark matter particles or Higgs particles. Pressure differentials within Pan fields explain both gravity and magnetism. Electromagnetic radiation and De Broglie waves are explained as physical, mechanical waves in the Pan field aether (encompassing the local hidden variables of quantum theory in what De Broglie called pilot waves), carrying discrete collections of Pan (which Planck called quanta) and we call photons. This explains the coexistence of particles and waves in the quantum realm, and would simplify this aspect of quantum theory to simple pilot-wave theory. The pilot waves for photons would be EM radiation, and the Pilot waves for electrons would be De Broglie waves. If this interpretation of quantum theory were valid and accepted, the applied physics of quantum mechanics, with its proven predictive power, would not necessarily need to change, and quantum mechanics could be considered mechanical rather than "mystical."

This aether would encompass the entire universe and would be comprised of aether particulates within it. It would have relative motions and flows to it. We partly observe it as the Zero Point Field. It would be a preferred reference frame. Other present-day theoretical/ hypothetical background fields are the microwave background, the Higgs field, dark matter, dark energy, gravitons, quantum foam, etc. Any background reference frame could theoretically negate special relativity. If so the effects of special relativity would be replaced by Lorentz transforms, whose formulations are the same as special relativity but would be based on aether physics as Lorentz proposed. Like quantum mechanics, many of the concepts and predictions of special relativity and its mechanics would not necessarily need to change.

Within the realm where the proposed pushing gravity works similarly enough to pulling gravity that currently forms the foundation of physics, Pan Gravity theory would have no application difference. Because Pan Gravity is pushing and mechanical, and involves field pressure differences and flows, it is not irrotational and leads to vortices being produced, at both ~~at~~ galactic and atomic scales. These vortices accordingly produce tangential accelerations as well as radial ones, but the tangential components are most recognizable at interstellar scales. These tangential accelerations, along with gravity mechanics, accordingly would explain the increased orbital velocities of spiral galaxy disk stars, and increased velocities observed concerning orbiting galaxies in a cluster, mostly in the same galactic plane.

3.1.1 Additional possible empirical support for this new aether comes from physical experimentation by Harris and Bush. Their experiments with mechanical, macroscopic oil droplets bouncing on water produced evidence of pilot waves, confirming previous work by Couder, and stable quantized orbits (Harris, 2014). As Bush explained, "this is a classical system that exhibits behavior that people previously thought was exclusive to the quantum realm, and we can say why" (Wolchover, 2014). Couder's previous experiments demonstrated that a combination of a bouncing droplet, the primary waves that it rides, and the pilot waves it generates can replicate the famous double-slit experiment (Couder, 2006). All of this shows that what used to be considered purely quantum mechanical phenomena can be produced and explained by macro-mechanics. This is not evidence of physical aether waves, admittedly, but it does lend credence to the Pan Theory (and De Broglie theory), or any concept or theory ~~of~~ explaining quantum phenomena in terms of macroscopic mechanics. It was the asserted impossibility of physical waves to exist in the absence of a background field that lead the De Broglie theory to be discarded completely in preference for the Copenhagen interpretation.

3.2 Proposing a Single Force Theory

The Pan Theory is a single-force theory that is inherently mechanical**:** this single force is an unwinding force innate to matter, observable as the particle spin of fermions. This is the sole force which would be the singular cause of both time and motion in the entire universe. This 'unwinding and concurrent rewinding' is the cause of individual Pan forming into spring-like stands which eventually lead them to *mechanically link* to themselves (in a looped form). As these loops self engage they begin to spin because of their innate unwinding requirement, but not all of the loops that form are stable. Some have a tendency to spin apart, while others, because of their configuration, lengths, and type of attachments, stabilize. This process explains stable, unstable, and virtual particles. Such spinning spring-shaped looped particles when forced together during the great force involved in stellar fusion processes**,** can describe nuclear bonds within matter (the Strong, Weak, and Strong nuclear force), and when spins are opposite explain matter/antimatter annihilation, which in this model only involves particle-form destruction rather than substance destruction. In the case of nuclear bonds, the bonds are actual physical, mechanical connections of the nucleons with each other.

These springs engage each other mechanically upon stellar fusion of nuclei, and produce a spring-stretching resistance force when attempts are made to separate nucleons. When these connections are broken, the springs physically break violently much like strong macroscopic springs do when they rupture.

Therefore, the single force aspect of Pan Theory would explain the Strong, the Weak, and the Strong nuclear forces as simply mechanical connections of nucleons resisting separation. Gravity and Electromagnetism are explained by differences in field aether pressures produced by matter and ferro-magnetic materials, resulting in aether flow that we have perceived as forces. The warped space of General Relativity would be explained instead as pressure differentials in a background aether field. The equations of Newtonian gravity and General Relativity or their applications, are changed to explain rotation curves of spiral galaxies, galaxies in a cluster, and the additional bending observed concerning gravitational lensing, as an additional bending diffraction, without the need for dark matter to explain anything. All effects presently explained by dark matter would instead be explained by a flowing aether caused by aether density variations, and where no unobservable dark matter would be needed.

3.3 Predictions, With Similarities and Differences to Other Models

The Pan Theory is based on the long-documented and widely accepted correlation between the distance to cosmological entities and the observed red-shift of their spectra. But unlike the standard model, space is not expanding (though, if matter shrinks, space would certainly appear to be expanding). Red-shifts rather then being stretched by expanding space, were created by larger atoms in past timeframes where time ticked more slowly. Both aspects would produce redshifted, longer wavelengths of light from our perspective, from a far distant time frame. From this viewpoint, different equations were derived which match observations very much better than the Hubble formula, without the need for any ad hoc hypothesis like dark energy (Noble, Cooper 2014).

In terms of observations, what the Pan Theory predicts is that galaxies in the distant past should appear unexpectedly bright, condensed, and that the average observed size of objects should appear to decrease the farther back in time one looks, using the Hubble formula to calculate distances. Since distances are accordingly underestimated using the Hubble formula**,** the angular size of galaxies will appear to be unexpectedly small at the farthest distances, by many factors, but would appear to be unexpectedly brighter because they would be calculated to be much closer than they really are based upon Hubble formula calculations. Using the alternative formulations above in 1.9, instead galaxies in all timeframes should appear to be the same variations of size and brightnesses that we see close by.

The Pan Theory proposes that Black Holes are not vacuous singularities but are instead a more dense form of matter comprised of highly compressed aether particles, more dense than neutron stars. They, along with the background aether field, are accordingly the creators of all the matter in the universe, with minor possible exceptions. In terms of operation, the Pan Theory proposes that ‘new’ matter is being created surrounding Black Holes similar to the ‘C field’ (creation field, Hoyle) creation processes maybe similar to those proposed by the quasi-steady state theory, or otherwise created by the forces at the base, surrounding, and within galactic and stellar black-hole jets.

Like Halton Arp’s original proposal, the Pan Theory hypothesizes that black holes can spin off pieces of themselves which eventually will produce a new galaxy, although it is not a theory requirement. The atomic particles of electrons, positrons, and protons are accordingly created by the above processes, with no Big Bang or original creation process. Anti-protons are theorized to be short-lived particles like free neutrons, unless their spin is somehow continuously reinforced. The lack of antimatter in the observable universe is explained by antimatter being mechanically unlikely to remain stable in the first place (particularly anti-protons) —going against the unwinding force inherent to Pan—and having a much shorter half-life.

As collections of individual Pan become smaller in size, they become longer in length, and eventually spin off pieces of themselves, or are pared off by particle interactions, the pieces again becoming part of the background aether. This would partly explain the zero point field, with more original matter-creating processes being involved. Phenomena such as virtual particles and hypothetical quantum foam would be explained as temporary combinations of Pan that mechanically engage and disengage. In effect, quantum phenomenon that are currently described as 'simply happening' without cause, would have almost classical mechanical explanations as to how they occur; for the most part, stochastic quantum mechanical equations would remain as an accurate description as to the frequency these phenomena will occur, as well as many other successful phenomenological equations of Quantum Mechanics.

One of the alleged philosophical weaknesses of most steady-state cosmologies was that they lacked initial conditions, invoking infinity forwards and backwards in time. Prior to the BB this was more-or-less accepted almost as a matter of faith, but the BB model did have the advantages of more reasonably explaining the observations of the time and proposing a beginning to a finite universe. Likewise, the Pan Theory similarly proposes an initial condition**:** at some point in the distant past, there was but one single Pan particle contained all of the matter and volume of the entire universe. The difference between this and the conventional universal monoblock of the BB model, in essence, is that if one had a set of 'magical scales' to measure the matter of the initial state in BB cosmology the monoblock would have been extremely massive, while the Initial Pan, to coin a term, would have been smaller than an electron: any measurement system has to be relative to the units that make it up, and even electrons would accordingly be made of huge numbers of Pan. This perspective of the Pan Theory involves an additional "simple" theory of relativity, involving the relativity of the size of matter to time.

This, and the diminution and progressive increase in the numbers of this first Initial Pan, establish the foundation for the rest of the Pan Theory's cosmology, although there are different possibilities concerning exact details of Pan mechanics. The rate of this diminution and number of "doubling cycles" dictates the age of the universe, and the diminution itself affects the observed size of matter, masses, and times concerning distant observations. One of the principal authors of this paper has calculated that the maximum rate of the proportional loss of size in atomic matter is approximately $1/1000^{th}$ part every eight million years. This small amount accordingly explains the redshifting of cosmic entities. Hence, every eight billion years (note that diminution is continuous and therefore must use an exponential function rather than a linear one) an atom has half the volume and substance it once possessed and, overall, there are twice as many Pan in the cosmos than there was about 8 billion year ago (which is a reduction in diameter of about .794 (1 over the cube root of 3) about every 8 billion years. From this, it is clear that the Pan Theory predicts a far greater age for the universe than conventional BB models. Indeed, the age could be 'functionally' infinite since there is no effective way to estimate the bounds of the cosmos beyond the observable universe. Unlike previous steady-state theories an initial state and beginning is proposed; no infinities would exist in the Pan Theory. It would be a model whereby we are "lost" in both time and space.

One important difference between the expansive and diminutive interpretations of observations is that in the Pan Theory, galaxies do appear to be moving away from each other but new galaxies will eventually form in the spaces so opened up, resulting in a relatively steady-state appearance and densities. While galaxies are moving away from each other, they are only doing so at a relatively minor pace. Mutual gravitational attraction causing the formation of cosmological structures such as galactic superclusters and filaments, the same as in the standard model, but there would have been a much greater amount of time for such galactic structures to form. Large voids may be created in this model by a number of hypothetical occurrences such as burned out or exploding galaxies, and again there is much more time available for their formation. As matter would slowly radiate outward from a starting point such an exploding galactic core, or a dissipating burned out galaxy, new galaxies would form from this outward moving matter leaving large expanding voids as the origin of an ancient galactic parent.

4. Conclusions

It is the opinion of the authors that the merit of any theory can be judged on the summation of reasonable criteria: We propose four in our short summation.

1. A theoretical model should be able to explain all observations and predict the outcome of experiments over time, with a minimum of ad hoc additions or adjustments.
2. Within its scope, a theoretical model should be able to make predictions agreed upon by a consensus of its practitioners, rather than many different practitioners proposing different predictions and outcomes.

3. New observations and analysis should tend to confirm the model, rather than requiring the model to be regularly adjusted.
4. One or more methods to disprove the model should be agreed upon and proposed by a consensus of its practitioners.

Considering both the conventional BB model and the proposed Pan Theory model under these considerations, it appears to the authors that the Pan Theory could have some distinct advantages over the BB model in places where the BB model is demonstrably weak. It can be argued that the BB model has *ad hoc* alterations and additions due to regular observational contradictions of the model. But on the other hand the same observations that seem to contradict the BB model support the Pan Theory. In observation and natural experiment, then, radio astronomy often sees the farthest. Future observations of the most distant galaxies by radio telescopes, especially by extremely capable and newer ones such as the James Webb Space Telescope or the ATACOMA array, have the potential to confirm or deny the Pan Theory, other cosmologies proposing an older or infinite age universe, or the BB model.

Three observations, in particular, could make the distinction of validity:

1. **Galactic density:** an expanding universe should have evidence other than red-shifting. The galactic density of past epochs should be able to determine whether the universe is expanding or whether matter is getting smaller and 'filling in the gaps.' In an expanding universe, past epochs should have had galaxies more densely packed than they are now. In the Pan Theory, density should remain roughly constant no matter what epoch is observed, although density would appear to have been less since distances would appear to have been relatively greater in the past.
2. **The Dark Ages epoch:** according to the BB model, there should be a horizon beyond which we can observe no galaxies because there are no galaxies for us to observe, since they had not formed yet. This should also be a relatively hard limit; before it in time there should be the beginning luminous galaxies and after it nothing, rather than a weakening in luminosity until there is eventually nothing, as that would suggest some other possible factors, such as the imperfect transparency of the intergalactic medium, being responsible. The Pan Theory instead expects a gradual weakening in luminosity until the opacity of intergalactic hydrogen and dust establish a 'foggy' horizon.
3. **Galactic evolution:** the composition and structure of early-epoch galaxies will be a deciding factor between the BB and steady state models. The very first galaxies should not be large, well-ordered elliptical or spiral galaxies with a wide range of Population I stars with high metallicities. They should be small, blue galaxies of Population III stars. The Pan Theory, alternatively, expects some galaxies to be mature-looking and complex no matter how far back in time one looks until they are finally obscured by the dust horizon.

One of the biggest problems for those proposing the Pan Theory is that BB practitioners are using different formulas for calculating distances and brightnesses and therefore would be expected, according to the Pan Theory, to misinterpret distant galaxies as being smaller, denser, and brighter than what they really were.

Observations along these lines are already causing uncertainty amongst practitioners, as can be seen from the reference observations listed below. The authors expect that these challenging observations to the BB model will continue in greater numbers as new telescopes of all types identify even more distant cosmological entities, a portion of which will continue to appear old. They further predict that the BB model may be seriously questioned—in terms of an active search for an alternate model—within three years following the proper placement and functioning of the James Webb Space Telescope, if the trend in observations holds true. Before an attempt is made to add an additional hypothesis to the Big Bang model to greatly increase the age of the BB universe based upon contradicting observations, it is hoped that the Pan Theory may be better known by that time and considered an alternative possibility. In the meantime, it is hoped that the theory may become known for its many different predictions, and in particular that of continuous anomalous observations of large, old appearing galaxies at ever increasing distances and that its distance and brightness equations will be tested and confirmed by many others, as it was by the authors concerning hundreds of type 1a supernova in their prior research.

Further Explanations

For any cosmology when one is first exposed to the theory, despite all explanations given, there will always be many possible remaining unanswered questions that cannot all be thought of, addressed, or answered in a single paper. All readers are encouraged to ask the authors questions concerning any and all remaining questions they may have regarding this paper or related theory.

Responses

Please contact the author Forrest Noble at pantheory.org@gmail.com. He will be very happy to answer any questions, consider corrections, and comments. If you are interested in testing the equations on page 9, have new or different insights, or need additional explanations concerning this paper or the alternative cosmological model, the authors are willing to discuss this.

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Applied Physics Research; Vol. 6, No. 1; 2014
ISSN 1916-9639 E-ISSN 1916-9647
Published by Canadian Center of Science and Education

Journal of Applied Physics Research

An Alternative Universe-Scale Analytic Metrology and Related Cosmological Model: An Analysis of Type 1a Supernovae Data With Newly Proposed Distance and Brightness Equations Which, if Valid, Would Eliminate the Need for Changing Expansion Rates of the Universe vis-à-vis Dark Energy

Forrest W. Noble[1] & Timothy M. Cooper[1]

1 Pantheory Research Organization, 19401A Diamond Ct. Cerritos, California, USA

Correspondence: Forrest W. Noble, 19401A Diamond Ct. Cerritos, California 90703, USA. Tel: E-mail: pantheory.org@gmail.com, forrest_forrest@netzero.net

Received: December 6, 2013 Accepted: January 20, 2014 Online Published: January, 2014

doi:10.5539/ URL: http://dx.doi.org/10.5539/

Abstract

The purpose of this research and study was to help derive and test new theoretical equations to accurately determine cosmological distances and luminosities for type 1a supernovae and all cosmological entities, without the need for the dark energy hypothesis. These derived equations were based upon an alternative cosmological model and a study of type 1a supernovae observation data. This paper presents the results of this research and study and the resultant new equations.

A new distance equation is presented in this paper for peer consideration for the first time. It is proposed as an eventual replacement for the Hubble distance formula concerning calculated cosmic distances based upon redshifts. A new "brightness equation" is also offered herein. Its calculations are required to accompany the calculations of the distance equation to determine brightnesses and are proposed as an addendum to the inverse square law of light concerning luminosity calculations for cosmic-redshifted distances. In the subject supernova study these alternative equations are used to show their application and proposed validity concerning calculated distances and observed brightnesses of type 1a supernovae.

The proposed alternative distance equation is very different from the Hubble distance formula since it is directly linear and was derived from an entirely different non-expanding-universe cosmology. Both the newly proposed cosmological distance and brightness equations were tested and refined based upon a study of type 1a supernova data involving the subject applied physics research. Explanations of the alternative cosmological model which was used to derive these equations, are presented here for the consideration of their merits. Hopefully these proposed equations will be tested by many others concerning all types of cosmological-distance observations of redshifts requiring distance and brightness-determination calculations, eventually resulting in the serious consideration of the subject cosmological model for reasons discussed in this paper.

Keywords: type 1a supernova, alternative cosmology, alternative equations, contradicting dark energy

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1. Introduction

This paper proposes how an alternative cosmological model, using entirely different distance and brightness equations fit type 1a supernova (SN, plural SNe) data very precisely. This strongly implies that the dark energy hypothesis is the wrong interpretation of supernova data and therefore adds unnecessary complications to the field of cosmology.

To evaluate the advantages of the proposed cosmological model and equations, this paper compares the standard dark energy interpretation of type 1a SN data using the Hubble formula to calculate distances, with the proposed cosmological model which is based upon a Euclidean non-expanding universe (Noble, 2012). After recalculating and plotting these cosmological distances from redshifts using the alternative model equations, there appears to be no indication of the universe's expansion or the acceleration or deceleration of expansion based upon hypothetical dark energy.

The primary purpose of this paper is to present these new equations to accurately calculate cosmological distances and luminosities for all cosmological entities, and in this paper and study, for type 1a supernovas. These alternative-model equations are very different from the Hubble distance formula since they were derived from an alternative cosmological model and based upon a study of type 1a supernova (SN, plural SNe) data as presented herein. This paper proposes how this alternative cosmological model, using these entirely different distance and brightness equations, fit SN data very precisely. To evaluate the advantages of the proposed cosmological model and equations this paper compares the standard dark energy interpretation of type 1a SNe data using the Hubble formula to calculate distances, with the proposed cosmological model which is based upon a Euclidean non-expanding universe model. After recalculating and plotting these cosmological distances from redshifts using the alternative model equations, there is no indication of universal expansion, or the acceleration or deceleration of expansion of the universe based upon hypothetical dark energy.

For more than a decade now cosmologists have been investigating numerous possibilities to better explain type 1a SN observations and data as standard candles, with various hypotheses of explanation. As of 2013 some of the most prominent of these hypothesis were the de Sitter invariant special relativity proposal (Wikipedia, De Sitter Relativity, 2013), the evolving supernova model, the closed dark energy model, the flat dark energy model (Conley et al., 2011), the late-time integrated Sachs-Wolfe effect, dark energy as a cosmological constant, dark energy as Quintessence (Wikipedia, Dark Energy, 2013), other variable expansion models (Wikipedia, Metric expansion of space, 2013), and many other proposals. The models presently being considered by mainstream cosmology, by intent, are consistent with the Big Bang (BB) premise and therefore would not include seemingly feasible but outside-the-box explanations such as the one presented in this paper based upon an alternative cosmological model.

This paper proposes that this alternative cosmological model and its theoretical formulations properly explain the observations of type 1a SNe and accurately calculate distances and brightnesses based upon their observed red-shifts, with completely different results from the Hubble distance formula. The results of these calculations and evaluations of supernova binned data instead support the validity of this alternative cosmological model and its equations calculating distances and brightnesses for all cosmic entities, as well as proposing a new luminosity formula as an addendum to the inverse-square relationship of Electro-Magnetic (E.M.) radiation concerning Luminosity Distances (Wikipedia, Luminosity Distance, 2013). Figure 2 shows that the newly proposed distance and brightness equations produce a relatively straight-line plotted graph of type 1a supernova when compared to the Hubble formula which produces a very curved-line graph.

The proposal that the Hubble formula calculates distances inaccurately is not surprising or unique. Those who support the dark energy hypothesis also assert, based upon their observed luminosity, that both type 1 and 2 SNe with a red-shifts of $z < \sim.5$ (Wikipedia 2013, Accelerating universe), are dimmer and appear to be farther away from us than the Hubble formula calculates. For this reason these observations formed the basis for the dark energy hypothesis.

For all statements concerning "angular sizes," also called "observation angles" and Petrosian angles θ, directly relate to these primary references in this paper**:** Martin Lopez-Corredoira (2010), and Alexander Unzicker (2010). The new distance and brightness formulations used for this supernovae study also support simple explanations for anomalous angular sizes of galaxies as explained by these references.

Some believe that the observed angular sizes of cosmic-redshifted entities are a major problem with Big Bang cosmology. This is because the angular sizes of galaxies and distant entities appear to be too large (anomalous) at low redshift distances, and far too small at the greatest redshift distances based upon their observed angular sizes alone and the studies described in these references. For this reason most observed and calculated angular sizes of cosmic entities are considered anomalous and not easily explained by the Big Bang model. These so-called anomalies are not only predicted by the alternative cosmological model herein, but they are requirements of the alternative cosmological model as explained below. When using the Hubble distance formula to calculate distances to cosmic entities, the ratio of angular sizes to such cosmic redshifted entities has been shown to be closely associated with the relationship, where $\theta \sim 1/z$ or $\propto z^{-1}$, ($\propto$ "proportional to"). Instead when using the alternative cosmological model and its equations to calculate these distances and brightness, the relationship results in $\theta \propto z$, thereby indicating a strictly linear and proportional relationship between cosmological redshifts and distances as proposed by this study of type 1a supernovae data and the resultant derived equations.

2. Classifying the Alternative Cosmological Model

The alternative cosmological model which was used to derive the equations presented herein, can be categorized under the broad classifications of Scale-Changing theories, and "variable mass cosmologies" first proposed in the early 1930s. The alternative cosmologies being presented at that time were proposed to explain the observed cosmic redshifts by means other than by the expansion of the universe, which was based upon galaxies moving away from each other. One of the first of these proposals was made by Paul Dirac when galactic red-shifts were first discovered. He proposed both "the uniform expansion of matter and space." Another proposal was made by Fred Hoyle, Jayant Narlikar (Dass, 1998) whereby the diameter of matter accordingly decreases over time by electrons becoming closer to the nucleus of atoms. One of the latter proposals was by Robert Dicke (Wikipedia, Robert‑H.‑Dicke, 2011) directly related to the alternative model proposed herein, whereby in 1957 he proposed that "the cosmological redshift is described by a shortening of measuring rods rather than an expansion of space" (Dicke et al., 2008; Unziker, 2007) which is the same explanation proposed for the subject cosmological model.

The subject cosmology is also a type of steady-state model but one contrary to an expanding universe, more like the many steady-state proposals before the 1920's. Although Dicke's model is a gravity based model, both models propose that the size of matter relatively speaking, decreases over time, simply that matter is getting smaller as time passes. As to the subject model everything else in the universe would also change in size and magnitude over time but maintain its same relative proportions to matter. This is based on the premise that matter can be used to define everything else in the universe which accordingly would maintain its relative proportions to matter in all time frames. Based upon the alternative cosmology if matter is getting smaller dimensionally at the foundation level of matter such as atomic particles or smaller, then larger matter in the past would have had exactly the same number of atoms in them and be identical to the same matter today only that it would have been relatively larger, but not necessarily larger by direct comparison considering that the foundation particles of matter were accordingly proportionally the same to matter in the past as they are proportional to matter today.

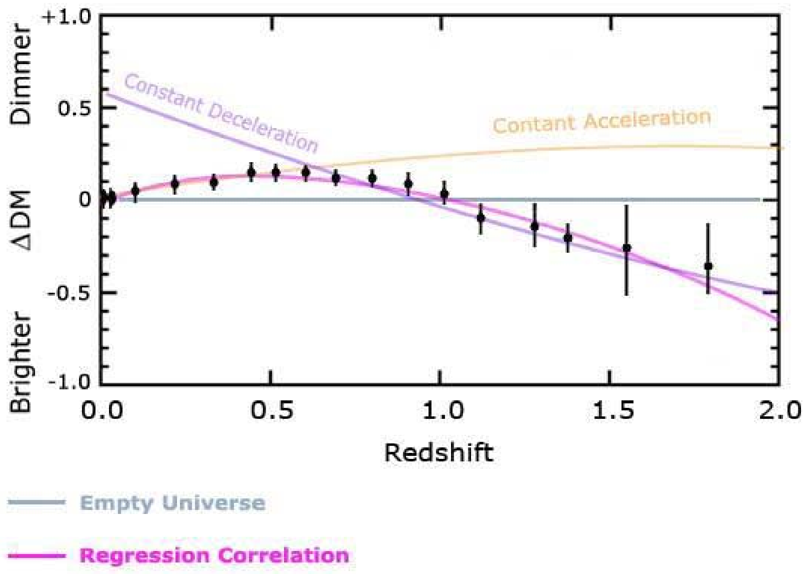
3. Data Reduction of Type 1a Supernovae

The type 1a SNe data used for this study and analysis has been organized into averaged groups of adjacent redshifts called bins. There were over 400 separate type 1a SNe observations used for this study based upon publicly available information (M Kowalski et al., Improved cosmological constraints 2008, 2012). This data was averaged into 17 separate bins. Bin redshift averages were chosen with an effort to evenly space them, leading to averages generally progressing from $z \sim 0.0$, $z \sim 0.01$, $z \sim 0.03$, $z \sim 0.1$, $z \sim 0.2$, $z \sim 0.3$, $z \sim 0.4$, $z \sim 0.5$, and so forth. Adjacent redshifts of type 1a SNe observations were combined at their average redshifts of their peak brightnesses into separate central redshift "bins."

After this, a secondary unconventional averaging between these bins was conducted: Bin #1 is represented by the average of supernova data in this bin only, but bin #2 is an average of bins 1, 2, and 3 averaged together. Bin # 3 is an average of bins 2, 3, and 4 averaged together and so on. Bin #17 (the most distant bin) like bin #1 includes averaged supernova data in this bin range only. As a result of this secondary averaging each separate supernova event is also averaged into adjacent bin(s).

Since type 1a SNe are assumed to be standard candles, the authors of this paper realize that this additional secondary bin averaging additionally smoothes curves and straightens lines by averaging out small brightness differences between supernovas such as possible variations of intrinsic brightnesses, our relative motion within our galaxy, the relative motion of our galaxy, possible human errors influencing the data, etc., but such additional averaging should not disguise telltale non-linear patterns within the data such as those now attributed to dark energy. The Graph, Figure 1, depicts the standard-model graph of supernova with the dark energy interpretation.

Figure 1: Hubble Formula distance-related brightnesses vs. observed redshift



Fg. 1: Dark Energy Interpreted regression lines of type 1a supernovae data

For both Figures 1 and 2, ΔDM designates how much fainter or brighter SNe were than what would be expected in an empty universe model (literally the change (Δ) in Distance Modulus). Redshifts are the increase in wavelengths over what is observed close by. Dimmer is a positive luminosity number and brighter is a negative number. The graphing is of the variation of type 1a supernovae from expected brightnesses as they relate to observed redshift quantities "z".

Figure 1 shows the plottings of type 1a supernovae based upon the standard Hubble formula distance calculations and its implications of dark energy. It does not vary a lot from graphs produced by others using generally the same data (Conley et al., 2011). The primary difference between the looks of this graph and other similar plottings using the same data, relates to a secondary averaging of data which was conducted on this data as explained above – which generally would show less linear variations and somewhat reduce the variance from regression lines and curves. The yellowish regression line represents a constant accelerated expansion of the universe, based upon the dark energy hypotheses. The light lavender regression line indicates constant deceleration of the universe starting accordingly over 13 billion years ago and ending at a redshift of about.5.

(Figure 1 continued). The pinkish colored regression curve represents a best-fit correlation requiring the universe to first decelerate after "Inflation" to a redshift of ~.5, then to accelerate again thereafter to the present day.

This is the general idea of the "Quintessence" version of the dark energy hypothesis, where varying expansion rates of the universe are thought to have taken place for presently unknown reasons. This pinkish line represents the best fit to the observed supernovae data based upon the Hubble formula calculated distances.

4. Comparison of Hubble Calculated Distances (Blue Parabola) With Distances Calculated Using Equations Derived From the Alternative Cosmological Model (Red Line)

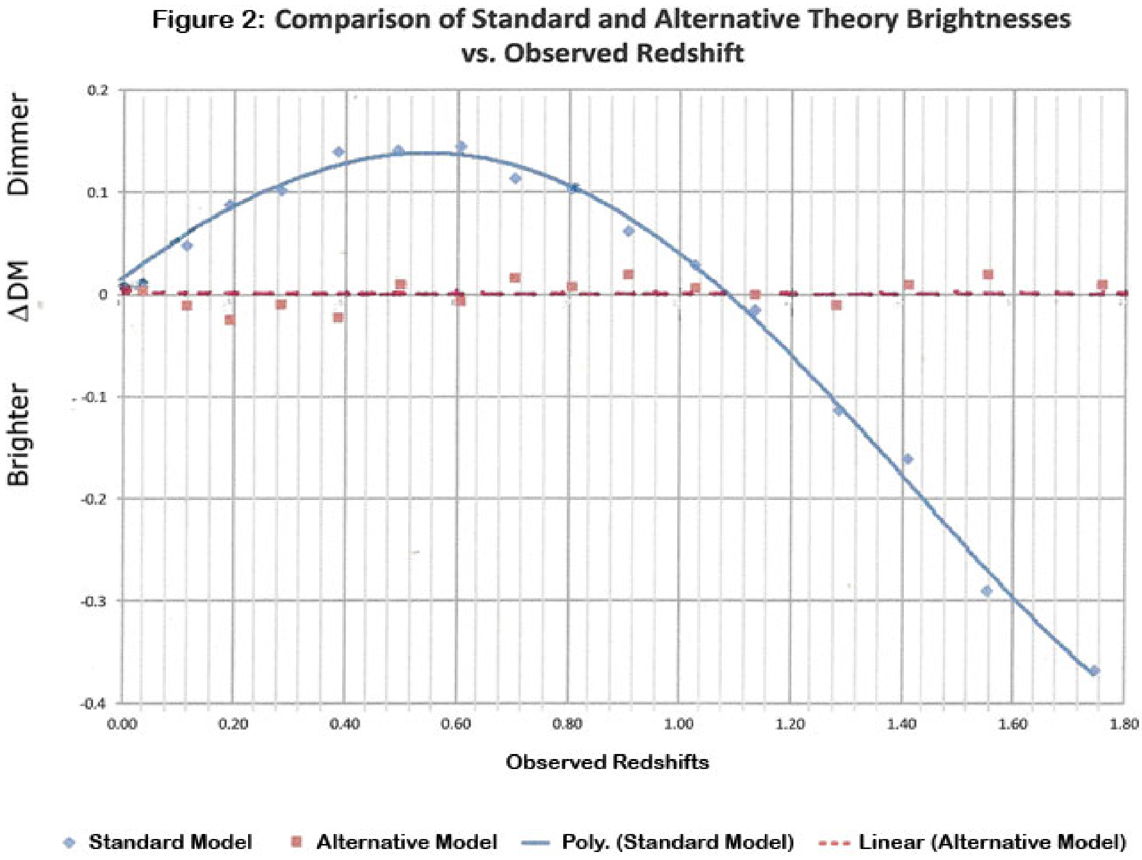


Figure 2.

In Figure 2 the horizontal scale on the bottom represents "redshifts" "z" of type 1a supernovae (where redshifts "z" represent the proportional increase in wavelength, and the entire observed wavelength is equal to (z + 1). The vertical scale on the left-hand side represents *ΔDM* (the change in brightness) in standard luminosity units which indicates how much fainter or brighter the designated SNe was compared to what would be expected in an "empty" (Milne) universe model based on the calculated variation from a perfect fit to luminosity distance represented by the centerline 0.0.

Concerning supernovae brightnesses, those supernova bins above the 0.0 line are designated as positive and were dimmer than what would be expected in an empty universe, and bins below the line are designated as negative and were brighter than what would be expected based upon their Luminosity Distances in an empty universe.

Two different plots of type 1a SN brightness versus their red-shifts are shown in Figure 2 above. Both plots were developed from published supernovae data (Kowalski, M. et al. 2008, 2012).

The plottings produced by the standard Hubble formula are shown in blue and result in a curved parabolic line with its dark-energy interpretation, as is familiar to cosmologists and most astronomers. This "curved-line" plot was used to support the proposal of the accelerated expansion of the universe and the related "dark energy" hypothesis. Calculations and supernova plottings produced by the alternative equations are shown in red. The result is a "straight-line" plot showing type 1a SNe as true standard candles. The alternative cosmological model is based upon a slow but constant decrease in the size of matter going forward in time (rather than the expansion of space), to explain observed galactic redshifts. The rate of this decrease in the size of matter is calculated to be about 2.2% per billion years of time which accordingly totally accounts for cosmic redshifts now attributed to expanding space. Cosmological redshifts in the alternative cosmological model are explained by relatively larger matter in the past creating a relatively longer rate of time and longer wavelengths of E.M. radiation. From either perspective, expanding space or the decreasing size of matter going forward in time, the size of matter relative to space, would decrease over time by the same constant factor.

This alternative plotting, identified as the red binned data bins and red dotted line in Figure 2, is what one would hope for when evaluating standard-candle entities using correct distances without the existence of dark energy. When interpreted by the alternative model, the slopes in the standard model supernova graph (Figure 2, blue) are simply based upon an incorrect distance formulation, the Hubble formula.

The focus of this discussion will be on how the alternative formulations of distance and brightness better explains and properly calculates distances and brightnesses of type 1a SNe observations. It may be more important, however, to realize that these same alternative equations, based upon the subject cosmological model, were formulated to calculate distances and brightnesses of galaxies for all observable cosmic entities including supernovas.

5. Reviewing the Standard Hubble Distance Formula

$$r_H = \frac{v}{H_0} = \frac{\beta c}{H_0} = \left[\frac{(z+1)^2 - 1}{(z+1)^2 + 1}\right]\frac{c}{H_0} \tag{1}$$

The standard Hubble formula shown here as Equation 1, is the basis for the standard model distance calculations shown in Figure 2. The Hubble constant H_0 used for this comparison was 66.3375 km/s/Mpc, which results in a less exaggerated standard model curve and a flatter alternative model line since *ΔDM* brightness determinations were calculated using Hubble-calculated distances, and a somewhat lower cosmological constant produces greater distances and therefore somewhat less variation in the standard model plot from the alternative model. The standard model plot shows that the inflection point in the binned data occurs at a redshift of z ~.5 based upon this plotting (Wikipedia 2013, Accelerating universe); this is often attributed to the Hubble "constant" being considered an average of the universe's expansion rates and asserted to be based upon changes in the force of dark energy.

6. Continuing Explanations of the Alternative Cosmology

"The most accurate way to measure redshifts of cosmic entities is by using spectroscopy." Redshifts are determined by both absorption and emission lines of specific observed elements, then comparing the shifted positions and lengths of the spectra as they relate to laboratory spectra of the same elements (Las Cumbres Observatory, Redshifts, 2012). The alternative cosmological model is a diminution-of-matter model whereby matter very slowly becomes smaller as time progresses.

This model is also a type of steady-state model concerning the observable universe, whereby new matter accordingly is being continuously created and the density of the observable universe remains constant. It is also a model concerning a new concept of relativity in that all aspects of reality, although individually larger in the past, would have had the same relative proportions to matter and therefore past timeframes would have been indistinguishable from the present.

In this paper the explanations of this alternative model primarily relate to how this model better explains type 1a supernovas. There are primarily four observed justifications for this model concerning type 1a supernovae. The first two justifications relate to distances and brightnesses. The combination of the resultant distances and brightnesses have been calculated by alternative equations derived from this model, which seem to be confirmed by observed brightnesses of type 1a supernova without dark energy. The third observed justification relates to the angular sizes observed concerning cosmic redshifted galaxies. Although this does not directly relate to type 1a supernovae, the same distances calculated by the alternative distance equation used for this supernova study also would apply to distances of all cosmic entities. The angular sizes of observed galaxies, concerning the standard model, are considered by many to be an unexplained anomaly of the standard model. The fourth justification concerning observations, relate to a cosmological test concerning the expansion of the universe. This test is called The Tolman surface brightness test, which can be used for all cosmic redshifts and entities.

The Tolman test is based upon the extent of the brightnesses that have been observed based upon distances.

Observations have confirmed those supernovae, galaxies, and all observable cosmic redshifted entities, without additional hypothesis like galaxy evolution or dark energy, fail this fundamental test concerning the expansion of the universe, without the inclusion of additional hypotheses concerning the evolution of the entities being observed. This hypothetical evolution requires observed cosmic entities to have been different in the past from the same entities today. All of the above statements are thought to be totally justified by evidence presented herein, and by other papers referenced in this study. Besides the four types of observations which appear to throw much evidentiary support for the alternative cosmology; other justifications are also mentioned.

6.1 Explaining the Alternative-Model Details Related to This Study

The alternative cosmological model proposes that matter becomes smaller in size but proportionally greater in quantity as time progresses. In the past there would have been accordingly fewer individual units of matter than there is now, but over time the density of matter in space would remain the same; as these individual units halve in size, they double in their numbers. These matter units in the future will accordingly be smaller but there will be more of them. For this reason this model is also a type of steady-state model.

If this diminution-of-matter model is correct, what would the red-shift of galaxies whose atoms in the past were exactly twice the size of present-day matter? Take a galaxy equivalent to the Milky Way in every respect, at some epoch in the past; it accordingly would have been twice as voluminous. To us observing it at a redshift of $z = 1.5874$, it would appear twice as massive as the Milky Way is now as explained in detail below. Due to proportionality in that time frame, this theoretical galaxy would have been only Milky Way-sized in every way as far as the past epoch and time frame was concerned, having the same relative characteristics as the Milky Way in every respect.

Since atoms can be simply modeled as spheres, the relationship between a spherical atom's volume V and diameter d is shown in Equation 2 below:

$$d = 2 \cdot \sqrt[3]{\frac{3}{4\pi}V} \tag{2}$$

If $V = 1$ in Equation 2, $d = 1.2407$. If $V = 2$ in Equation 2, $d = 1.5632$. Arranging this into a ratio to represent the reversed diminution of matter, it is shown below in Equation 3 that the diameter of atoms in this past galaxy would have been $2^{1/3}$ (~1.26) times larger in diameter.

$$\frac{d_2}{d_1} = \frac{2 \cdot \sqrt[3]{\frac{3}{4\pi}V_2}}{2 \cdot \sqrt[3]{\frac{3}{4\pi}V_1}} = \frac{\sqrt[3]{\frac{3}{4\pi}2}}{\sqrt[3]{\frac{3}{4\pi}1}} = \sqrt[3]{\frac{2}{1}} = \sqrt[3]{2} \approx 1.2599 \tag{3}$$

In this model, the wavelength and amplitude of emitted electromagnetic (EM) radiation is dependent upon the diameter of the atoms emitting it. Therefore, E.M. radiation emitted in the past would have had longer (red-shifted) wavelengths and amplitudes more intense (brighter) by this same factor. Similarly, horizontal distances and velocities relative to the observer would appear to be greater and velocities faster by the same factor of $2^{1/3}$ at an observed wavelength of $z + 1 \sim 1.5874$. The square root of this wavelength is also ~1.2599, which again is $2^{1/3}$, where $2^{2/3} \sim 1.5874$, and $2^{3/3}$ (2^1) = 2.

A "doubling period" in this alternative model is defined as a time interval when looking backward in time, where the diameter of matter would have been 1.2599 ($2^{1/3}$) times its present diameter and twice its present "size" (volume). For three doubling periods past, for instance, matter would have been twice its present diameter and eight times its present volume.

The perceived recession velocity of distant objects would, according to this model, be directly proportional to the change in the relative size of matter and its proportionality to the measurement of space and its associated velocities. Space is accordingly measured in terms of the size of matter. Standard "rulers" in the past would have been made of bigger atoms and thus past rulers would have been bigger than the same "rulers" today. Standard distances and "space itself" would now be measured as having been larger in the past since measuring "rulers" of space then were also comparatively larger (meters, light years, for instance). Therefore, size relativity over time is based on two factors: one factor would be associated with our perception looking backward in time, regarding the apparent increased size of matter and space, and the other equal factor is related to the difference in the measurement of time now and time in the past.

Since these factors are equal one can calculate the quantity of either factor by taking the square root of the observed red-shifted wavelength. Conversely, the red-shift parameter can be found by squaring either factor as shown below in Equation 4:

$$z + 1 = f_{space\_size} f_{matter\_size} = \left(2^{1/3}\right)\left(2^{1/3}\right) = \left(2^{1/3}\right)^2 = 2^{2/3} \approx 1.5874 \tag{4}$$

According to this model, the combination of these factors concerning the changing sizes of matter, space, and the length of time, collectively explain presently observed red-shifts and brightnesses, and this can be extended using the same factors concerning velocities. Velocities are defined as distances traveled per unit time. As the distances would have been measured as being relatively larger, time would also have been of a relatively longer duration by the same factor, so the distance traveled per unit of time would still have been the same for a constant velocity (such as the speed of light). Because of this, the speed of light would appear to have been faster by this same factor in the past when compared to today's measuring sticks of distances and time.

6.2 The Alternative Cosmology: The Theoretical Basis for Formulating its Equations

The limit to the distances to galaxies and their ages in the observable universe, according to the alternative model, is solely based upon the capabilities of telescopes rather than the distances and ages allowed by the Hubble formula since the universe accordingly would be vastly larger and probably countless times older than what the Big Bang model proposes.

The equations of the subject cosmological model have no limit concerning the calculable distances and ages of galaxies unlike the BB model, although feasible limits of observation equipment and methods can be estimated concerning the limits of their capabilities.

The alternative-model equations that have been presented in this paper are based upon the theoretical principles of the proposed cosmological model, the foundation principle being that matter was relatively larger in the past and slowly gets smaller as time progresses. This accordingly explains the observed cosmic redshifts. With these principles in mind various possibilities were tested against type 1a supernova data until the resultant equations were able to predict observation data. Accordingly all dimensions, measurements, speeds, and time, are accordingly related to, and can be derived from the dimensional changes in the size of matter over time. Constant ratios, like the speed of light, and other primary ratios considered "constants of nature", would accordingly have been measured as having the same values in past time frames as we measure them today.

Hopefully these alternative-model equations will eventually be tested by astronomers and theorists concerning a wide variety of divergent cosmic observations and related data, to criticize, verify, propose changes, identify problems, etc, concerning the equations and underlying theory proposed herein. Most believe that consistency with an underlying "comprehensive" theory should be a primary consideration to justify any new or amended equations in theoretical physics. .

7. Explaining the Derivation of the Alternative Model Distance, Luminosity, and Time Equations

The alternative model's distance, brightness, and time equations are primarily based upon a single foundation factor which is the square root of observed redshifted wavelengths $(1 + z)^{.5}$. The distances and brightnesses calculated by these formulas are, at the greatest distances, much greater than those calculated using the Hubble formula to calculate distances and the inverse square law of light for brightness calculations.

Wavelengths of E.M. radiation are defined as the length between successive crests of a wave. The observed redshifted wavelengths of cosmic entities are accordingly comprised of two equal factors:

One factor creating redshifts would be that matter would appear to have been larger in the past. Larger matter dimensionally would accordingly have produced proportionally longer wavelengths of E.M. radiation for all frequencies.

Distances and space within past time frames would appear to have been larger because smaller yardsticks today would measure greater distances in the past. According to the subject model all ratios would remain constant over time, such as the speed of light for instance. Since velocities are distances traveled per unit of time they are ratios. These velocity ratios can be mathematically represented in the alternative cosmology as $d/t = d_1/ t_1 = d\,(1 +z)^{.5} / t\,(1 +z)^{.5}$, where d and t are distances and time respectively today, and d_1 and t_1 are distances and time in a prior timeframe.

The second equal factor would therefore be time which accordingly measures the rate of changes of matter within timeframes.

Separately each factor of distance and time is equal to the square root of the observed redshift.

7.1 Deriving the Time-Period Equation

We will derive an alternative-model time equation that determines intervals of change which we can call "time periods," and "timeframes" for a particular point in time within a time period. This formula is based upon the "doubling periods," described by Equations 2, 3, and 4, determined by the relative changes in the size/measurement of matter and space over time.

The time function, Equation 5, equates modern time with the change in the size of matter over a calculated time interval, where whole numbers represent a complete time period, and decimals a fraction thereof, also seen in

Table 1. The 9.966 factor in the formula is a constant which when multiplied by the $\log_{10}$ scale, converts redshift quantities into time interval doubling periods starting from zero, as explained previously concerning Equation 4.

$$t = 9.966 \log_{10}[(z+1)^{.5}] \tag{5}$$

The square root of the redshifted wavelength factor is converted into a $\log_{10}$ factor to start time from zero, where zero would represent the present timeframe. All time intervals are positive numbers involving time intervals when looking backward in time. The result is a backward-in-time calculating equation which can equate past time periods with the changing size of matter over time.

The larger the number the farther back in time is being represented. The scale is then adjusted by a constant selected to organize time periods into even integers based upon integers being at doubling periods of matter, as was explained in Equations 3, 4, and 5. A timeframe then would simply be any past point in time.

7.2 Deriving the "Apparent-Luminosity" Provisional Equation

Relatively "larger matter" dimensionally in the past would have produced larger, brighter stars, and brighter stellar explosions (supernovae), yet in their own timeframes they would have appeared exactly the same as close by supernovae appear to us today.

Based upon matter being larger in the past, supernova and consequently brightnesses would also appear to have been brighter in the past requiring a "brightness-enhancement function", Equation 6, to be used in conjunction with a compatible distance formulation.

$$\Delta L = \log_{10}[[[((z+1)^{.5t} - 1)).5t + 1](z+1)^{2.512}] \tag{6}$$

Explaining Equation 6:

The innermost $(z + 1)^{.5}$ term (the foundation factor) is related to the constant rate of matter diminution observed as redshifted wavelengths, where matter, space, and the speed of light, by today's measuring standards, would appear to have been greater in size and magnitude in distant timeframes. This foundation factor of this equation is based upon the speed-of-light being faster by half the redshift quantity.

The foundation factor is then raised to the power of t, resulting in $(z + 1).^{5t}$, to take into account the increased size of matter and brightnesses of supernovae progressively looking backward in time, described in Equation 5. For example, after 3 doubling periods backward in time matter would have been eight times larger in diameter and eight times brighter (2^3). This would convert the square root factor $(z + 1)^{.5}$ into $(z + 1)^{.5t}$, where t = 3. With the distant observation now "corrected" into our present size-scale, the modified wavelength term then has one subtracted from it (-1) so that only a modified redshift factor remains rather than the whole modified square root of the wavelength.

This factor is next divided by two to establish an average between the present and past time frames since the speed of light, based upon its measurement, has been changing over its travels proportional to the observed redshift as described above. After this the remaining factor is multiplied times "t". When looking at the derivation of time, Equation 5, it can been seen that the time period integers calculated by this formula are a proportional analog to the square root of the redshift factor so that by multiplying the results by time would be the same as multiplying it by the square root of the wavelength, then taking the $\log_{10}$ factor to start brightnesses from zero. The constant 9.966 was calculated to delineate time doubling periods into intervals of time.

The result would be two factors based upon the square root of the observed wavelength. The first factor relates to the change in the speed of light over time, and the second factor "t" relates to the perceived changing size of space over time. After combining these two factors together by multiplication, one (1) is then added to the results. This is because the increasing-brightness factor must start at one rather than at zero.

Such an increasing brightness factor could be any number starting from one (1), but not a number less than 1 since that would result in the product that would reduce brightnesses.

Finally the results are then converted to luminosity in the conventional way by taking the observed wavelength factor to a base-10 logarithm, then multiplying the results by 2.512 (wikipedia, Surface brightness, 2013), or as shown in equation 6, by taking the wavelength factor to the power of 2.512 and then taking the $\log_{10}$ of that, yielding the same results.

7.3 Deriving the "Apparent-Distance" Provisional Equation

The interim distance equation is used for all calculations concerning brightnesses in this study. Although this is not the complete equation its calculations relating to brightnesses are the same as for the completed equation when used in conjunction with the final brightness equation. Similarly, the "interim distance equation", shown below as Equation 7, is derived thus: starting, as usual, with the square root of the observed wavelength.

The basis of the modifying factors of this distance equation is also the speed-of-light from the source to the observer. In this alternative model the speed-of-light was relatively faster in the past by a factor equivalent to the square root of the observed wavelength. The change in the speed of light factor $(z + 1)^{.5}$ is the foundation factor for this interim distance equation. For a given time period (time of travel), a faster speed of light would represent a greater distance.

Since accordingly the relative speed of light changes over time, the speed of light between the source and the observer would therefore be the average speed of light between the time of its emission and the speed of light now (a lesser speed relatively speaking).

One is added to the other then divided by two. For example: $[(z + 1)^{.5} +1]/ 2$; note this is the same as $.5 [(z + 1)^{.5} – 1] +1$. This is turned into a log factor providing proportional distribution of data while enabling calculated distances to start from zero parsecs rather than one. The constant 21.1695 is multiplied times the logarithm as a fitting factor based on the estimated rate of matter diminution (in particular, it meets the requirements of Equations 3 and 4 above at the doubling periods).

Finally, factor P_0 is functionally equivalent to Hubble's constant in that it relates wavelength quantitatively to distance quantities (which in this case is a constant of 1958.0), determined and calculated by the supernova data , distances herein given in kilo parsecs.

$$r_{alt} = 21.1695 \times \log_{10}(.5[(z+1)^{.5} - 1] + 1) \cdot P_0 \tag{7}$$

(where P_0 = 1958. Kpc)

Of course the P_0 factor 1958.0 could be combined with the 21.2946 factor to become a single factor of 41,694.83 designated as P_1.. The last factor is the constant P_0. Based upon the brightness of the supernova data this constant was calculated to be 1,958.0 mega parsecs. Since this constant applies over the entire distance range, it appears to be very accurate since a small variation in its accuracy would become apparent over the full range of supernova charting concerning a variation of brightness inconsistent with supernova data.

In a similar way, the constant factor could be determined as a ratio concerning the changing speed of light and the proposed rate of matter diminution. It also could be directly equated to the Hubble constant based upon supernova observations; if so the constant could be equated with a Hubble constant of about 66 km/sec/Mpc, where instead matter would be getting smaller rather than the universe expanding.

This equation produces alternative distances that can be directly compared to the conventional Hubble equation-produced distances. This comparison is then converted to an expected change in brightness, as shown below in Equation 8, where the ratio of the distances is squared based upon the inverse square law of light concerning changing distances, which is applicable in this case. The results are then converted into lumens in the conventional manner.

$$\Delta B_1 = \log_{10}([(\frac{r_{alt}}{r_H})^2]^{2.512}) \tag{8}$$

Finally, the alternative ΔDM values are found for plotting the redline plottings of Equation 7, which takes the given observed ΔDM values (now referred to as ΔDM_H to indicate that they are the result of the calculations by the Hubble formula (shown in Figures 1 and 2) and separate them from the concept of ΔDM in general, and changes them by the "corrected" brightness factor and difference found in Equation 9.

$$\Delta DM_{alt} = \Delta DM_H - \Delta B_2 \tag{9}$$

When comparing the alternative to the conventional model graph at this point, there is no indication in the alternative model, Figure 2 red line, of the accelerated and decelerated expansion of the universe suggested by the conventional curved plot shown in blue in the same Figure. The alternative model red straight-line graphing instead strongly suggests no "expansion" of the universe; instead redshifts are explained in the alternative model by the diminution of matter.

Thus, it is posited that a much simpler explanation than the deceleration and acceleration of a constantly-expanding universe would be that the standard Hubble distance formula and calculations are simply wrong.

The present interpretation of type 1a supernova data by cosmologists is the reason why the dark energy hypothesis was proposed in the first place. Dark energy has been included in the Big Bang model—now called the Lambda Cold Dark Matter, or Concordance Model—which is presently thought to be the simplest explanation that is in general agreement with observed supernovae data.

However the calculations of the alternative model result in a good fit with the observed luminosity data of type 1a supernova, based upon a flat non-expanding Euclidean universe. It seems apparent that the results produced by the alternative cosmological model with its calculations and resultant plottings, provide a far simpler explanation since its results require the universe to do nothing "special:"

The brightnesses/luminosities designated for supernovas as ΔDM are/were determined by the observing astronomers primarily based upon two factors.

One factor is the inverse square law of light based upon related measuring devices and calculations, called luminosity distances, and the other factor is the reduction of luminosity based upon increased wavelengths resulting from redshifted EM radiation, which is a dimming inverse relationship equal to $1/(1 + z)$.

The extent of this decreased luminosity is not theoretical. It has been tested and confirmed in laboratories and has generally by known for more than a century. As the wavelength of EM radiation increases the energy of the radiation decreases by this same inverse relationship.

Up to this point we have only included within the distance and brightness equations about 1/3 the magnitude of the entire equation factors independent of the constants. The reason why the entire equations were not used in the graphing calculations of Figures 1 and 2 is that only the factors shown in Equations 6 and 7 vary from the inverse square law of light and therefore would show up as variations of brightnesses in this study, which is the basis for the supernova Figures/charts above. The additional factors, explained below, do not show up in observational astronomy because the increased brightnesses produced by larger and brighter matter in the past accordingly would be equally compensated for by equally increased distances, but greatly reduced angular sizes of large galaxies cannot be disguised.

If the additional factors were included in the above calculations the resultant variations of brightnesses would accordingly have been exactly the same. So if these factors of the distance and brightness equations are missing, how could we know of their need or existence and to determine their magnitude other than by the observed angular size?

Based upon Equations (2), (3), and (4), the alternative cosmological model states that type 1a supernovas at a wavelength of 1.5874, for example, were twice as energetic because the exploding star itself would have accordingly been twice as large dimensionally. However brightnesses could be calculated using either the distance and brightness combinations of Equations 6 & 7, or the combination of Equations 10 and 11 shown below, with both combinations of equations yielding the same brightness results. But separately or combined equations 6 & 7 cannot calculate distances, angular sizes, etc., since they were only formulated for their combined use to make brightness calculations easier.

The model itself explains redshifts by the increased size of matter in the past. Increased brightnesses accompany increased size but increased distances would hide increased brightnesses concerning the primary added equation factors shown below.

7.4 Adding a Final and Primary Factor to Both the Distance and Brightness Equations

Additional factors are needed for the final distance and brightness equations. This factor is an additional square root of the observed wavelength $(1 + z)^{.5}$. This additional factor will be added to both Equations 6 and 7.

These addendum factors have not been used or discussed as yet in any past derivations of type 1a supernova. These equations must be combined to determine brightnesses but these added factors to both equations do not effect brightness variations in supernovae, galaxies, or other cosmic entities since increased distances are compensated for by equally increased brightnesses. So these additional factors are not needed for brightness studies like this study where brightness variations are the primary considerations relating to distances.

Instead these added factors result in increased angular sizes for galaxies with redshift values less than.5, and decreased angular sizes for redshifts greater than this amount (Martin Lopez-Corredoira, 2010; Alexander Unzicker, 2010).

7.4.1 Deriving the Final Distance Equation

The additional distance factor is: $(z + 1)^{.5}$, where the entire distance equation becomes

$$21.2946 \log_{10}[.5((z+1)^{.5}-1)+1](z+1)^{.5})P_0 \tag{10}$$

The primary factor in the distance equation was explained as being **$(1 + z)^{.5}$**, determined by the relatively changing speed of light, as explained in 7.3. The final factor shown in Equation 10 is also the square root of the observed wavelength. This second factor is based upon the increased relative size of matter in the past as it relates to distances. Using smaller yardsticks today we would measure distances in the past to have been relatively larger, as explained in Equations 3 and 4.

This new factor is greater than the primary factor by an increase in magnitude of half the observed redshift..

7.4.2 Deriving the Final Brightness Equation

For the **brightness equation** the additional factor is also **$(z + 1)^{.5}$**. This factor is squared to determine increased brightnesses based upon the increased area of the observed entity, in this case supernovas. It is a numerator factor in the equation since accordingly increased sizes dimensionally produce brighter observations. This squaring is based upon the increased area of the observed cosmic entity produced by a larger diameter/ radius i.e. r^2 when looking backward in time. This progressively increasing factor when squared results in an 2D surface area factor equivalent to the observed wavelength **$(z + 1)$**, where the entire equation then becomes:

$$\log_{10}[[[((z+1)^{.5t}-1)).5t+1](z+1)^{2.512}] \tag{11}$$

or its equivalent**:**

$$2.512Log_{10}[[((z+1)^{.5}t-1)).5t+1](z+1)]$$

Neither of these complete equations was needed or used for this study to determine brightnesses but of brightnesses determined by the combination of these equations would be the same as Equations 8 and 9. Both addendum factors are needed however to determine any and all cosmic distances and to determine angular sizes of cosmic entities based upon cosmic redshifts

Although the increased brightnesses resulting from these additional factors are hidden in the results by equally increased distances, the angular sizes of the cosmological entities being observed cannot be hidden, as has been discussed. Besides the evidentiary support of this supernova study for the alternative model and its equations with its resultant straight-line plotting, these "hidden factors" are also strong evidentiary support for the alternative cosmological model and maybe the simplest explanation for the presently anomalous observation angles/ angular sizes of galaxies being observed.

In a Euclidean static universe as in the proposed model, angular size vs. redshift dependence should be evident as a direct relationship. Using the Hubble formula to calculate distances, this relationship instead is proportional to z^{-1}, in inverse relationship, which should be a primary indicator of the grossly under-calculated distances by the Hubble formula at the highest redshifts. According to the alternative model distances are greater for all supernovae, galaxies and other cosmic entities.

Besides being much farther away and brighter at the farthest distances, this model also predicts that distant galaxies, based upon present distance and brightness calculations, will appear to be smaller and more condensed (angular sizes), and often appear to be more massive than they really were in their own time frames (increased brightnesses).

This cosmological model also predicts that average galaxy appearances, sizes, and types were the same in the past as they appear to us close by and therefore the universe would be much older. The model would assert that we are both lost in space and lost in time, but accordingly past time would not be infinite.

The three chart-forming equations calculate Time, Distance, and Brightness; all of these equations have their basis in the square root of the observed wavelength: $(1 + z)^{.5}$.

Application: According to the alternative model for instance, distances at a redshift of $z = 10$, calculated by the alternative model, are 10 times greater than what the Hubble formula would calculate. The age of the universe accordingly would be many times greater than the Hubble model calculations.

These calculations of the observed angular sizes of galaxies are confirmation of the alternative model calculated

distances if no universal galaxy evolution over time exists. This is a huge difference between the two models and their calculations. For distances within the range of the observed type 1a supernova data, distances are about 2.4 times greater using the alternative distance formula than distances calculated by the Hubble formula, but this difference is also very significant.

8. Other Equations of This Alternative Model

According to the Standard-Model time dilation formula, time dilation is calculated using the formula $(1 + z)$ t. For instance at a redshift where $z = 1$, (with wavelength of ($z + 1 = 2$)), a supernova observation event would accordingly last exactly twice as long.

For the alternative cosmological model the time dilation equation is somewhat different from the equation used by the standard model.

First, time in the past accordingly would have been based upon the square root of the observed redshift $(z + 1)^{.5}$ as would be the size of matter and distances as per Equation 4.

In the case of time, however, it would be observed as a slower rate in the past by a factor of $1/(z + 1)^{.5}$ in that velocity is distance traveled per unit of time. In this way the speed of light and all related velocities would remain a constant ratio in that the distance traveled would be considered greater, but the length of time would be measured to have been equally longer.

The alternative model equation for time dilation is:

$$t' = f(z) = \left(\left(\frac{z}{2}\right) + 1)(z + 1)^{.5} t \qquad (12)$$

8.1 Explaining the Alternative Time Dilation Formula:

where (t') is the extent of the expected time duration/ dilation concerning type 1a supernova and other cosmic events, and (t) is the timing of the same event today based upon standard time. All type 1a supernova events with the same redshifts should all last about the same amount of time.

This alternative time dilation formula may be the easiest way to evaluate the alternative cosmological model because there would be a slight but observable difference between the length of time dilation of a type 1a supernova events calculated based upon the standard model and the alternative model which should be observably significant, especially for the most distant type 1a supernovae. The first factor of this derivation is

($z / 2 + 1$). This is a half-redshift factor based upon the change in the speed of light. A decreasing rate of time, when looking backwards in time, would be a prediction of the alternative cosmological model. A longer observable time period following a type 1a supernova explosion, we call time dilation.

The second factor in the equation is the square root of the observed wavelengths. This factor is accordingly based upon our perspective of greater measured distances and the increased size of space in past timeframes.

It should be noted that this time dilation equation would also apply to any other possible cosmic observations and events that would last a constant period of time in the present. This difference between the two equations can be seen in table 1, column a. the standard formula, and column b. the alternative-cosmology formula.

Table 1.

Comparing the larger calculated factors of the alternative cosmology with the standard model calculations concerning**:** time dilation, distances, angular size, and luminosities, within the entire range of wavelengths/ redshifts

	a. Wavelengths (z +1) of averaged binned data ("z" value is the redshift alone) Also conventional time dilation formula t' =(z +1) t	b. Time dilation formula t' = ((z / 2) +1)(z + 1). 5 t Equation 4.1 alternative model time dilation formula	c. The Change in distance factor, D, Also 1/ D Change in angular size factor, $\sim D^{-1}$	d. Complete brightness Enhancement, in Lumens (Equation 11)
Bin #	(z +1)	Type 1a supernovae and all cosmic entities		
1)	1.0109	1.0109	1.0079^{-1}	-.01184
2)	1.0333	1.0335	1.0223^{-1}	-.03584
3)	1.1127	1.1143	1.0741^{-1}	-.11809
4)	1.1903	1.1948	1.1273^{-1}	-.19689
5)	1.2819	1.2918	1.1925^{-1}	-.29094
6)	1.3840	1.4023	1.2684^{-1}	-.40004
7)	1.4917	1.5216	1.3529^{-1}	-.52304
8)	1.6046	1.6496	1.4413^{-1}	-.65884
9)	1.7021	1.7626	1.5212^{-1}	-.78463
10)	1.8046	1.8838	1.6074^{-1}	-.92403
11)	1.9058	2.0058	1.6941^{-1}	-1.0680
12)	2.0258	2.1533	1.7989^{-1}	-1.2454
13)	2.1335	2.2884	1.8947^{-1}	-1.4182
14)	2.2850	2.4520	2.0320^{-1}	-1.6456
15)	2.4088	2.6453	2.1456^{-1}	-1.8409
16)	2.5515	2.8365	2.2780^{-1}	-2.0666
17)	2.6791	3.0110	2.3981^{-1}	-2.2967
Wavelengths (z +1) "z" beyond type 1a SNe				
2.0	3.0000	3.4641	2.7039^{-1}	-.2.5027
3.0	4.0000	5.0000	3.6800^{-1}	-.3.7637
4.0	5.0000	6.7082	4.6676^{-1}	-.5.1140
5.0	6.0000	8.5732	5.6516^{-1}	-6.2512
6.0	7.0000	10.583	6.1164^{-1}	-7.2185
7.0	8.0000	12.728	7.5871^{-1}	-7.9952
8.0	9.0000	15.000	8.5344^{-1}	-.8.7631
9.0	10.0000	17.393	9.4677^{-1}	-9.5209
10.0	11.0000	19.900	10.3870^{-1}	-10.223

Column "a." is the observed redshifted wavelengths which also represents the time dilation factor of the standard model. Column "b." is the calculated time dilation factor for the alternative model. Comparing the two it can be seen that at the farthest type 1a supernova observations to date, the length of the event should last about 12% longer in time. Column "c." is a factor which represents how much greater in distance the alternative model calculates than the Hubble formula. Its inverse is the calculation of what should accordingly be observed concerning the angular size of galaxies. Column "d." represents the calculated change in brightness for all cosmic entities (*negative means brighter*), primarily galaxies. For example for bin #17, an increased factor of -2.2967 would calculate to about 8.2 times brighter.

Table 2.

Comparing Hubble-calculated distances with the Provisional and Final alternative distance calculations including predicted angular size calculations.

Wavelengths (z +1) of averaged binned data (“z” value is the redshift alone)		a. Distances calculated by Hubble formula, where Hubble constant = 66.34 km/sec/Mpc Megaparsecs (Mpc)	b. Alternative distances calculated by Provisional Equation # 8 Mpc	c. Alternative distances calculated, by Final Equation #10 w/ additional factor (z + 1). 5 Mpc	d. Columns c/a, <u>change in distance factor</u>, and a/c <u>Change in angular size factor</u> or c/a^{-1}
Bin #	redshift				
1)	1.0109	49.07	49.14	49.41*	1.0079^{-1}
2)	1.0333	148.13	148.90	151.36*	1.0223^{-1}
3)	1.1127	481.23	489.88	516.75*	1.0741^{-1}
4)	1.1903	779.94	805.79	879.12*	1.1273^{-1}
5)	1.2819	1,100.42	1,159.12	1,312.36*	1.1925^{-1}
6)	1.3840	1,420.10	1,530.86	1,800.95*	1.2684^{-1}
7)	1.4917	1,717.98	1,900.75	2,321.49*	1.3529^{-1}
8)	1.6046	1,992.10	2,266.92	2,871.57*	1.4413^{-1}
9)	1.7021	2,201.47	2,567.32	3,349.44*	1.5212^{-1}
10)	1.8046	2,397.52	2,868.93	3,853.99*	1.6074^{-1}
11)	1.9058	2,569.78	3,153.77	4,353.80*	1.6941^{-1}
12)	2.0258	2,750.15	3,476.43	4,948.03*	1.7989^{-1}
13)	2.1335	2,893.20	3,753.36	5,482.35*	1.8947^{-1}
14)	2.2850	3,068.51	4,124.62	6,234.87*	2.0320^{-1}
15)	2.4088	3,192.71	4,413.64	6,850.10*	2.1456^{-1}
16)	2.5515	3,317.97	4,732.31	7,559.12*	2.2780^{-1}
17)	2.6791	3,469.44	5,005.31	8,192.67*	2.3981^{-1}
Wavelengths (z +1)		(z=)			
2.00	3.0000	3,617.86	5,647.92	9,782.48*	2.7039^{-1}
3.00	4.0000	3,990.29	7,342.08	14,684.16*	3.6800^{-1}
4.00	5.0000	4,174.46	8,713.69	19,484.40*	4.6676^{-1}
5.00	6.0000	4,277.88	9,870.18	24,176.91*	5.6516^{-1}
6.00	7.0000	4,341.44	10,872.20	28,765.14*	6.1164^{-1}
7.00	8.0000	4,383.18	11,757.52	33,255.28*	7.5871^{-1}
8.00	9.0000	4,412.03	12,551.37	37,654.11*	8.5344^{-1}
9.00	10.0000	4,432.78	13,271.48	41,968.11*	9.4677^{-1}
10.00	11.0000	4,448.19	14,533.84	46,203.28*	10.3870^{-1}

Table 2: Column “a.” contains distances calculated by the standard Hubble formula. Column “b.” contains calculated distances based upon the alternative model Provisional Equation 8. This equation is the basis for distances calculated for the subject supernova study. Column “c.” is the complete distance equation. The additional factor $(z + 1)^{.5}$ is equally compensated for by the final brightness equation so this factor does not show up as a change in brightnesses, but it shows up as a large decreased angular size of galaxies and other large observable cosmic entities. Column “d.” is an indication of how much greater the calculated distances differ from the Hubble formula. Its inverse indicates how much smaller the angular size appears to be based upon Hubble calculated distances, but this size is directly proportional to calculations of the alternative model.

Table 3.

Comparing both alternative model brightnesses factors, separately and combined, based upon a changing time scale. These factors are combined with the inverse square law of E.M. radiation concerning luminosity.

Wavelengths (z +1) of averaged binned data (“z” value is the redshift alone, one less than the value shown below.)		a. Time Scale (also as a Distance & Brightness factor) Equation #5	b. Provisional Brightness Equation #6	c. Final brightness factor included; (z +1) Added to Equation 6	d. Entire brightness Enhancement equation of the alternative cosmologic model (Equation 11)
1)	1.0109	.023480	.00000	-.01184	-.01184
2)	1.0333	070937	-.00009	-.03575	-.03584
3)	1.1127	.23115	-.00156	-.11653	-.11809
4)	1.1903	.37699	-.00684	-.19005	-.19689
5)	1.2819	.53736	-.02004	-.27090	-.29094
6)	1.3840	.70331	-.04549	-.35455	-.40004
7)	1.4917	.87046	-.08674	-.43630	-.52304
8)	1.6046	1.02328	-.14298	-.51586	-.65884
9)	1.7021	1.15096	-.20441	-.58022	-.78463
10)	1.8046	1.27755	-.27998	-.64405	-.92403
11)	1.9058	1.39563	-.36444	-.70358	-1.0680
12)	2.0258	1.52767	-.47522	-.77015	-1.2454
13)	2.1335	1.63983	-.58289	-.82668	-1.4182
14)	2.2850	1.78830	-.74405	-.90153	-1.6456
15)	2.4088	1.90249	-.88178	-.95909	-1.8409
16)	2.5515	2.02698	-1.0447	-1.02185	-2.0666
17)	2.6791	2.18519	-1.1947	-1.10198	-2.2967
		“z” (redshifts)			
2.000	3.0000	2.37743	-1.4007	-1.10198	-.25027
3.000	4.0000	3.00000	-2.5652	-1.19853	-.37637
4.000	5.0000	3.48288	-3.6016	-1.51237	-.51140
5.000	6.0000	3.87743	-4.4954	-1.75581	-62512
6.000	7.0000	4.21102	-5.2638	-1.95472	-.72185
7.000	8.0000	4.49998	-5.9787	-2.01651	-.79952
8.000	9.0000	4.75487	-6.6402	-2.12289	-.87631
9.000	10.0000	4.98287	-7.2523	-2.26856	-.95209
10.000	11.0000	5.18913	-7.8261	-2.39706	-10.223

Table 3: Column “a” shows bin numbers and at the bottom, redshifts beyond distances where type 1a supernovas have been observed. Time periods in column “a” are regressive (progressively looking backward in time) and are based upon “doubling periods” concerning the size of matter in the past. See Equations 2, 3, 4, 5, & 6 and related explanations. For example: at a redshift of 10, time frame 5.18913, matter would have been ~3.17 larger in diameter (the square root of z + 1), which in this case is the square root of 11. In column “b.” shows the progression of increased brightness based upon redshifts and directly proportional distances calculated by the alternative model. Column “c.” shows the brightness addendum as a result of the addendum factor. This would not show up in either conventional or the alternative model concerning brightnesses. This is because in the standard model unobserved distances due to compensating brightnesses would be unobservable except by the decreased angular size of cosmic entities, Column “d.”

Note: For standard astronomy calculations the brightness adjustment factor is simply the inverse square law of light, where the alternative cosmological model proposes an additional brightness addendum factor which is needed to explain the brightness/ luminosity of observations.

9. Further Discussion

This discussion has focused on type 1a supernovae because there are strong reasons to believe that they are the standard candles that have long been sought after to provide valid distance indicators to distant galaxies. The distance and brightness equations of the alternative-model presented herein support this belief and therefore would apply to all cosmic entities. The distance equation supported by the supernova data might be described as a linear "Hubble law" directly proportional to the observed redshift, as first noted by Hubble when he recognized the proportional relationship between galactic redshifts and distances.

This distance equation and its linear relationship proportional to observed wavelengths, is based upon a theory of matter diminution. Matter slowly getting smaller over time would generally appear the same as galaxies moving away from us and each other. Differences between the alternative equations and the Hubble formula result from the proposition that matter, distances, and the speed of light, would appear to have been greater in the past. At the greatest distances, the observable universe would accordingly also be many times older than the Big Bang model could allow. The universe would accordingly be both Euclidean and static with galaxies aging in cycles while new galaxies would be continuously forming.

9.1 Blue Shifted Galaxies as They Relate to the Subject Cosmological Model:

It is generally unknown that there have been thousands of observed blue shifted galaxies (Vanderlass, 2009)

(SNP Gupta, 2013)**.** These are galaxies presently moving toward us as explained similarly by both the standard and the alternative cosmological models. Thousands of galaxies slightly redshifted, thousands generally neutral having no redshifts, and also thousands of slightly Blueshifted galaxies have been observed in the local Virgo supercluster which we are a part of. Doppler shifting related to relative motion, is the simplest explanation of these observations. Blue shifting can be produced in front of our relative motion and redshifting of galaxies behind our relative motion.

First to be considered regarding relative motions is the orbital velocity of the Earth around the sun, next the orbital velocity of our solar system around our galaxy, next the orbital motion of our galaxy within our Local Group, and then the local group orbits within the Virgo supercluster. It has been asserted, although still controversial, that the group of local superclusters, including our Virgo supercluster, is moving at a great velocity relative to the micro-wave background and the over-all distant background of galaxies. This has been dubbed the "Dark Flow," which is supposedly toward a "Great Attractor". That would be only a part of the overall relative motions involved for calculations. Most other galaxies would also have similar relative motions by orbiting within their local groups, within their supercluster, and could have even greater orbital or linear motions like the dark flow at an even grander scale, relative to the overall background of galaxies.

This is probably the primary reason why that within our Local Group and our local supercluster Virgo, redshifts are not reliable indicators of galactic distances. This is also why other distance indicators are used to determine distances of entities within our supercluster. These distance measurement methods are collectively called The Distance Ladder. Within the local Virgo Supercluster all relative motions could cancel out each other since they are additive. Relative motions including all of our own, plus those of observed galaxies, have produced thousands of blue-shifted galaxies from our perspective. The largest Blueshifted galaxies have been found to be some of the closest in our Local Group and supercluster. Several thousand slightly blue-shifted galaxies have been observed overall, primarily within our Virgo supercluster. The closest large galaxy Andromeda is the most well-known blue-shifted galaxy from our perspective.

In any non-expanding-universe cosmological model, like the subject model the Pan Theory (Noble, 2012), the appearance of Blue-shifted galaxies would be expectedly more prevalent. Only at distances and timeframes beyond our supercluster could the increased size of matter with longer wavelengths, accordingly overcome relative motions that would otherwise produce equal quantities of redshifting and blueshifting.

In both models, whether expanding space or matter getting smaller, additional gravity would seem to be needed to hold solar systems, galaxies, galaxy groups and superclusters, together to enable them to maintain their observed forms for a long period of time – or to have formed in the first place. This is where a different theory of gravity might better explain observed reality.

9.2 Reference to Dark Matter

Brief mention: The subject cosmological model proposes that dark matter does not exist. It instead proposes an alternative theory of gravity, generally something like MOND gravity (Wikipedia, Modified Newtonian dynamics, 2012), but with what is believed to be a strong theoretical basis. Additional refinement concerning the final determinations of equations concerning values of constants and balancing variables has not been finally determined. A study with adequate stellar, galaxy and cluster-motion data will be needed by the authors to further refine these preliminary equations.

Note: Readers may still have unanswered questions regarding the subject cosmological model that were discussed in this study. For these questions contact the authors through the noted reference e-mail address herein, concerning corrections, questions, etc. as noted below in “Responses.”

For all questions concerning the alternative cosmological model which may or may not be directly related to this study, such as dark matter mentioned above, readers could also look for answers at the related website the Pan Theory (Noble, 2012) or contact the authors through the e-mail address given herein, anytime following the publication of this paper.

10. Summary of Reasons Why This Paper and the Alternative Cosmological Model and Equations Should Seriously Be Considered and Evaluated:

1) Type 1a supernovae observations: The primary reason for this consideration might be that the consensus of cosmologists, including the authors, considers type 1a supernovas as standard candles of cosmic distances. Because of their brightnesses nearly all agree, including the authors, that supernovas closer than a redshift of (z =.5) are farther away than what the Hubble formula calculates (Wikipedia, Accelerated Expansion, 2013). The authors believe that an inaccurate Hubble formula along with a non-expanding universe model, is a far better explanation than the universe having to first accelerate its expansion superluminally (Inflation), then to decelerate this expansion, then again to accelerate expansion again (dark energy) during a timeframe at a distance determined by a redshift of z ~.5.

Conclusion 1. An incorrect distance formula seems far more likely than the universe having to perform multiple tasks explained by proposing an additional unknown, unobserved new force like dark energy.

2) Observation angels: The observed angular sizes of galaxies are considered an anomaly in standard cosmology as discussed in detail above. The observed angular sizes of galaxies are off by many factors of magnitude and for this require an ad hoc hypothesis of galaxy evolution to explain galaxies being much more condensed in the past.. The alternative model herein exactly fits the observed angular sizes of galaxies predicted for normal galaxy evolution.

Conclusion 2. A model of the universe where the model’s equations easily explain the observed angular sizes of galaxies seems far more likely than a universe requiring a number of ad hoc hypothesis (unexpected based upon theory) such as dark energy, dark matter, and others such as the seemingly ad hoc galaxy evolutionary processes required to explain the Tolman test.

3) The Tolman Test: The Tolman surface brightness test, was conceived in the 1930 by Richard Tolman to compare cosmological models.

The Tolman test compares the surface brightness of galaxies as they relate to redshifts (designated as z), to determine as to whether the universe is expanding or not. The initial results of the studies of those initial times seemed contrary to an expanding universe.

The logic goes like this: In a simple flat, static universe, light intensity drops inversely with the square of the distance from its source. The apparent area of the object also drops inversely with the square of the distance from the source.

“In an expanding universe, however, there are two (additional) effects that reduce the power detected coming from distant objects. First, the rate at which photons are received is reduced because each photon has to travel a little farther than the one before. Second, the energy of each photon observed is reduced by the redshift. At the same time, distant objects appear larger than they really are because the photons observed were emitted at a time when the object was closer. Adding (all) these effects together, the surface brightness in a simple expanding universe (flat geometry and uniform expansion over the range of redshifts observed) should decrease with the fourth power of (1+z), 1/ (1 + z) 4” (Wikipedia, Tollman signal, 2001).

Also according to the Big Bang model the universes’ density should have steadily decreased over time based upon the expansion of space. No consensus opinions concerning broad-scale observations or studies have been made regarding the density of galaxies per volume, for any timeframe in the past, having been greater than in the present except by inferences of the Big Bang model.

The additional factor, energy being reduced by redshifts, would be the same for both the standard model and the proposed alternative model, so the primary differences between these models would be the decreased brightnesses produced from an expanding universe based upon the standard model.

"To date, the best investigation of the relationship between surface brightness and redshift was carried out using the 10m Keck telescope to measure nearly a thousand galaxies" redshifts and the 2.4m Hubble Space Telescope to measure those galaxies' surface brightness.

The exponent found (was) not 4 as expected in the simplest expanding (universe) model, but (instead was) 2.6 (to) 3.4, depending on the frequency band (being evaluated)**"** (parenthesis added) (Wikipedia, Tollman signal, 2001).

In a non- expanding universe like the alternative model, the Tolman Test would reduce to simply the inverse square law of light, luminosity distance, plus the decrease in brightness due to the decreased frequency of E.M. radiation without a forth power exponent. This would result in a constant brightness ratio of $1/(1+z)^3$.

Based upon observations and distances calculated by the Hubble formula, brightness ratios begin at about $z \sim 1/(1+z)^3$ for the closest supernovae. Brightnesses then decrease to their dimmest extent of $\sim 1/(1+z)^{3.4}$ at a redshift of $\sim z = .5$; then brightnesses increase again to a ratio of $1/(1+z)^{2.6}$ at the farthest observed redshifts of type 1a supernova concerning the data used/ available in this study. This was at a redshift of $z \sim 1.679$ (a wavelength of 2.679). Beyond this redshifts according to predictions of the alternative model concerning Hubble calculated distances and brightnesses concerning all types of supernovae, should progressively and steadily increase in their brightnesses based upon Hubble formula calculations, to the edge of the observable universe, as this ratio would continue to decrease. This would not be the case if distances were much greater than the Hubble formula would calculate such as distances and brightnesses determined by the alternative equations.

The Tolman Test, based upon the alternative model equations, would seem to indicate a static, non-expanding universe. The same test using the Big Bang model with the Hubble formula, does not meet the requirements of the Tolman Test. To explain the results of this test, ad hoc galaxy evolutionary hypothesis such as those proposed by Bruzual & Charlot (Wikipedia, 2001; Tolman Signal, 2001) are thought to be needed to explain these unexpected brightnesses of galaxies at the greatest distances. For supernovas additional hypothesis concerning supernovae evolution have been proposed to explain the unexpected brightnesses observed concerning the most distant cosmic entities (Foley et al., 2008).

Conclusion 3. A cosmological model that passes cosmological tests concerning theory and observation, is more likely to be valid than one that fails the same tests unless additional untestable ad hoc hypothesis are added. This may be the case concerning the Tolman test contradicting an expanding universe, or the case for Hubble calculated distances being contradicted by the inverse square law of light concerning cosmic entities, unless the dark energy hypothesis is added for justification.

11. General Conclusions and Applications

This paper presents a study of type 1a supernovae data comparing the standard Hubble distance formula and Luminosity Distances (Wikipedia, Luminosity Distance, 2013) with an alternative cosmological model with its own equations. The result of the alternative equations seems to effectively explain the observed brightness-versus-distance trend of type 1a supernovae based upon a linear, "static" universe model as represented by a very good standard candle line. According to the analyses herein the reason why dark energy was postulated in the first place was seemingly because of the miscalculation of distances by the Hubble formula. The alternative model and its equations, on the other hand, indicate no need for the theoretical complications of the accelerated and/or decelerated expansion of the universe and dark energy. The alternative cosmological model proposes that the observable universe is not expanding, that space itself does not expand or warp. It proposes that the most distant entities, galaxies, quasars, and supernovae, currently observable having wavelengths of roughly $z = 1.5$ or greater, are at distances much greater than the present Hubble formula could allow.

The alternative cosmological model presented here is called the ***Pan Theory,*** the details of which include answers to many "why" and "how" questions, proposed tests of the model, its implications and predictions. All can be found at the related website (Noble, Pan Theory cosmology, 2012). For example such a question and extended answers relate to why matter accordingly becomes smaller over time.

The plots and tabulated data (included Figures) comparing the alternative model to the conventional one, are the result of a best-fit analysis by the authors after extended study. Based on the alternative cosmological model concerning the diminution of matter and proceeding from that "first principle," the subject equations were derived. It should be noted that the alternative equations in this paper contradict the Big Bang model and cannot be derived from its premises.

11.1 Applications/Implications:

Those who wish to try out these proposed alternative-model distance and luminosity, or time dilation equations on real observations, Equations 10, 11, and 12 respectively, may also find solutions to other problems in cosmology. One such problem that has been discussed herein is the anomalous angular sizes concerning cosmic redshifted entities, primarily galaxies and quasars (Lopez Cordera, 2010) (Unzicker; 2010). Many astronomers have noted that the observation angles of galaxies are generally inversely proportional to their observed redshifts based upon Hubble calculated distances. To explain these anomalies some mainstream theorists have proposed that galaxies collectively underwent a vast unpredicted universe-scale evolution (B. Epinat, P. Amram, et al., strong dynamical evolution, 2009).

Correctly determined/calculated distances could also solve other perceived cosmological problems such as why distant cosmological entities such as quasars seem to be so bright but their brightness variations are not time-dilated, unlike the EM radiation resulting from supernova explosions.

It is hoped that others will try to recreate the subject study and analyses of type 1a supernovas based upon the same data set, an improved or updated data set, and the subject cosmological model to justifiably criticize, correct, confirm, or add improvements to these conclusions.

The distance and brightness equations offered provide an explanation for observed angular sizes of cosmic entities (Lopez-Cordera, 2010; Unzicker; 2010) without requiring cosmic evolution, using one of the simplest possible cosmological models of a Euclidean non-expanding universe, with explanations consistent with observed redshifts. It is further hoped that this alternative interpretation, if confirmed, will solve the problem of dark energy by showing it to be a construct of a sub-optimal cosmological model akin to adding epicycles in geocentric theory.

Responses:

Please contact the author Forrest Noble at pantheory.org@gmail.com. He will be very happy to answer any questions, consider corrections, and comments. If you are interested in testing these equations, if you have new insights or need additional insights into this alternative cosmological model and equations, the authors are willing to discuss this.

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Not dark matter or MOND
A simpler alternative

By Forrest Noble & Timothy Cooper

Abstract: This paper proposes a different explanation for spiral galaxy rotation curves, the rotation rates of galaxies in a cluster, and the observed extent of gravitational lensing caused by occulting galaxies and clusters, without dark matter or the changing strength of gravity.

The related study involves a number of alternative explanations to dark matter including MOND gravity and other gravity-changing proposals. The focus of this paper is on an alternative explanation involving a pushing gravity model called Pan Gravity (Noble). It is asserted to be a simpler alternative to dark matter or the changing strength of gravity, to explain all venues where dark matter is presently believed to dominate.

As to spiral galaxy rotation curves and the Pan Gravity model, this paper explains the theoretical basis for its equation(s) which is based upon proposed currents and vortices of the Zero Point Field in both the macro and micro worlds, and asserts that the realization of these currents will provide a much better understanding of the natural world. The study concludes that the Pan Gravity model, when calculating spiral galaxy rotation curves, much more closely matches observations than do standard model rotation curves of spiral galaxies, which are based upon roughly 6 times more hypothetical dark matter than observable matter.

This study concludes that from an over-all perspective dark matter can be considered an overkill of added mass to galaxies and to the universe primarily because it requires a vast majority of all matter to be hypothetical. This hypothetical addendum is also many times the mass of what is needed for the alternative explanation, the Pan Gravity model, which is instead based upon vortex currents of the Zero Point Field.

Dark matter and its proposed characteristics:

What is the justification for dark matter? General Relativity is highly regarded as the correct model of gravity. For General Relativity to make accurate predictions in all venues the existence of vast quantities of unobservable matter is thought to be the only explanation consistent with observed spiral galaxy rotation curves, the rotation rates of galaxies in a cluster, and the angular extent of gravitational lensing.

Spiral galaxy rotation curves have been observed to be generally “flat,” meaning that spiral galaxy disc stars have similar velocities regardless of their distances from the galactic bulge. The primary hypothetical candidate to account for this is dark matter of some type. The prevailing Big Bang model asserts that more than 80% of the matter within a galaxy, and within the universe, is unobservable non-baryonic matter.

According to the hypothesis dark matter neither absorbs nor radiates EM radiation at any observable wavelength. Many would agree that proposing an unobserved particle to explain these observations would not necessarily be a drastic proposal, but what could be considered drastic is that this unobserved particle(s) must make up about 84.5% of all the matter in the universe to be consistent with General Relativity. The question then becomes, is there one or more reasonable alternative that is less drastic and therefore more likely?

If not dark matter, then what?

The above is one of the main questions that this paper proposes to answer. A number of different theories/ hypothesis have been proposed to explain observed stellar velocities in spiral galaxies without the need for dark matter. Most of these hypotheses propose the increased strength of gravity or different gravitational mechanics, depending upon the surroundings, rather than proposing vast quantities of unseen matter. The most well-known of these hypotheses is called MOND gravity (MOdified Newtonian Dynamics). MOND was proposed in 1983 by Mordehai Milgrom, an Israeli Physicist. Milgrom proposed the increased strength of gravity at galactic scales to explain the much greater observed stellar velocities in spiral galaxies. In 2004 Jacob Bekenstein, a Mexican-Israeli theoretical physicist, developed the first complete relativistic gravity formulation with MONDian strength and behavior, called TeVeS. Another proposal has been Scalar-tensor-vector gravity (STVG) also proposing stronger gravity to explain the anomalous rotation curves of spiral galaxies.

Still another proposal is called Metric Skew Tensor Gravity (MSTG) proposed by John Moffat. This model proposes the additional gravity tensor influences caused by electro-magnetism. Magnetic influences are known to exist in spiral galaxies concerning the orbital momentum of ions in the form of plasma, and other magnetic influences relating to the rotation of the central black hole and surrounding volumes, but such influences are presently thought to be too small to directly explain the additional velocities of spiral galaxy disc stars by any means.

MOND and most gravity-changing hypothesis propose that if the strength of gravity at galactic scales were stronger, then the additional gravitational strength could accordingly allow a star to maintain a much greater velocity and its relative position within the galactic disc without flying off. Most theorists presently believe that known proposals that change the strength or mechanics of gravity depending on the scale, do not have strong theoretical justification to support their hypothetical math (theoretical physics).

Gravity as a pressure differential acceleration of a background field causing a uniform pushing force upon all matter

The meaning of the word “field” in the Pan Gravity model is a volume of non-matter particulates, thousands, or millions of times smaller than electrons, which collectively could be called an aether or similar type wording. This field would be physical and observable as Zero Point Energy or the Zero Point Field, comprised primarily of unknown mass-less particules with unknown characteristics. Such fields accordingly could be thought of as operating under the laws of, or similar to, fluid and vortex dynamics having internal kinetic pressure differences causing field flows and vortices like an atmosphere.

The Pan Gravity Model

The alternative gravity model presented herein as an alternative to dark matter is called Pan Gravity. This model proposes that not only matter determines stellar velocities in the discs of spiral galaxies, but that there are additional flow mechanics involving vortex energies of the Zero Point Field (ZPF). It is proposed that both gravity and vortex mechanics accordingly control and explain the observed stellar velocities in spiral galaxies.

This model proposes differential pressure flows of the ZPF. For spiral galaxies these flows would be in the form of cylindrical storm-like vortices flowing from higher pressure volumes above and below the galactic plane, flowing toward lower pressure volumes within the galaxy. These flows would progressively decrease in pressure and velocity from outside the galaxy, inwardly toward progressively decreasing field pressures to the galactic core which would be the center of the vortices, similar to the eye of a hurricane.

Separate from vortex mechanics and field flows, the Pan Gravity model is a pushing gravity model involving the Zero Point Field. Pushing gravity models have been proposed since Newton’s time. The first noted model was proposed by Nicolas Fatio in the late 1600’s, Le Sage in the mid 1700’s, and has continued with theorists such as George-Louis, Cramer, Redeker, Preston, Van Flandern, Harp, and many other mechanical models of gravity continuously being proposed to the present day. (wikipedia, pushing gravity)

Newton himself proposed a ‘pushing gravity’ model in his second edition of *Optics* (1717). Unlike his first pulling-force explanation, Newton proposed a mechanical pushing aether explanation of gravity whereby the aether would get progressively thinner (less dense) when approaching massive bodies.

In letters to both Henry Olderburg and Robert Boyle, Newton proposed the following: [Gravity is the result of] “a condensation causing a flow of aether with a corresponding thinning of the aether density associated with the increased velocity of flow.”
“He (Newton) also asserted that such a process was consistent with all his other work and Kepler's Laws of Motion. Newtons' idea of a pressure drop associated with increased velocity of flow was mathematically formalized as Bernoulli’s principle published in Daniel Bernoulli's book *Hydrodynamica* in 1738.” (Wikipedia, gravity, mechanical explanations, Streams, Newton)

A similar explanation given here for gravity is based upon the accelerating flow of the Zero Point Field (ZPF) inward into all matter.

The cause of gravity according to the Pan Gravity model

All atomic matter radiates EM radiation which accordingly is an outflow of pressure waves travelling at the speed of light, moving away from all matter lowering the pressure of the Zero Point Field surrounding all matter. As a whole these physical energy waves (EM radiation and De Broglie waves) produced by matter would add to the animation and kinetic pressures of the external ZPF. Other contributors to ZPF field energy and pressure would be the interaction of virtual particles, high-energy cosmic ray particles, high-speed neutrinos, influences of stellar black holes and neutron stars, the jets of galactic black holes, supernovae explosions, etc. All are observable entities which can accordingly increase the energy of the Zero Point Field.

Like a very large mixing bowl, where an egg beater reduces the liquid level surrounding the egg beater(s) when in operation, the smoother backflow of the liquid back toward the egg beater would be an analogy to the inflow of gravity, compensating for the outgoing radiated pressure waves and the resultant continuous reduction of field pressure surrounding matter.

This relationship is accordingly based upon the amount of EM radiation radiated away from a spiral galaxy, the galaxy’s mass, its stellar density per volume, and the average age of its stars. The absolute brightness of a spiral galaxy is accordingly the source of the low pressure field vortex that develops, its strength, and the basis for the Tully-Fisher relationship discussed in detail in this paper. Besides the spiral appearance of a galaxy, the next best indicator of an existing vortex is the generally flat plane of the galactic disc.

Gravity Mechanics, space and time:

Matter acts like a damper by its absorption of field vectors and flows so that matter within gravitational range of each other will be pushed together by stronger surrounding *vector forces and field flows pushing inward toward lower pressure volumes. These stronger inward vectors and flows in the direction of their mutual center of mass would result in the effect which we call gravity.*

The vector absorption by matter is called the shadow effect in pushing gravity models, where the absorption of kinetic field animation results in lower field pressures likened to the blocking of light which casts shadows.

Like General Relativity, vortex mechanics would result in the non-linear motion of matter in its interaction with gravity, but unlike General Relativity, in this model space cannot, and does not expand, bend, warp, or do anything at all.

Space would accordingly be one of the simplest of all concepts, defined in this model simply as**:** *the distances between matter and the volume which collectively encompasses both matter and field.* By this definition space is not synonymous with the Zero Point Field; instead space is the vacuous volume which encompasses the Zero Point Field. *Time is an interval of change involving motion within space.* Spacetime is a concept necessary for the equations of General Relativity and a better understanding of reality. *Spacetime can be defined as a designated point or volume of space at a designated time.* Space, time, and gravity can have no separate existence from matter.

We can observe this background field in the lab as Zero Point Energy, also called the Zero Point Field, and that the energy of its forces and flows push matter together as explained above. The known particulates within it we call virtual particles because of their very short longevity.

There have been many proposals of hypothetical particles within this field such as gravitons, Higgs particles, dark matter, etc. Experimental evidence for the existence of this field as an energy source is well-known.

At galactic scales, at the scale of galaxy clusters, and at the largest scales of the universe, the force of gravity intermingles with vortex flows involving both linear and non-linear currents

“Disks of spiral galaxies are similar in appearance to hurricanes and whirlpools.” “The disks of spiral galaxies rotate somewhat like a hurricane or whirlpool.” Similar quotes come from many sources including educational and observational. (HubbleSite 2015).

The vortex forces and mechanics, as proposed, greatly increase the proper motion of matter within the discs of spiral galaxies. The strongest forces and velocities are at the edges of the vortex analogous to wind forces on the outskirts of a hurricane. Above and below the plane of the galaxy a three dimensional, generally cylindrical vortex of field material of the Zero Point Field extends above and below the plane of the galaxy, spiraling upward, downward, and inward from higher pressure volumes of the outer vortex and galaxy, toward lower pressure central volumes of the galactic core, which can be likened to the eye of a hurricane. These changes in field pressure relate to the distribution of matter within the spiral disc, which progressively increases in density inward toward the galactic bulge and core.

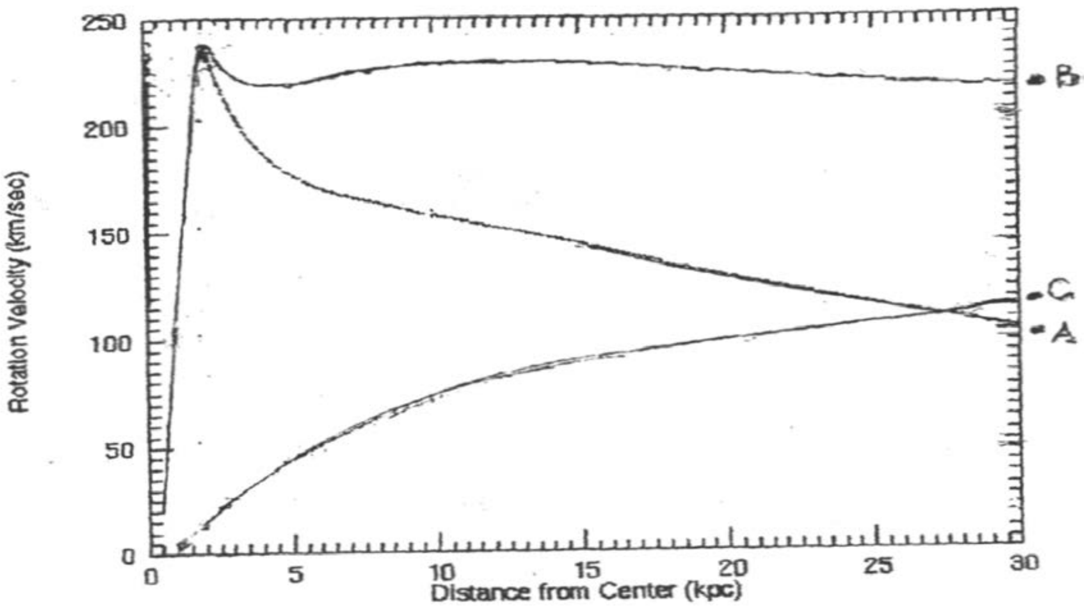
Although the proper motion of most stars within a spiral galaxy disc may reach speeds of hundreds of kilometers per second, compared to the galaxy's size, its rotation velocity from a human perspective of time moves more like the speed of a glacier than like the speed of a hurricane's wind.

Stars and other matter within a spiral galaxy disc will also be influenced by the orbiting vortex currents of the ZPF rather than just the linear influences of gravity. Velocities of matter would be far greater than just the influences of Newtonian or Einsteinian gravity alone. This also does not preclude lesser vortex influences of spiral galaxy bulges which may have gone undetected to date.

Modeling spiral galaxy rotation curves and the universe based upon the Pan Gravity Model

Models of spiral galaxies are averaged velocities of their disc stars and hydrogen clouds which are at the same distances from the galactic center. For this model we will also consider orbital velocities of the visible spiral galaxy as being two dimensional since the thickness of discs are usually thin compared to the diameter of the galaxy. Some spiral galaxies also have twist characteristics to their forms which also will not be considered in our discussion for simplification purposes.

Figure #1



<u>Above, line B, is the observed Curve of the velocities of the Milky Way disc stars</u>

Figure 1: From the beginning of the distance axis, far left, the velocities of stars steeply increase as can be seen by the almost vertical rise of line B above, until the beginning of line A. Line B as a whole is the actual observed rotation curve of Milky Way galaxy disc stars and gas clouds based upon observations. This rotation curve is similar to other galaxies that have a so-called flat rotation curve as represented by most of line B which is generally horizontal. Line A represents the predicted rotation curve of the outer stars of the Milky Way and similar galaxies based upon Newton, Keplerian gravity (no difference also for General Relativity). Line C can be calculated based upon the increase in the velocities of Line B (observed velocities) over line A, the calculated Newtonian velocities, or otherwise determined by formulation and mass distribution.

Line C is the vortex velocity profile. It is like the profile of a hurricane in that the speed of the vortex progressively increases from being dormant in its center, to the outer edges where its speeds would be at their greatest. On the galactic plane this would be inside from the galactic core, to the outermost galactic disc.

According to the theory being presented, if the background vortex rotation curve for the disc stars of any Spiral Galaxy, line C for the Milky Way, were subtracted from the entire stellar rotation curve, line B, then a perfect Newtonian gravity profile, Line A, would result. Stellar momentum would therefore only be related to gravitational influences and would be much less than the proper motion.

This model does not deny the possibility of additional large quantities of presently unknown quantities of baryonic matter to contribute to spiral galaxy rotation curves, but unseen baryonic matter alone concerning the quantities of dark matter needed, seems like an unlikely possibility to explain observed rotation curves

Like dark matter, vortices are not visible excepting by the spiral pattern of the galaxy. How they are formed, their strength and size relate to the size of the galaxy, its form, the distribution of its matter, and usually interactions with a large number of surrounding galactic vortices, of the group of galaxies, of the cluster, etc. For this reason some galaxies will have rotation profiles quite different from what their size and form might indicate by themselves. Also for this reason modeling of galaxies and their rotation curves in some cases will necessarily be very inaccurate. The difficulty in modeling some spiral galaxies and the accuracy of modeling others based upon alternative gravity models can be seen in the examples of Moffat et. al.. (Moffat, Galaxy Rotation Curves….). Once vortices are realized as a major component of galactic motions and of the universe, methods and equations can be developed to estimate their locations and strengths and the related field flows, which will enable a better modeling of the universe at all scales.

Major consequences would be that Einstein's field equations being the presently accepted mathematical model of the universe, would need to be changed or replaced based upon major flows and vortex influences of the Zero Point Field besides the changing mechanics of gravity discussed. As to the universe, entropy would have little meaning concerning any steady-state universe model, especially one proposing a non-expanding universe where gravity creates new order in the form of stars and galaxies, in a recycling of disbursed intergalactic matter.

Newtonian formula for Orbital Velocities

The orbital diameter and velocity of a star varies in its path around the center of a galaxy. This is because bounded orbits, where the gravity of a central body dominates, are generally elliptical in nature. The standard formula for the velocity of stars in orbit within a spiral galaxy is approximated by circular orbits, since a special case for elliptical orbits is a circular orbit. Circular stellar orbital velocities, when modeled, are the average of changing velocities of their elliptical orbits.

The standard Newtonian formula to calculate velocities is shown below.

Equation #1

$$v = \sqrt{\frac{GM}{r}}$$

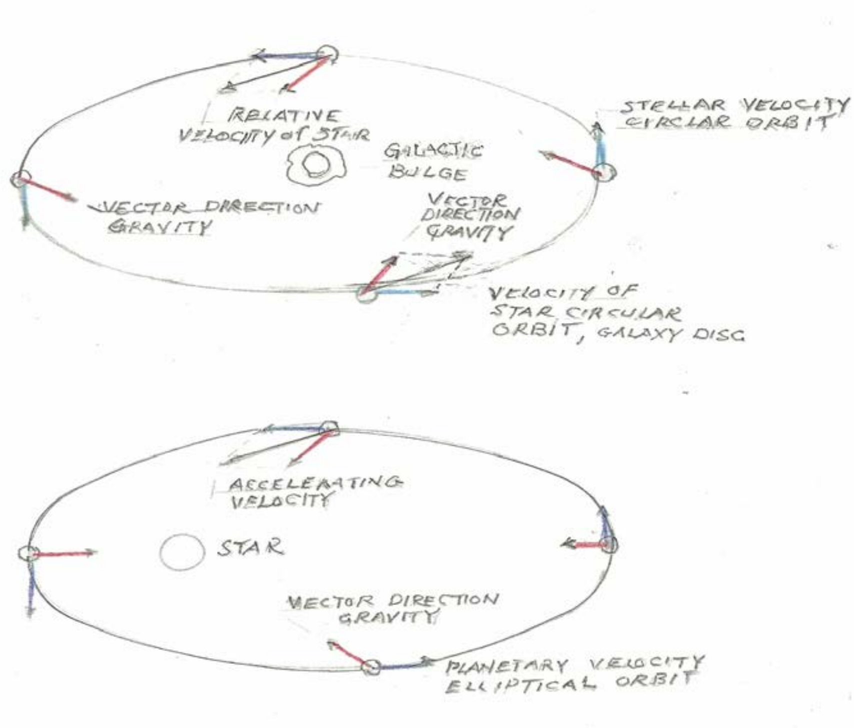
Where v is the velocity of a star, G is the gravitational constant which is equal to
$6.673\,84 \times 10^{-11}$ $m^3/(kg \cdot s^2)$. The mass M in kilograms is the mass inside the galactic orbital diameter of the star or other matter being considered, and ignores all matter outside this radius and diameter as in Newton's Shell Theorem (Shell Theorem). 'r' is the distance of the star from the center of the galaxy in meters, and 's' represents seconds in the G constant enumeration.

Once the average orbital velocity of a star by its location within the galaxy is calculated, then its escape velocity can be calculated by multiplying its velocity by the square root of 2.

The observed velocities of stars in the discs of spiral galaxies (their proper motion) are too great to be contained by the observed amount of mass inside the orbit of these stars unless the mass of the galaxy was much greater as in the dark matter hypothesis, or the forces of gravity are much greater as in MOND gravity, or other forces are involved such as in the subject model of spiral galaxies where vortex energies are involved.

Vortex mechanics of spiral discs according to the Pan Theory

Figure #2



Directly above is shown a planetary elliptical orbit based upon Newtonian gravity. As the planet passes closest to its star, the strength of gravity and the planet's velocity are at their greatest. When the planet is at its farthest distance from its star gravity is at its weakest and the planet's velocity is also at its minimum. In an elliptical orbit the velocity of the planet accelerates when going toward the star and decelerates when it is going away from the star. The direction of the force of gravity at this scale is generally a centripetal force directed toward the center of the star – in the absence of other gravitational influences.

In the top diagram, on the other hand, is a model of a spiral galaxy with a galactic core near its center. The analysis of this diagram will be based upon Pan Gravity model. Notice that the vector forces of gravity are not angled toward the center of the galaxy but are instead angled between the direction of the center of the gravity and the direction of the motion of the vortex. According to this model the added vector forces adding to the velocity of the stars and clouds of matter are based upon the velocity of the background vortex funneling inward concerning two equal vectors. One vector is tangent to the stellar orbit and the other equal vector is directed toward the lowest pressure volume of the galactic bulge.

The velocity of the vortex would progressively decrease at a relatively constant rate from the outside of the galaxy and vortex, inward and downward toward the center of the galaxy.

Density Wave Theory (a mainstream theory)**:** According to this mainstream theory the spiral pattern of a galaxy is a density wave rotating through the galaxy at a fixed angular speed, called the pattern speed. This pattern speed moves at a slower velocity than the stars and other matter of the galaxy. (Wiki, Density Wave)

The Pan Gravity model generally agrees with this density wave proposal. But additionally it proposes that the pattern speed is generally the same as the vortex speed, absent the gravitational influences of matter.

What is vortex energy?

According to the Pan Gravity model the proposed vortex influences do not impart a force of gravity on matter. Instead a galactic vortex has much in common with light which is bent by gravity. According to this model light involves density and pressure waves in the background field moving away from its sources at the speed of light. Like EM radiation, vortex energy is a field flow involving a field density and pressure differential, it is mass-less, and like light it bends by orbiting the galaxy under the influence of gravity.

Since stellar velocities are directly proportional to the mass of the galaxy, to have a relatively flat rotation curve as has been observed concerning spiral galaxies, would require more than 6 times the mass than what can be observed, if distributed according to the distribution of galactic matter, based upon the inverse square law of gravity and the dark matter hypothesis. But instead if the addendum matter, or its equivalent, were distributed in the opposite manner, more on the outside of the galaxy and progressively decreasing inward toward the galactic bulge, then only roughly twice the additional quantity of matter would be needed than what is observed to explain a flat rotation curve.

In the case of vortex energy, it accordingly would have a mass equivalence in spiral galaxies similar to the observable mass but would be separately calculated. For this vortex model no dark matter is needed, nor is a change in the force of gravity needed, only the flow of a background field, the known Zero Point Field.

Equation #2 $\quad \mathcal{V}_1 = (G\,(M+E_M)/\,r)^{.5}$

Rather than equation 1, $\mathcal{V}_1 = (GM\,/\,r)^{.5}$, equation 2 instead would be used to calculate stellar rotation velocities of spiral galaxies as explained below**:**

Instead of the observable mass alone of a spiral galaxy being considered as in Equation #1, the observable mass would be increased by the variable E_M which adds the additional mass equivalence of the vortex energy to the Newtonian equation. This application would be similar to adding some dark matter to equation 1, but the big advantage would be that the addendum mass equivalence of the vortex energy would be roughly only 1/6th the dark matter needed based upon the dark matter hypothesis. This is because this energy would be more abundant on the outside of the galaxy and would progressively decrease inward toward the galactic bulge, where this addendum would become inconsequential. This is the opposite of the dark matter proposal and is thought to be exactly what is needed to very closely model spiral galaxy rotation curves compared to the vast quantities of dark matter needed to produce a smooth rotation curve which varies considerably from measured velocities.

The Tully-Fisher relationship:

Equation # 3 $\quad L \propto \mathcal{V}^4$

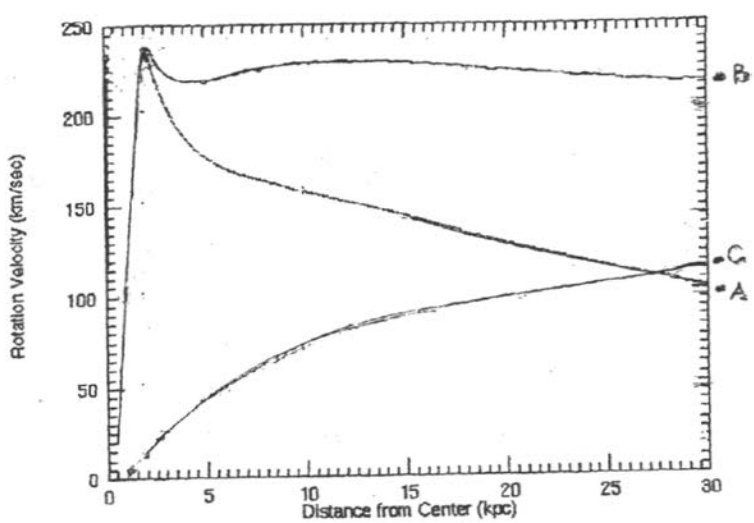
The Tully Fisher relationship proposes that a spiral galaxy's intrinsic luminosity is proportional to the forth power of the greatest velocity of its observable orbiting stars as formulated above. The range is from the power of 3.2 for the largest galaxies, to about 4.0 for the smaller ones, with mid-sized spiral galaxy power factors somewhere in between. The Milky Way power factor would be approximately 3.5 depending upon the reference source.

Explaining the Tully-Fisher relationship, Equation 3 above:
The Tully-Fisher relationship "works if the surface brightness times the mass-to-light ratio squared is constant" (Pennsylvania State). As to the Tully Fisher relationship, brightness is based upon the absolute magnitude, how bright a star or a galaxy appears at a standard distance of 32.6 light years, or 10 parsecs.

According to the Pan Gravity model, the field backflow resulting from the intensity of EM radiation explains gravity. Gravity is therefore proportional to the intensity of EM radiation, which is proportional to the galaxy's mass. The strength of gravity is proportional to the velocity of stars in spiral galaxy discs, the intensity of galactic radiation, and its disc velocity.
Spiral galaxy discs can be considered two dimensional for calculation purposes since their diameters are roughly a thousand times greater than their width which is comparatively thin. Along with the mass of the galaxy, an additional power factor comes from two inflowing vortices, on the top and bottom of the galaxy, inflowing into the disc and galactic center.

How to calculate the mass equivalence of the vortex energy E_M seen in equation 2:
$\mathcal{V}_1 = (G\ (M+E_M)/\ r)^{.5}$

(repeat of figure 1 above)



By the observed luminosity of a spiral galaxy one can calculate the maximum velocity of the galaxy based upon the Tully fisher relationship, $L \propto \mathcal{V}_{TF}{}^{\sim 4}$, where $\mathcal{V}_{TF}$ is the maximum velocity of the visible stars of the galaxy as determined by the Tully Fisher relationship.

Next refer to Line A of Figure 1 above. One can calculate the stellar velocities at the outer limit of the observable stars of the galaxy using the galaxy mass and the Newtonian formula, Equation 1. This is the right hand side of line A, Figure 1. We will designate this as $\mathcal{V}_{(\text{min. A})}$. Now let's calculate the mass equivalence of the maximum vortex energy, $\mathbf{E_M}$, the right hand side of line C, Figure 1. From $\mathcal{V}_{\text{TF}}$ we will subtract the $\mathcal{V}_{(\text{min. A})}$ velocity, to calculate the vortex energy for the observable stars of the galaxy, $\mathcal{V}_{\text{TF}} - \mathcal{V}_{(\text{min. A})}$. This would relate to the vortex energy at the middle of line C, equation 1, at a distance of 15 Kpc, the middle of the above chart. $\mathbf{E_M}$ at this point will be designated as $\mathbf{E_{M.S}}$, which accordingly would be the vortex velocity at the farthest observable stellar distances from the center of the galaxy. $\mathbf{E_{M.S}}$ would then be calculated by $\mathbf{E_{M.S}} = \mathcal{V}_{\text{TF}} - \mathcal{V}_{(\text{min. A})}$.

This point, the middle of line C, would be the median vertex velocity based on the Tully-Fisher calculated velocity. From this point the vortex velocity would increase or decrease depending upon its distance from the outskirts of the galactic core. The inner core of the galaxy could be considered the center of the vortex, likened to the eye of a storm. All these data points combined result in line C. The square of the vortex velocity yields the mass-equivalence of the vortex energy divided by its distance from the outskirts of the core representing all points along line C, based upon equation 1.

According to this model, the two vertically moving vortices of spiral galaxies are generally *fixed-body vortices*, meaning the vortex velocity increases directly proportional to its distance from the outskirts of the galactic core, to the farthest extent of observable matter in the galaxy.

Density Wave Theory according to the Pan Gravity Model

The rotation speed of the galactic arms of spiral galaxies is called the **global pattern speed** within **Density Wave Theory** (wikipedia, Density Wave Theory**)**. To maintain the spiral shape, the global pattern speed of a spiral galaxy rotation would accordingly move at a fixed-body vortex speed. Added to this velocity would be the velocity of the matter of the galaxy based upon the standard Newtonian formula, Equation 1. Gravity would cause the spiral pattern to slowly smear over time.

According to the density wave theory and the subject theory, there would be a **co-rotation radius**. This would be the radius and related speed where stars would generally maintain their relative position within the pattern of the spiral disc. The stellar speeds at the co-rotation radius would be moving at the global pattern speed. Inside this radius stars would move faster than the global pattern speed, and outside the radius they would move slower than this speed.

An additional aspect of the Pan Gravity model is needed to explain the maintenance of the spiral pattern of a galaxy and complete the Density Wave Theory. As was explained earlier, the large spiral 3D vortices of the galaxy are primarily above and below the plane of the galaxy and both spiral toward the plane of the galaxy. These two vortices would both be moving in the same rotational direction but rotating slower than the galactic disc at the global pattern speed. It would funnel into the galactic plane from opposite directions, pushing adjacent matter toward the galactic plane.

As these two vertically moving vortices press the galactic plane together, relatively narrow perpendicular vortices also form along the galactic plane funneling inward toward the galactic core. These smaller, relatively narrow vortices will eventually become, and encircle the arms of the spiral galaxy as the galaxy matures. These secondary vortices delineate the arms of the galaxy which delineate the global pattern of the galaxy, its apparent spiral form.

Plasma and dust within the galactic plane, regardless of its original galactic position, accordingly can remain within the galactic arms for a longer period of time because of the circular and inward flow of the vortices of these arms. This produces a type of fog within the arms that more evenly distributes the radiation of light, reduces the complete occultation of stars by other stars, and increases the light production away from the galactic plane. Arms that appear to be disconnected from the core have probably become less active concerning these secondary vortices.

Plasma within the arms flow toward the galactic bulge which causes magnetic influences in the galactic arms that could hasten stellar production and create bars at opposite ends of the galactic core.

How far out do the primary galactic vortices extend?

As was explained above according to theory, like a storm vortex a spiral galaxy vortex is a low pressure volume within the surrounding field. This low pressure volume is directly proportional to the extent of a galaxy’s radiation and brightness. The more luminous and brighter a galaxy the faster the outer orbital velocities of its stars will be in accord with the Tully-Fisher relationship. A galactic vortex involves a reduction of field pressure rather than something additional such as dark matter. For galaxies that have a clear spiral pattern a vortex would be expected to exist, but for those that don’t, no distinct vortex may exist. The point of the greatest vortex velocities should not extend theoretically much beyond the hydrogen clouds at the farthest observable extent of the outer galaxy.

Not too far beyond this velocities would very slowly drop off since according to this theory galactic radiation creates the lower field pressure within the galaxy and the resulting field flow into the galaxy would compensate for the continuous pressure differential.

On a broader scale these vortex influences would be amplified in galaxy groups, clusters, and superclusters, or could be a mix or multi-directional vortices separate from those of the individual galaxies.

Problems with present models of gravity involving dark matter

For a long time now it was realized that dwarf galaxies surrounding the Milky Way display anomalous motions that cannot be accurately explained by computer modeling using dark matter models. In a resent study (Pawlowski, 2014) it was confirmed that the dwarf galaxies surrounding the Milky Way appear “preferentially distributed and orbit within a common plane,” now being called the Magellanic Plane.

In this study of the Milky Way and the Local Group of galaxies, Pawlowski stated that the majority of the Milky Way’s satellite galaxies and many external clusters are organized in a “vast polar structure (VPOS)… globular clusters and stellar and gaseous streams appear to preferentially align with the VPOS too.” M31 appears to have a similar satellite system, “and aligned systems of satellites and stellar streams are also being discovered around more distant galaxies.” This is “a challenge for the standard Λ-cold dark matter cosmological model” because it is “incompatible with the planar VPOS.” In short, most objects around the Milky Way orbit in the same direction and in a roughly-aligned plane, but because of the supposed dark matter halos, galaxies should form from first-order isotropics; there should be no preferred orientation within them. Likewise, the distribution of sub-halos should also be isentropic, so if there are follower galaxies they should be widely distributed and moving in random directions.

Pawlowski went on to say that his group “discovered that the non-satellite galaxies in the Local Group are confined to two thin and symmetric planes” (Pawlowski, Kroupa 2013). Professor Pavel Kroupa, a co-author of the paper, went further when he said: “<u>There’s a very serious </u>conflict, and the repercussion is <u>**we do not seem to have the correct theory of gravity**</u>” (with or without dark matter). (bold, underline, and parenthesis added) quote also (Kroupa 2014) and (Luntz, 2014).

Explaining galactic Planes

Besides the formation of spiral galaxy discs by vortices, as explained above concerning the Pan Gravity model, given enough time groups of interacting vortices can form additional planes of galaxies as seen concerning the adjacent galaxies to the Milky Way and the Andromeda galaxy. Galaxies and their related vortices form together which can influence both the form of galaxies and the form of galaxy collectives, whether small or large. This process accordingly relates to the interaction of vortices of galaxies, groups and clusters with each other. The Milky Way and the Andromeda galaxy each accordingly have additional vortices pushing small adjacent galaxies into perpendicular planes called the Magellanic Plane concerning the Milky Way, and the Andromeda Polar Plane of galaxies that the standard model of gravity cannot explain as described above by Pawlowski et. al.

Analyzing the dark matter hypothesis

If Dark Matter is some kind of presently unknown type of matter it would not aggregate only on the outskirts of galaxies, it would aggregate according to overall gravitational influences. This idea relates to the Cuspy-Halo problem (Wikipedia, Cuspy Halo) of dark matter. Therefore galaxies must be modeled so that the inner galaxy would contain a higher concentration of dark matter as would theoretically be expected regarding the influences of gravity. As a result, when dark matter is used to model rotation curves of spiral galaxy discs, the model does not closely match observations; instead the results are a much smoother velocity profile than what is actually observed. The Milky Way galaxy rotation curve is a prime example (Brownstein and Moffat, 2005). Dark matter drowns out the Newtonian calculated velocity profile by adding a lot more unseen matter than what is needed if dark matter (or its mass equivalence) were distributed mostly toward the outside the visible galaxy as it is concerning the vortices of the Pan Gravity model.

Dark matter also proposes to explain the observed extent of gravitational lensing, whereby the observed bending of light passing by a galaxy or cluster would seem to indicate much more matter within the galaxy or cluster than the matter that can be observed.

A much simpler explanation for these observations, however, would be that light bends around the perimeter of a galaxy based upon the presence of a large vortex. For a cluster of galaxies there could be one or more larger vortices encompassing the smaller galactic vortices within it. Isn’t this a more likely explanation for the extent of galactic lensing than having to add maybe 10 times more hypothetical matter to a galaxy, cluster, or to the universe than what can actually be observed?

Gravitational lensing according to the Pan Gravity model

The Newtonian gravity formulation above, Equation 1, deals with massive objects, not with mass-less entities like light. To deal with the bending of light according to Pan Gravity, we would accordingly need to follow the vortex currents of pushing gravity inward, considering deflection, refraction, and a primary asserted cause of the bending of EM radiation, by vortex currents. This would be the alternative to an occulting entity having primarily a vast majority of unobservable dark matter.

The vortex model of lensing is very simple. Light would follow the vortex currents around the perimeter of the lensing entity, being bent by the combination of the vortex path and the observable matter within the vertex to explain the angle of lensing being observed.

Supposed examples of dark matter

Maybe the most well-known acclaim for dark matter is the Bullet Cluster, 1E 0657-56 in Carina (Clowe et. al. , 2006). The Bullet Cluster example represents the collision of two galaxy clusters and their accompanying extremely hot interstellar gases.

Dark matter is inferred by the extent of gravitational lensing outside observable galactic matter and extremely hot intergalactic gases. Since the lensing is found separated from the visible mass of the cluster, and because lensing is associated with strong gravitational influences, the mainstream conclusion has been that dark matter has separated from the two clusters, and that this dark matter is the source of the observed gravitational lensing.

In this case the lensing of light around the galaxies and clusters would accordingly be due to EM radiation refraction by a changing refraction index of the extremely hot interstellar gases that it passes through leaving this cluster, and/or by Fresnel dragging by high velocity plasma in the cluster. Besides the matter of the galaxy, these causes alone can explain the observed extent of lensing without the existence of dark matter (Marret, 2013).

The reasons above are thought by the authors to be likely causes for the observed galactic lensing, but in the subject model concerning galaxies and clusters, vortices develop as a result of background field density flows within the field relating to differential pressures causing fast moving vortex currents. This could be a contributor to increased lensing angles. Lensing would accordingly produce its greatest angles where vortex flows/currents would be at their greatest velocities on the same plane and line of sight as the observed lensed light.

“Dark Matter Core Defies Explanation:”

Abell 520 involves a very large merger of galaxy clusters located 2.4 billion light-years away. Astronomers using the Hubble Space Telescope have observed what appears to be a clumping of dark matter left behind from cluster collisions. “*The result could challenge current theories about dark matter* that *predict galaxies should be anchored to the invisible substance even during* the *shock of a collision”* (NASA, 2012).

Astronomers commenting on these observations said that what is thought to be a remaining dark matter core defies current explanations and theory concerning dark matter. “*…the image reveals that a clump of dark matter resides near most of the hot gas, where very few galaxies are found.”* This is a similar finding as the Bullet Cluster, where the lensing appears directly adjacent to hot intergalactic gases, where a dark matter core is also supposed to exist. (NASA March 2012). Instead the lensing could be explained by light refraction by the hot gasses, density differences and flows of galactic clouds, and/or additionally by changing vortex currents resulting from galaxy and cluster vortex interactions relating to the Pan Gravity model.

Incorporating General Relativity into the Pan Gravity model

General Relativity equations produce non-linear paths for matter to follow. The reason for this diversion from Newtonian gravity was Einstein’s proposal of the existence of curved and warped space as expressed in his equations by use of the Ricci Tensor. To date the detection of curved space has not been observed. Instead the same non-linear effects can be explained by the existence of changing ZPF densities, pressures and vortex mechanics which also could justify the use of Riemann Geometry and the equations of General Relativity. This would mean that General Relativity could be used in the same venues as it is presently being used with the same success, only with a different justification for its equations.

Advantages of the Pan Gravity model of gravity

The Pan Gravity model presented here is not a new theory but dates back to the 1960’s when it was developed and proposed by one of the authors herein, Forrest Noble. The model has remained generally unknown since its proposal as a pushing gravity model because originally it had no unique gravity formulations. Like most other pushing gravity proposals its math was the inverse square law of gravity but it verbally proposed justification for General Relativity (GR) in terms of the Zero Point Field involving pressure differentials and flows. It was unknown at that time that spiral galaxy discs did not follow Newtonian gravity. The model then was just another in a long history of pushing gravity models.

Unique equations were added to this model in the 1980's when it was realized that spiral galaxy disc rotation curves did not follow Keplerian mechanics or Newtonian gravity. It was then proposed that gravity, in addition to being a pushing force at galactic scales, operates in conjunction with large vortex currents of the ZPF. Adding vortices to the model was a natural addendum since ZPF flow was already required to maintain a consistent gravity and field density surrounding matter while the matter itself could be orbiting stars and galaxies.

With the inclusion of vortices to this model it became a non-linear model of gravity in that it proposes that gravity at any scale can have non-linear interactions which could be vortex related. At stellar scales there would be little indications of vortex mechanics for mature stellar and planetary systems, but at the scale of galaxies and of the universe gravity would operate within the domain of small to ever larger vortices involving vortex flows rather than following the profiles of curved or warped space as in General Relativity. Such a vortex model would necessarily be contrary to Einstein's Field Equations which is a contracting model of gravity which requires a compensating factor such as the expansion of space. Instead in this model gravity would involve increasingly larger groups, clusters and superclusters of galaxies and their associated vortices, in a fractal type universe maintaining a relatively constant density.

Gravity can be modeled very closely, such as in our solar system. But at galactic scales, according to this model of gravity, there would be many hidden variables in the background field concerning vortex flows and currents, asymmetry of galactic form, etc. Spiral galaxy velocity approximations can be made and then compared to hydrogen and stellar velocities of the disc. For elliptical and irregular galaxies, the motions of the both the stars and background field of the galaxy could also be irregular and unsymmetrical, and if so predictions of motions within the galaxy would probably not be very accurate.

This theory proposes that at the largest scales of the universe, or at the smallest atomic and quantum scales, the Zero Point Field accordingly involves field flows, vortices, and other local hidden variables. Field flows depend upon the differences in pressure relating to adjacent background fields whether at the atomic or galactic scales.

Spiral galaxy rotation curves could be accurately modeled, and galaxy cluster rotation curves could additionally be closely be modeled based upon vortex mechanics rather than the overkill of adding vast quantities of hypothetical dark matter. Gravitational lensing would also be more easily explained by one or more influences such as diffraction of light based upon varying field densities involving hot gases, galactic clouds, following vortex field flows, light interacting with counter-moving field flows, and other conceivable causes that could bend light, rather than the single solution of gravity being the sole cause of the observed lensing requiring vast quantities of unobservable dark matter in the lensing entity to explain the entire angular extent of lensing.

Summarizing the proposed model of gravity

The Pan Gravity model is a pushing gravity model, a mechanical model of gravity the first of which goes back to Newton's time, where Newton himself, amongst others, proposed such a model (Newton, Pushing Gravity, second edition of Optics 1717).

The Pan Gravity model proposes vortex flows of the ZPF as well as gravity to explain motions and velocities at galactic scales. It proposes that EM radiation produces a lower pressure field surrounding all matter, and the backflow of the Zero Point Field into matter would be the sole pushing force of gravity at both the macro and quantum scales. The theory proposes local hidden variables at all levels of reality via the Zero Point Field.

By its formulation, the Pan Gravity model incorporates the Newtonian formula of orbital velocities with an additional non-gravitational effect of a flowing background field, the Zero Point Field, where flow presently is an unknown characteristic of this field. But unlike the dark matter hypothesis it proposes an absence of something, a lower field density and pressure surrounding matter, rather than the addition of something new such as more than six times more dark matter than observable matter. .

Just one fundamental particle as the sole building block for all of reality

A brief summary of theoretical background**:** According to the parent theory of the Pan Gravity model, the Pan Theory, there is just one fundamental particle that makes up all of reality. We accordingly observe ephemeral expressions of particulates in the Zero Point Field as virtual particles. The foundation particle of these particulates is hypothesized herein to be individually unobservable because of its smallness, being thousands or millions of times smaller than a single electron, which is also believed to be the foundation particle of all matter as well. Comprising the Zero Point Field, these mass-less particles, their energies, interactions and flows, could be called the new aether, observable to us as the Zero Point Field.

From the Pan Theory:

The calculated forces of the omni-present Zero Point Field pushing in all directions, according to this theory, has been determined to be 2.75236 × 10^{-11} m/(kg·s^2) Newtons. *This is .41241 times the gravitational constant G divided by mass squared, which is the quotient needed in the gravitation constant G to calculate the gravitational force after multiplying two masses together in the Newtonian formula.*

The gravitational constant 'G' in the Newtonian gravitation formula $G(m_1)(m_2)/r^2$ is equal to 6.673 84 × 10^{-11} $m^3/(kg \cdot s^2)$.

Conclusions

General: The Pan Gravity model being presented here is thought to be able to stand alone, separate from the support of the Pan Theory from which it was derived. The theory proposes presently unknown flows of the Zero Point Field to explain gravity and other observations presently attributed to dark matter.

"Extraordinary claims require extraordinary evidence" is a phrase made popular by Carl Sagan. Concerning the dark matter hypothesis, the extraordinary claim is that an unseen type of matter (dark matter) makes up more than 80% of all the matter in the universe, without any direct evidence concerning its existence or nature.
To date no particle Supercollider or other detector has Detected Evidence for Dark Matter. The dark matter hypothesis requires roughly six times more matter than what has been observed to explain spiral galaxy rotation curves, the orbital velocities of galaxies in a cluster, and the bending of light via galactic lensing. There is no direct evidence for dark matter, only indirect evidence based upon inferred gravitational influences.

MOND and other gravity strength-changing formulations, on the other hand, are generally not thought to provide strong theoretical justification for why gravity's strength should change at different scales.

A major conclusion of this paper is that gravity, acting at galactic scales, produces vortices best observed in the form of spiral galaxy discs. These field motions are comprised of flows and vortices of a background field which accordingly would dominate the formation and structure of the universe. This field is observable in laboratories as the Zero Point Field.

Another conclusion is that the dark matter proposal is drastic compared to the field flow vortex model presented herein. This conclusion is primarily based upon the vast quantities of dark matter needed to explain observation, but also somewhat considers that the search for dark matter has so far come up with no direct evidence to support it.

General Relativity, Einstein's field equations, and Newtonian gravity cannot be used at galactic scales to predict motions in the universe without dark matter, and then predictions are still inadequate compared to measured stellar velocities within spiral galaxies. It is believed by the authors that the Pan Gravity model involving vortices is not only simpler but a better explanation for what continues to be observed.

Based upon the above study, the summary conclusions of this paper are: **1) we are using the wrong model of gravity and the wrong equations to explain the universe** (Einstein's Cosmological Equations), and **2) dark matter probably does not exist.**

Summary reiterations and explanations beyond this paper

The foundation theory for the Pan Gravity model is called the Pan Theory. The Pan Theory for one thing is another model of cosmology quite different form the Big Bang model. It is also an alternative model concerning many aspects of modern physics. The website is pantheory.org. The Pan Theory makes many dozens of predictions, some of which are quantitative and can be tested.

This paper concludes that dark matter as a form of non-baryonic matter probably does not exist. A previous research paper by the same authors using data from hundreds of type 1a supernova observations, proposed a replacement formula for the Hubble distance formula based upon the Pan Theory and supernovae distance data, as well as a new formula to adjust the absolute brightness of distant galaxies for reasons explained therein, concluding by those observations, data and calculations, that **dark energy probably does not exist** concerning the expansion or accelerated expansion of the universe.

http://www.ccsenet.org/journal/index.php/apr/article/view/32603/19463

Beyond this, an additional paper by these same authors listed observations relating to what are perceived to be Big Bang problems that have been building up since the revival of the theory in the 1950's, with another explanation for galactic redshifts rarely considered, and thought to have much fewer theoretical and observational problems than the expansion of space, **concluding that the universe is probably not expanding** and that **the Big Bang model is the wrong model of cosmology**.

http://www.aijcrnet.com/journals/Vol_4_No_9_September_2014/2.pdf

For any theory when one is first exposed to it, despite all explanations given within the paper, there will always be many remaining unanswered questions that cannot all be thought of, addressed, or answered in a single paper. All readers are encouraged to ask the authors questions concerning any and all remaining questions they may have regarding this paper or related theory.

Responses

Please contact the author Forrest Noble at pantheory.org@gmail.com. He will be very happy to answer any questions, consider corrections, and comments. If you are interested in testing the equations, have new or different insights, or need additional explanations concerning this paper or the alternative cosmological model, the authors are willing to discuss this.

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(more references to be added)
