Applications of Space Density Relativity

The Implications of Space Density Relativity to Modern Theoretical Physics

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Preface

As described in the document titled *Space Density Relativity & Higgs Field Occupancy*, spacetime density relativity describes that the "curvature" of spacetime Albert Einstein described in general relativity is really a variance in the relative density of spacetime. In this document, the understanding provided by spacetime density relativity is applied to the larger part of the remaining unanswered questions in theoretical physics.

The reader will find that spacetime density relativity is pertinent to many of the puzzling concepts that were previously assumed should be resolved by the theory of quantum gravity. The fact that the application of spacetime density relativity resolves many otherwise unexplained issues is evidence to its inherent truth as the missing piece in understanding physics.

The concept of relative spacetime density proves to be very useful in providing a more resolute understanding of the singularities of black holes and the Big Bang, as well as other qualities regarding them. Furthermore, the phenomena that have been covered with the blanket terms of "dark energy" and "dark matter" are explained. Space density theory's explanation of the observations that led to belief in these two unidentified mysteries in the first place relieves the confusion regarding them. Basically, it is shown that neither "dark matter" nor "dark energy" really exist, but rather that the observations which led to belief in them are actually expected phenomena relating to variance in relative spacetime density.

Especially because the observational phenomena that led to the false conclusion of accelerating expansion of the universe is cleared up, a return to a cyclical view of the universe is plausible. Some of the details of the process of the cyclical universe are discussed herein, giving detail to the fact that understanding the implications of space density relativity provides a return of the field of theoretical physics and cosmology to a long lost picture of a universe that actually makes reasonable sense.

Just as with the document titled *Space Density Relativity & Higgs Field Occupancy*, the terminology in this document is admittedly extremely non-technical. Again, understanding the theoretical foundations are the important parts here. This has been written simply to share the understanding provided by this theory and to spark truly needed renovation in the related fields. The physics professionals should be able to relate these laymen’s concepts to the technical jargon and completed equations expected by peer-reviewed journals.

When considering the fact that much of the understanding provided in this document is contrary to status quo assumptions in the field of theoretical physics at the time of this writing, it must be expected that much within the field would have to be be reconciled with the paradigm shift brought about by the theory of quantum gravity.

Contents

I. Black Holes

Space density theory lends itself to a more detailed look at just what black holes really are, confirms the original understanding that nothing that enters a black hole ever comes back out, and clears up the confusing proposals regarding them. For instance, the proposed ideas that black holes can rotate, have charge, and evaporate are all shown to be technical impossibilities considering their true composition.

The begin, spacetime density relativity explains gravitational singularities as points of maximal spacetime density. To describe this effect, the zero-point field (zpf) and the invariant background described in *Space Density Relativity & Higgs Field Occupancy* can be invoked. In normal spacetime, spacetime density gradients—visualized by the difference in the spacing of the zpf upon the invariant background—are what cause gravitational actions. Again, Einstein described these spacetime density gradients as the curvature of spacetime, and defined them through his field equations.

The reason the field equations cannot describe gravitational singularities is because maximal spacetime density is reached at them. With the viewpoint of the zpf, one can visualize a gravitational singularity as a place where the spacetime density becomes so compacted that neighboring zero-points touch. There is a fissure between describing gravitational singularities and all other places in spacetime because at all other places, the spacing between zero-points can be said to be the same distance (in measures such as meters), because the variance is always relative and to scale. (Remember, this is why the invariant background had to be theorized for reference to see that the density of spacetime varies relatively.) But at gravitational singularities the spacing between zero-points cannot compact any more relatively and jumps to zero.

To reiterate, zero-points are always the same relative distance apart at all other places in spacetime, except at gravitational singularities. This is why general relativity can describe all other places in spacetime but breaks down at gravitational singularities. To explain this in a view from relative units, adjacent zero-points will always be the same distance apart in meters, and space-time intervals will be equal, continuing right up to the singularity. Where the singularity is reached, however, the zero-points will no longer have any separation, and there will be a type of leap to where the idea of space-time interval no longer has any meaning.

This sharp jump makes a drastic difference in spacetime, and can be said to characterize a distinctly different state of spacetime, which could be fittingly named the *singularity state* of spacetime. Thus, what have been termed gravitational singularities are actually instances where the singularity state of spacetime is reached. Therefore, singularities are identified by Einstein's field equations because they become undefined at singularity state spacetime. All singularities appear as single points in spacetime in comparison to the surrounding spacetime.

In the singularity state, spacetime density becomes infinite (∞) and the rate of time goes to $1/\infty$. In other words, all distances become zero and time ceases to pass. Indeed, this is exactly what has previously been expected for gravitational singularities. This explanation also gives reason for why the gravitational force just outside of the singularity becomes infinite. Because space-time intervals merge to have no spacing between them in the singularity state spacetime, but just outside the singularity there is spacing between space-time intervals, it makes for an infinite difference between spacing and no spacing. Thus, the gravitational force on anything just outside the singularity is infinitely large.

Though, as will be covered shortly, there will never be fermions this close to the singularity, as they will all have been reduced to radiation by that point. So, this gravitational force potential is never really observed on particles. Rather, the gradient there will only influence the path of radiation (light) via geodesics, which could be explained in the same terms: Because the space-time intervals touch in the singularity, the geodesics at the singularity touch. Due to the geodesics in the singularity state spacetime having zero separation while there is separation to the geodesics around the singularity, light will never leave the singularity. Since everything that enters the event horizon of a black hole will be turned into light and enter the singularity of the black hole, all the mass in a black hole will be held within its singularity.

It is known that when a black hole takes in matter and energy, the diameter of the event horizon increases. Because the spacetime density reached at all event horizons is always the same, and the spacetime density at the singularity is always the same, the space density gradient between the singularity and the event horizon of a black hole will always be the same. It is because the singularity cannot become any denser that the amount of spacetime that is within the black hole's event horizon must increase when more mass is added to the singularity.

This means that the distribution of the density of spacetime within a black hole will always be the same according to the proportion of the distance of the radius of the black hole's event horizon. In other words, the spacetime density within any black hole will always be equal between all black holes at equal proportions of the radius of the event horizon. (For example, this theory predicts that the spacetime density at a distance from the gravitational singularity of ½ the radius of the event horizon for any particular black hole will be equal for all black holes.)

Now, because all fermion particles take up some non-zero amount of space, and a gravitational singularity by definition has zero size, the consequence is that no particles with rest mass can exist in singularity. The significance of this is that only pure energy, i.e. radiation, can exist in the singularity, as radiation takes up zero space. Therefore, when black holes gain mass through the intake of matter and energy, it must all eventually be converted into pure radiation by the time it enters the singular state spacetime at the center. Extending this idea, the conclusion must be reached that any time a black hole takes in matter, it must be destroyed on its voyage from the event horizon to the gravitational singularity.

As the matter is destroyed during its transit deeper into the black hole, the entropy of it increases. This effect increases all the way up to the singularity, at which point all entering material contents have converted all of their mass contents to energy in the form of pure radiation. Thus, the equivalent of nuclear explosions occur within black holes, though this is never visible to viewers outside the black hole, because all paths of light within the event horizon lead only to the gravitational singularity. And again, because of the geodesics at in the singularity state of spacetime touching, the radiation will never leave that singularity. This is the process by which everything that enters a black hole will end up as pure radiation in the gravitational singularity.

Now, the next question that must be asked is how black holes can be gravitationally attracted, though they are not made up of particles. It might seem that because the actions of gravitation described by *Space Density Relativity & Higgs Field Occupancy* require particles with wavefunctions of non-zero size, that there would be no means for a black hole to be gravitationally attracted. However, there is a way around this in explaining how black holes are gravitationally attracted by space density gradients.

This issue, in which it seems there is no theoretical means whereby to gravitationally accelerate a black hole, is resolved by looking at the entire black hole as one particle. With this view, the black hole can be viewed just as an individual particle described in *Space Density Relativity & Higgs Field Occupancy*. The only difference is that instead of the diagram representing the spherical Higgs field occupancy diameter of the quantum particle, now the diagram depicts the spherical event horizon of the black hole.

Just as a particle is drawn toward the denser spacetime in a space density gradient, a black hole will be drawn toward the denser spacetime in a space density gradient. Thus, black holes are gravitationally attracted by the same process that individual fermion particles are gravitationally attracted. Generally, black holes are considered for their own gravitational effects on other bodies, but they too must be gravitationally accelerated and possess their own inertias. Naturally, a space density gradient must be of huge potential to affect a supermassive black hole, such as that created by an entire galaxy, but it would not take so much to gravitationally attract a black hole with a mass comparable to one star.

Not only does this explanation—of treating the entire black hole as one individual particle—provide means by which black holes are gravitationally attracted, but it also describes how they can have inertia. Again, to explain how black holes have inertia, despite not being made up of any particles with rest mass, the entire black hole can be treated as one large particle with the mass equivalence of all the energy contained in its singularity. Furthermore, this description would explain why black holes cannot move at the speed of light, just as fermion particles cannot move at the speed of light.

(From the understanding ascertained from *Space Density Relativity & Higgs Field Occupancy*, it ought to be possible to calculate the mass of one particle having a Higgs field occupancy diameter equal to the diameter of a black hole's event horizon. It would be interesting to see if a single particle with a Higgs field occupancy diameter the size of a black hole's event horizon diameter would have the same mass as that black hole, though this is not necessarily a prediction of this theory.)

Of course, there are many differences between the Higgs field occupancy of a particle and the event horizon of a black hole. First of all, the black hole has a physical spherical area contained within its event horizon, whereas the Higgs field occupancy diameters of particles are merely their spherical wavefunction distribution. So, regarding the gravitational attraction of black holes, it is not the wavefunction area that undergoes relative distortion on the side toward the relatively denser spacetime of a space density gradient, but the event horizon.

Therefore, when considering the black hole with the diagrams of *Space Density Relativity & Higgs Field Occupancy*, it must be the event horizon of the black hole that undergoes distortion on the invariant background. Because the black hole has a defined amount of zero-point field (zpf) contained within its event horizon—which will always be determined by the mass of the black hole—it is the distortion in the zero-point field around the black hole that will cause its spherical event horizon to be distorted on the invariant background.

The distortion the black hole's event horizon caused by any space density gradient it finds itself in will cause a difference in the zpf distribution between the one side of the black hole and the other. The zpf on the side toward the space density gradient will be slightly denser than the zpf on side opposite to the space density gradient. Because the same amount of zpf must remain in the black hole, this will cause a shift in the singularity toward the relatively denser space. Thus, the singularity of the black hole is gravitationally accelerated in the same way as the center point of a particle in the diagrams of *Space Density Relativity & Higgs Field Occupancy*.

This all occurs while to the black hole remains perfectly spherical unto itself (when considering a black hole not actively taking in any matter), with the singularity always staying centered in the middle and all points on the event horizon the same relative distance from the singularity in relative measurement such as meters. The distortion in the black hole's event horizon caused by a spacetime density gradient larger than its own could only be noticed when referring to the invariant background.

An exception to this would be when black holes collide and merge. When this happens, there will be a merging of the otherwise spherical event horizons of the previously independent event horizons as they morph into one another. The separate singularities previously at the center of each hole will unite rather quickly into one after the event horizons cross. The resulting singularity will contain the combined mass equivalence of all the energy that was contained in the previously separate singularities, and one black hole will remain with an event horizon of larger size, containing the same amount of zpf previously held within the separate event horizons. The momentum of the newly formed black hole will logically be the combination of the momentums of the previously separate black holes. Thus, the consolidation of the velocities of the previous black holes will give the resulting black hole its velocity.

At this point one can see that the use of space density theory provides a far more detailed depiction of the inter-workings of black holes than has been achieved by any previous theory of theoretical physics regarding them. Prior to the theorization of spacetime density relativity, black holes were basically only describable by mathematical equations. This is why there has been confusion regarding the properties the can and cannot possess. This leads into the application of this understanding of black holes provide by space density theory to the remaining properties which have been theorized regarding black holes.

First, many questions have been raised involving the subject of black holes and their entropy in theoretical physics. The idea that black holes might radiate energy was first thought up by Stephen Hawking when he hypothesized that black holes must have a temperature. This ended up leading him to believe black holes must somehow emit thermal radiation. The idea was first met with considerable resistance, but Hawking's theory and equations have now generally been accepted, primarily due to the mathematical reproductions of his solutions.

However, the idea that black holes can lose mass by emitting radiation is contested by the understanding of black holes provided by space density relativity, because all the mass of a black hole is contained within its singularity, and there is no means by which mass can transverse the space between the singularity and the event horizon to be lost. Thus, this theory maintains that all matter and energy that goes into a black hole must stay in the singularity. Therefore, black holes can never lose mass and the proposed evaporation of black holes by the theorization Hawking radiation cannot physically occur.

Furthermore, the understanding provided by this theory of black holes also negates the theorizations that black holes can have charge and rotate. Because all charge-having particles that enter black holes are destroyed into the singularity, there is no means by which the black hole can hold charge. Likewise, whereas stars and planets are composed of particles, the combined inertias of which give them their attribute of angular momentum, black holes are not composed of particles and have no means of possessing angular momentum. So, because (inactive) black holes are comprised of only a singularity of zero size and empty space, they simply cannot rotate nor have charge.

Thus, the angular momentum and charge of the dying star that creates a black hole in a supernova is bequeathed into the singularity of the black hole when the particles that held that angular momentum and charge are destroyed into it. Furthermore, unlike objects such as stars and planets, which can exert a Lense-Thirring precession, black holes have no body of particles to have such an effect on spacetime. This means that the ergospheres hypothesized by some to surround spinning black holes cannot occur in reality, despite the fact that they are real solutions to mathematical equations.

Likewise, because neither singularities nor empty spacetime can rotate or hold charge, what we are left with is that all black holes in reality must be Schwarzschild black holes, and the the Kerr, Reissner-Nordstrom, and Kerr-Newman metrics are all mathematical solutions that do not represent any reality in nature. Therefore, the "no hair theorem" should be able to be extended to leave nothing observable from outside any black hole except for its mass and its accompanying event horizon diameter.

(The author of this work understands that this would mean that the information loss problem of black holes must remain unresolved. Truly, the information contained by all matter and energy that goes into a black hole is destroyed into one state. This technically does destroy all information from all the previous states of all of the matter and energy that goes into black holes. This problem is resolved when one understands that God has taken note of everything in history, and thus no information can truly be destroyed. Though this conclusion has traditionally been one that has tried to be avoided in physics, it seems that it is the only plausible answer to this particular question.)

The understanding that black holes cannot rotate clears up the idea that ring singularities can occur. And when this is combined with the fact that black holes cannot evaporate through Hawking radiation, the perplexing propositions that "naked singularities" might occur in reality is cleared up. Thus, the "cosmic censorship" hypothesis always remains true, with all singularities being contained within event horizons.

There is some observational evidence that has been interpreted to suggest that black holes can rotate, primarily the relativistic jets in active galaxies. However, these jets could just as well be caused by the rotation of the materials in the accretion disks around black holes, leaving no requirement for the black hole itself to be spinning. There are many extreme processes going on around active supermassive black holes, from which great energies can evolve. Thus, the jets could be produced without black hole rotation.

Despite the theorization that black holes can rotate, have charge, and emit Hawking radiation, there is no solid evidence that proves they do. And so there is no evidence against the new way that space density theory presents black holes. On the other hand, this new theoretical interpretation makes logical sense concerning what exactly black holes are, giving a vast improvement from the previously intangible descriptions of them.

II. The Big Bang

The Big Bang is one of the most intriguing theories in modern science. The concept is most important to us because it has been found to be the farthest back science can reach on one of the most ultimate questions in life: Where did we come from? The fact that space density theory plays into the Big Bang and can help in answering this question is quite exciting. While space density theory does not change the details of the Big Bang, it does make sense of some crucial parts, beginning with the Big Bang singularity.

The reason the equations of general relativity break down at the beginning point of the Big Bang singularity is the same for why they break down at the singularities of black holes: the spacetime at the singularities is actually a different state of spacetime, the singularity state. The Big Bang and black holes share this same circumstance of singularity state spacetime, in which there is no space density gradient to describe. Again, because Einstein's field equations of general relativity actually describe gradients in relative spacetime density, they cannot apply to singularity state spacetime.

The difference between the gravitational singularity of black holes and the Big Bang singularity is that the Big Bang singularity contained all of the spacetime that exists in the universe today in the singularity state, with no spacetime surrounding it. This circumstance can only occur when the entirety of the universe's mass is all piled into one point—making for no gradients for the dispersion of spacetime around that point. Of course, for all of the universe's mass to be in one point, it all had to be in the form of pure energy.

While the universe was all packed into the singularity state of the Big Bang singularity, there was no passing of time, just like at the singularity of black holes. This means that time did not start for this universe until the moment that it expanded out of the singularity. Thus, the first instant of time in the universe must have occurred immediately upon the departure from the singularity state of spacetime—the actual "bang" of the Big Bang.

At that first moment, all zero-points of space were first separated from one another by an extremely miniscule length on the invariant background—though they could be said to have been separated by the same length in meters that they are now in all places, as spacetime was only relatively denser. Time in the early universe would have passed at an extremely slow rate relative to what it does now, though if there were anyone to experience it then it would have seemed to pass at the same rate as it does for us now.

Along with the expansion of all spacetime out of the singularity state of spacetime, the pure energy that had been held in the Big Bang singularity would have spread out evenly. It must be assumed that this energy would have expanded out of the singularity at the speed of light in all directions. This could be explained with the zpf as that each zero-point would observe each of its neighboring zero-points to be receding away from it at the speed of light. Because this was happening at every point in space, the compounded effect would result in an over-all exponential expansion. This is the process by which the universe inflated in size at a nearly unimaginable rate, called the period of inflation.

The vast expansion of inflation would naturally have continued, with all of spacetime uniformly expanding at the speed of light in all directions, until the first particles formed out of the originally pure energy. Up until the point of the formation of the first particles, the entirety of the universe would have been perfectly consistent, without even the slightest irregularities. This means that throughout inflation all of spacetime was homogeneous, with no space density gradients, but rather the spacetime density evenly decreasing with expansion.

Because every point in spacetime had the exact same qualities until the end of inflation, the conditions suitable for the first particles to form must have arisen instantaneously across all of the spacetime in the universe. But after the formation of the first particles, due to quantum fluctuations, the first spacetime perturbations occurred. These first irregularities in spacetime density were the first miniscule space density gradients.

With the emergence of particles and the first space density gradients, the first gravitational actions occurred. The combination of the effects that particles with rest mass cannot move at the speed of light, along with the first gravitational attractions would have caused the expansion rate to fall for the first time below the speed of light. This means that with the formation of the first particles, the expansion very abruptly began the trend of decelerating expansion. This happened at a considerably drastic degree and in one instant. Thus, the period of inflation can be said to have ended immediately upon the formation of the first particles, though expansion would have still continued at quite a fast rate.

Once there were particles with rest mass, gravitational actions could occur. This does not mean that the gravitational force emerged at that time, because gravitation is not actually a force but an effect of the structure of spacetime on mass-having particles. Thus, once particles with rest mass occurred within spacetime density gradients, gravitational actions began to occur. Prior to that time, there were no actions of gravity—not because gravity did not yet exist but because there were no space density irregularities or particles to be effected by them.

For those reasons, space density relativity explains that gravity does not need to be unified with the other forces after all. Rather, as described in *Space Density Relativity & Higgs Field Occupancy*, gravity is not a force with a force carrier such as a graviton, and thus there is no reason to support the idea that gravity was first joined in one unifying force with the other forces. Rather, gravity is the result of space density gradients upon particles with rest mass, once they arise. Thus, gravity must have been predetermined before the beginning of the Big Bang (presumably as well as the other forces), though the first actions of gravity would not occur until there were actually local differences in relative space density and particles with rest mass for them to act on.

The first gravitational actions would have been extremely minute once they did begin to occur, due to the fact that spacetime would have still been incredibly smooth at that time. Nevertheless, the space density irregularities that came with the first particles would slowly contribute to larger and larger space density gradients. The effects of these first perturbations in spacetime density are notable today as what seeded the variations that would eventually turn into the primary anisotropies in the Cosmic Microwave Background (CMB).

The CMB is one of the most important pieces of cosmological evidence for the Big Bang that we have today. Space density theory explains not only explains the primary CMB anisotropies as resulting from the first space density gradients, but also the secondary CMB anisotropies. The space density relativity explanation for the secondary anisotropies has to do with the Shapiro delay. As CMB light traveling to us from the distant past has passed through regions of denser spacetime, such as clusters and superclusters of galaxies, those rays have been slowed due to the relative slowing of time there. This has the effect of making the CMB light we receive at any moment not necessarily released at the same time. The CMB light that comes from the directions with more supercluster will actually have been released prior to the CMB light that has traveled through more supervoids. This means that secondary anisotropies should cause the light coming from directions in space with more supercluster to be hotter, due to it having been emitted while the universe was just a bit younger and closer to the Big Bang. The effect will be hard to distinguish, but secondary CMB anisotropies must occur due to light being offset on its journey to us by traveling through different spacetime densities.

So, space density gradients led the structure formation of the universe from the very beginning and have affected it since. The structures evolved from the bottom up, forming the smallest structures first hierarchically. Initially, the variations were very minute, causing only the lumping together of nearby particles. That caused the irregularities to grow, eventually leading to the formation of stars. Then the space density irregularities grew larger and stars lumped together to form galaxies, clusters of galaxies, and superclusters. It is also interesting to note that with the deaths of large enough stars, black holes were formed. As black holes grew larger, the first supermassive black holes formed. From this, the more advanced evolution of galaxies that we know of today first began. This is seen in the light from the quasars of the young universe that we still receive today.

The universe has come a long way since it was all in the singularity state of spacetime in the beginning. And, as we have just uncovered the knowledge that the black holes mark small returns the singularity state of spacetime, it is plausible that all the spacetime in the universe may eventually be converted back to the singularity state—especially considering that black holes can only grow larger once formed. This line of though logically leads to the idea of an eventual Big Crunch, which will be returned to in more detail in the section on the cyclic universe.

This line of thought will be deviated from momentarily, however, to devote some time to the domineering concepts of dark matter and dark energy that modern theoretical physicists invented to explain observational data that was not expected before spacetime density relativity was understood. The next sections show that space density theory provides rational explanations for most all of the confusing observations involving these two subjects that have recently perplexed both laymen and scientists alike about cosmology.

IV. Dark Matter

The term “dark matter” has been hypothesized in theoretical physics to account for the observation of stronger gravitational interactions at the edges of galaxies and between galaxies that, by the old paradigm, could not be explained by the observable matter in the galaxies. It was previously assumed that the only thing that could account for this extra gravitational pull would have to be matter that is not observable and does not interact. Physicists have searched diligently for such an invisible, non-interacting particle for dark matter, but have not found one.

Simply, the reason no dark matter particle has been discovered is because they do not exist. Much to the contrary, the observations attributed to dark matter are wholly explainable once the relative variance in spacetime density is accounted for—as is the theme of this document. Thus, it has not been a particle physics was missing, but something that was not understood about the nature of spacetime and gravitation itself.

Of the observations that have been related to dark matter, the most cited have been galactic rotation curves and gravitational lensing around galaxy clusters. (Some have also noted CMB anisotropies, but the ways in which space density relativity accounts for the CMB anisotropies has already been described. Others have also hypothesized that the hierarchical structure formations of the universe require dark matter, though those too should be accountable for using only space density gradients from the bottom up.)

The galactic rotation curves which seem to require additional mass within galaxies can actually be accounted for by considering the space density gradient caused by the entire galaxy together. The reason stars near the edge of galaxies orbit the galactic center faster than expected is because the space density gradient at the edge of the galaxy is steeper. This has to do with the fact that at the edge of galaxies, the increased spacetime density of the galaxy meets the lower density spacetime of intergalactic space. This results in a steeper space density gradient toward the edge of the galaxy, and thus increased gravitational action. With this understanding of gravitation, the increased speeds of stars toward the edges of galaxies should actually be expected in galactic rotation curves.

The reason this has been unaccounted for previously has to do with the fact that we have up till now based our account for gravitation here within in our solar system without accounting for the fact that the background spacetime density that our solar system is within is already increased spacetime density compared to that outside of a galaxy. Obviously, because we are within a galaxy, the background spacetime density here is going to be much higher than the background spacetime density in a void.

This effect will be stronger for galaxies surrounded by voids than galaxies in clusters and superclusters. Observations should show that lone galaxies have more increased outer rotational speeds than galaxies residing in areas where there are many galaxies. On the other hand, galaxies surrounded with other galaxies, such as those is clusters and superclusters, are likely to have more “normal” galactic rotation curves. Therefore, space density theory predicts that galaxies previously thought to have higher dark matter content are likely galaxies that exist in neighborhoods with lower background spacetime density.

Once spacetime density relativity is accounted for, the expected galactic rotation curve for any galaxy will be able to be predicted according to the background spacetime density within which that particular galaxy exists. When the galaxy is located in a void, it will naturally cause a stronger spacetime density gradient around its edges than if it were in a neighborhood with many other galaxies and already submersed in increased background spacetime density. In this, the odd problem of there being such great variation in the alleged dark matter content of different galaxies is explained.

The second greatest founding observation for dark matter to be discussed is gravitational lensing around galaxy clusters. This will be explained in much the same way, but first it should be pointed out that the phenomenon of gravitational lensing is actually evidence for space density gradients in the first place. A gravitational lens can be directly explained in that the varying density of space can be compared to the varying thickness of an optical lens. Light traveling across a gradient of space density will be warped toward the denser spacetime, simply following the geodesics toward the denser space. Where this was previously attributed to the curvature of spacetime by Einstein, space density theory now gives a more descriptive understanding in that it is caused by variation in relative spacetime density.

Regarding dark matter, this theory needs to show why this effect should cause more gravitational lensing than expected from the total mass of the galaxies in the cluster. Here again it will be essential to look at the background spacetime density. A galaxy cluster should be expected to cause a stronger space density gradient if it exists in lower background spacetime density than if it were already submersed in increased background spacetime density. Thus, lone galaxy clusters are predicted to show increased gravitational lensing compared to galaxy clusters within superclusters. Much like for galactic rotation curves, this effect to gravitational lensing should account for the varying alleged amounts of dark matter among different galaxy clusters.

With this understanding, one can actually view the increased gravitational lensing and galactic rotation curves attributed to dark matter to be expected proofs of the Theory of Space Density Relativity. In fact, the observed degree of gravitational lensing and galactic rotation curves can be used to study the topology of space density in the region, rather than the existence of some type of elusive non-interacting matter.

As some may have picked up on already, what this has been implying is that what is required to understand the confusing data that has led to belief in dark matter is actually a renovation of our current understanding of gravitation. The part that must be renovated is to account for background spacetime density in calculating gravitational predictions. This involves the fact that we have developed our equations of the gravitational constant in the local background spacetime density, here in our location within the Milky Way galaxy.

What is being proposed here is that if our solar system was out in a void away from galaxies, in lower relative spacetime density, we would see stronger gravitational effects. Due to the background space density there being significantly lower than it is here, the Sun would cause a much stronger space density gradient around itself. Due to this, the planets would have to orbit the Sun at higher speeds. Likewise, the mass of the Earth would also cause a stronger space density gradient around itself and therefore the Earth's gravitational field would be stronger. If Newton were on that world, it would have resulted in the derivation of a higher value for the gravitational constant (G) in his equations for gravity.

Thus, there must be a factor missing in Newton's law of gravity, the factor of the background spacetime density in which the gravitational bodies under consideration are immersed. This factor is represented in the equation below. (Though, it should be noted that

Newton's law of gravity is simply a shortcut for predicting gravitation compared to the equations of Einstein's general relativity. So, to really account for this change, this factor of background spacetime density will require similar accommodation in Einstein's field equations, which may be found to pertain to the cosmological constant (Λ).)

Because the strength of gravitational acceleration for any two objects will vary depending on the local background spacetime density (background sd), Newton's equation for the gravitational force must be placed over the factor of the background sd.

$$F = \frac{G\ (m1m2/r2)}{\begin{matrix} background \\ sd \end{matrix}}$$

This equation shows that the given gravitational force between any two objects will be stronger in lower background spacetime density and weaker in a region of higher background spacetime density. This is explained by the effect of mass causing space density gradients.

This effect has not been noticed here because all of the local measurements of gravity in and around our solar system exist within roughly the same local background spacetime density. Thus, in this local area of spacetime—basically constituted by our location within this galaxy—the background sd = 1. But if the Earth was placed in relatively lower background spacetime density, making the background sd < 1, we would observe the Earth to have stronger gravitation. With this view, the gravitational constant (*G*) can still be considered to remain constant, while it is the local background spacetime density that changes relatively.

Considering this, a strong case is being made that it would be more accurate to formulate the equations describing gravity from our observations—such as galactic rotation curves and gravitational lensing—rather than sticking to the current equations for gravity and inventing dark matter to explain them. This variation from the standard equations of gravitation will be difficult to derive, but the founding concepts needed for the new understanding required to do so should be adequately provided by the Theory of Space Density Relativity being discussed here.

The new equations for gravitation including background spacetime density relativity could be tested through using a set-up similar to that used in the Cavendish experiment. If measurements for the force between two masses were measured near to the Earth and then sent into the relatively less dense spacetime away from the Earth for measurement, they could then be compared to see if there was increased gravitation between masses in relatively less dense spacetime. If such an increase occurs, as predicted by this theory, the measurement thereof could be considered experimental evidence in support of Space Density Relativity.

One of the last pieces of evidence that has been considered to indicate the existence of dark matter, but can instead be discussed as evidence for spacetime density gradients, is the large scale structure of the universe. Surveys such as the Sloan Digital Sky Survey (SDSS) depict the universe as having enormous filaments where galaxies and clusters of galaxies line up to form larger web-like structures. These structures have previously been held as a look at dark matter filaments, though in reality they represent larger spacetime density gradient filaments. Therefore, the large scale structure of the universe is basically a picture of how regions of increased space density accumulate. The Sloan Great Wall would be one example of where increased space density gradients have accumulated to form a large supercluster filament.

All together, it appears that space density theory can neatly replace most, if not all, observations which have been tagged as to be explained by dark matter. As such, space density theory makes sense of such observations without the need of any unfound particles, just as the theories of space density relativity and Higgs field occupancy describe gravitation and particle mass without the need for any unfound particles. In the next section, space density theory is applied to the argued bigger problem in modern theoretical physics and cosmology that has been termed “dark energy”.

III. Dark Energy

Cosmologists have for the longest time expected that the expansion of the universe that started with the Big Bang should logically be slowing down due to gravitation. However, some observations have been found that seems to suggest otherwise. This data is namely the red shift surveys of distant supernovae, the analysis of which seems to indicate that the universe used to be expanding slower than it is today. This would make it appear that the expansion of the universe is mysteriously accelerating under some unseen force in opposition to gravitation. Thus, it would seem that some "dark energy" must exist to explain this. However, this does not have to be the case is something has skewed the redshifts from those distant supernovae.

Of course, the suggestion here will be that what has caused the skewing of these redshifts is the difference in the relative spacetime density of the universe between the time that the light of those distant supernovae was emitted and the relative spacetime density in the universe now that those light rays have been observed. Such a skew would account for the observations reported by both the High-Z Supernova Search Team and the Supernova Cosmology Project without requiring the conclusion that expansion is accelerating.

To explain this, it should first be pointed out that it is the stretching out of spacetime that causes cosmological redshift. Thus, redshifting of light from distant galaxies is actually due to decreasing relative spacetime density in the first place, as opposed to being from them having a velocity through space in the direction away from us. This is explained as that the galaxies are actually staying the same distance apart in relative units, and would only really be observed as moving apart if viewed on the invariant background. Thus, it is the stretching of the light waves on the invariant background that is observed as a redshifting of the wavelengths.

Cosmologists have had this understanding already, knowing that the cosmological redshift in light from distant galaxies never really was a measurement of velocity, but rather an indicator of the expansion of spacetime. Whereas the Doppler redshift is due to the recessional velocity of an object, the cosmological redshift is due to the stretching of spacetime lengthening the wavelength of light. So, just because light from the most distant supernovae have slightly less redshifting than expected by the Hubble's constant, does not necessarily mean that the rate of expansion of the universe is accelerating.

The space density explanation of this particular phenomenon is simple. In the distant past when the light from the most distant supernovae was emitted, the overall spacetime of the universe was denser, due to being closer to the Big Bang. Thus, the wavelengths of light rays were relatively shorter, as could be noted only from the invariant background. Due to spacetime being much denser then, the wavelengths of light emitted at that time would have started out relatively shorter. It is due to the fact that the light from the distant supernovae started out relatively shorter in the denser spacetime of the more compact early universe that it has less redshift than expected by Hubble's constant.

Now, because the concept of spacetime density relativity was not previously understood, this has not been accounted for in the expectations from Hubble's constant. For Hubble's constant to be accurate, all of the wavelengths have to start out in the same relative spacetime density, and as has just been discussed, this is not the case. Consequently, the redshifts predicted by Hubble's constant will be overestimated with increasing distance, because the light from the more distant stars will have been released in the more distant past and closer to the Big Bang when spacetime was relatively more compact.

To correct for this, one would need to compensate for the difference in the originating wavelength. The more distant the galaxy observed, the earlier in the universe it was emitted, and the shorter the beginning wavelength. So, for distant light, this would require compensation for its beginning relatively more blueshifted. After this is compensated for, what one ends up with is that a constant rate of expansion should not actually be expected to give a linear graph when plotting distance vs. red shift. Rather, it must be expected that the redshifting will be slightly decreased from what is expected with distance. In this case, a slight decrease of redshift with distance is not an abnormal value to be explained, but an expected result of the change in relative spacetime density in the universe over time as it has expanded from the Big Bang.

Therefore, the prediction being made here is that if this compensation is made for the denser spacetime in the past to correctly interpret the measured redshift values, it will be shown that the rate of expansion has indeed decreased with time as common sense would assume. If this is found to be the case, the accelerating expansion problem will be resolved as a mistaken conclusion and there will be no further impetus to try to figure out any hypothetical invisible dark energy force to account for that misgiven conclusion of accelerating expansion.

The idea that the universe might have been expanding at an accelerating rate has been quite perplexing to theorists, especially regarding the theory of the ultimate fate of the universe. But, as has been discussed, if the observational evidence for an accelerating expansion is re-analyzed accounting for relative spacetime density, this confusion should be cleared up. Then, the more logical conclusion of decelerating expansion can return.

Moving on, with the conundrum of an accelerating expansion out of the way and resolved as mere observational effect due to not understanding the fundamental structure of spacetime, cosmology will soon find a reinstatement of the cyclical universe theory. The idea of a Big Crunch was first theorized by scientists after the original development of the Big Bang model as the predicted result of gravitation eventually reversing the expansion set forth by the Big Bang into universal contraction. It only makes sense that each Big Bang would be followed by a Big Crunch in successive cycles of the universe. The details of such a cyclic universe are discussed in the next section.

V. The Cyclic Universe

As will be covered in this section, space density theory supports a model of the universe which is of the purest cyclical nature. There have been various cyclic models for the universe proposed in the past, but most have repeatedly found problems with entropy and the second law of thermodynamics. It should be shown that space density theory avoids the entropy problems of previous cyclic models by giving an unprecedented look at how energy is fully recycled through the singularity state of spacetime that has already been discussed for the singularities of black holes and of the Big Bang.

By incorporating the principles of space density theory to the analysis of the grandest view of the universe, the end of this cycle of the universe can be predicted. Interestingly, the end predicted for this universe is the result of all of spacetime being converted into the singularity state, much like was the case at the start of the Big Bang. The end of each cycle of the universe will be termed a Big Collapse to differentiate it from previous Big Crunch theories.

In effect, space density theory can be utilized to show how a Big Collapse of a previous universe would share the same conditions with the starting point of the Big Bang. Thus, there may have been a universe prior to this one that also started with its own Big Bang. However, it is philosophical impossibility to rule out that this also could be the first universe in the beginning of such a cyclical system. To analyze such a cyclical universe beginning with the current state of the universe, the steps by which the end of this cycle of the universe will be brought about must be addressed.

Based on the refutation of an accelerating expansion that was just covered in the previous section regarding dark energy, we must conclude that expansion is decelerating and that the universe has a spherical topology, as was described by Einstein. As such, the universe must currently be in decelerating expansion, which will eventually stop expansion and begin an accelerating contraction. (To prevent any confusion about this, time will not reverse once contraction of the universe begins, just as gravitation will continue to be attractive.)

With universal contraction, it would only make sense that galaxies continuously merge more and more frequently. As this occurs, spacetime will become relatively denser, with more galaxies lumping into filaments, and the size of the universe on the invariant background will decrease. When one adds to this concept of continual collisions between galaxies the fact that all of the black holes in the universe can only grow larger and unite with one another over time, one sees that eventually all of the matter of the galaxies of the universe will eventually cross paths with and be consumed by supermassive black holes.

It follows from this that all of the supermassive black holes will also eventually cross paths and engulf one another as the universe shrinks on the invariant background. Finally, in the end, everything will eventually end up in the gravitational singularity of the resulting ultra-supermassive black hole. Once all of the mass of the universe is in one gravitational singularity, there will be no spacetime density gradients to balance out, and thus all of the spacetime in the universe will converge into the singularity state of spacetime. This is the Big Collapse.

Immediately upon all of the mass in the universe entering the singularity of the final black hole and all of the spacetime entering the singularity state of spacetime, there will be instability due to that singularity being surrounded by no supporting spacetime density gradient.

The only thing that can occur at that point is for all of the pure energy that has accumulated into the singularity state of spacetime within the gravitational singularities of all of the black holes over the course of the universe to be released instantaneously in all directions at the speed of light. Now, this is precisely how the moment of the Big Collapse of one cycle of the universe is shared with the exact moment of the Big Bang of the next cycle of the universe.

In this event, 100% of the energy and spacetime of the universe will be recycled into the next cycle of the universe. And so, the inflation stage is begun, and the whole process of events of the Big Bang carries forward once again, with particles again forming out of the quantum fluctuations randomly and the laws of physics carrying out the rest. Because of the random process of the formation of particles, each cycle of the universe will be unique, and different stars and planets will form every time.

That is how the cyclic model of the universe proposed by space density theory unfolds continuously. This is the way it has always been since its creation, and the way it will continue in cycles perpetually. With this logic we can see that there is only one universe, but it continually recycles itself through this process as a natural result of its laws, yielding an infinite number of unique ensuing universes. This makes a great deal more sense to an analytical mind than the proposal of one Big Bang to be followed only by never ending expansion.

Logic concludes that the same laws of physics must persist throughout all cycles of the universe, and indeed must have been determined by God since before the start of the first cycle of the universe. One could represent the cycles of the universe by drawing out a sine wave, though this would not necessarily depict the actual expansion and contraction rates. The sine wave could be extrapolated to a three-dimensional ribbon of cycles, and that ribbon could be connected in a loop to represent the cyclical nature of the system, with no single cycle of the universe being able to tell if it were the first or the last, but always in between.

To finish, I must fulfill the last promise from the opening statements of this section. That is, to clear up the notion that a cyclic model must break the second law of thermodynamics. This problem is solved in through space density theory's explanation that all mass is converted into pure energy in the singularity state of spacetime in black holes, and that pure energy is precisely what fills the Big Collapse singularity, which is also the Big Bang singularity. Thus, black holes recycle all matter back into the pure energy that started the Big Bang, essentially returning to having zero entropy. One can only view the processing of this system as a flawless architecture of Divine conception.

VI. CONCLUSIONS

One can see that modern theoretical physics will be vastly revolutionized if space density theory is found to be experimentally supported and agreed upon by the scientific community in the field of theoretical physics. This should come as no surprise as it has been expected that the theory of quantum gravity would revamp the current understanding of the universe, solve many inconsistencies, and bring about great changes in the field. In this section, it is discussed whether this is a truly complete theory of quantum gravity and what it would mean for the old concept of a Theory of Everything. But first, it must be addressed that this theory most blaring issue regarding the implications of this theory—that it basically destroys the most currently agreed upon model of the universe, the Lambda-Cold Dark Matter (Λ-CDM) model.

Λ-CDM Model?

Though the Lambda-Cold Dark Matter model has found much support, it was based upon a lack of knowledge about the universe, having the hypothetical dark matter and dark energy as foundational components of the model. As has been discussed, this theory explains that neither dark matter nor dark energy are existent, making it blaringly apparent that this Λ-CDM model must be replaced. The good news is that a replacement model should be able to be built that does not depend on hypothetical unfound particles and forces.

After all is considered, the Λ-CDM model will likely come to be viewed as the greatest misreckoning of modern theoretical physics. It was all founded upon a lack of understanding of quantum gravity and molded together into a way that fit so that each hypothetical value seemed to complement the other. The understanding of quantum gravity provided from *Space Density Relativity & Higgs Field Occupancy*, along with the cosmological implications discussed in this document, should be able to provide a more resolute replacement for the Λ-CDM model based primarily upon matter and energy that is known to exist now that the structure of spacetime and gravitation is properly understood.

Theory of Everything?

The theory of quantum gravity is attained through the theories of space density relativity and Higgs field occupancy, which shows gravitation to be an emergent function of the structure of spacetime itself on particles, rather than being a force carried out by a boson force carrier. Because of this, there is no need to try to unite gravity with the three gauge interactions toward a Theory of Everything. This proposed unification does not actually even make sense considering that gravitation is not mediated by a gauge boson. Thus, the idea that a Theory of Everything could represent every interaction in a single formula should be discarded.

Complete Theory of Quantum Gravity?

In *Space Density Relativity & Higgs Field Occupancy*, an explanation for quantum gravity is provided, along with the basis for an equation to calculate the force of gravity on any individual quantum particle. Nonetheless, the question must be asked, “Is this the true and complete theory of quantum gravity?” One particular checklist for a quantum theory of gravity that can be referenced to consider this question comes from a 2003 paper by Lee Smolin titled, "*How far are we from the quantum theory of gravity?*" (arXiv:hep-th/0303185). The table below comes from page 60 of that paper, and has had a third column added for space density theory (SD Theory).

Table 1: Summary of results. A=solved. B=partial results, or solved in some cases, open in others. C=in progress using known methods. ?=requires the invention of new, so far unknown methods. -=makes no claims to solve. --=claims problem non-real.

	String Theory	Loop QG	SD Theory
Quantum Gravity			
1. *GR and QM true or need modification?*	A	A	A
2. *Describes nature at all scales?*	B	A	A
3. *Describes quantum spacetime geometry?*	B	A	A
4. *BH entropy and temperature explained?*	B	A	A (--)
5. *Allows* $\Lambda > 0$*?*	?	A	? (--)
6. *Resolves singularities of GR?*	B	B	A
7. *Background independent?*	?	A	A
8. *New predictions testable now?*	?	B	B
9. *GR as low energy limit?*	A	B	A
10. *Lorentz invariance kept or broken?*	A	B	A
11. *Sensible graviton scattering?*	B	C	A (--)
Cosmology			
1. *Explains initial conditions?*	?	C	A
2. *Explains inflation?*	C	C	A
3. *Does time continue before Big Bang?*	?	A	A
4. *Explains the dark matter and energy?*	?	?	A (--)
5. *Yields transplankian predictions? (CMB)*	C	C	A
Unification of Forces			
1. *Unifies all interactions?*	A	-	A (-)
2. *Explains* $SU(3) \times SU(2) \times U(1)$ *and fermion..?*	?	-	C
3. *Explains hierarchies of scales?*	?	-	A
4. *Explains values of standard model parameters?*	?	-	A
5. *Unique consistent theory?*	?	-	A
6. *Unique predictions for doable experiments?*	?	B	B
Foundational Questions			
1. *Resolves problem of time in QC?*	?	C	A
2. *Resolves puzzles of quantum cosmology?*	?	C	A
3. *Resolves the black hole (evaporation) puzzle?*	C	C	A (--)

*The explanation for most of these questions can be found in the text of this document or in the original document titled, *Space Density Relativity & Higgs Field Occupancy*. The answers given here under SD Theory are obviously biased and will require further review from people other than the author of this paper, but have been given here to show by comparison how effective this theory of quantum gravity truly is.

From this, space density theory appear to have the potential to surpass both string theory and loop quantum gravity as the complete theory of quantum gravity, so long as it is actually taken into consideration and worked on by professionals in the field. The fact that this theory completes all of these questions suggests that it is a correct depiction of nature. In all, space density theory appears to be the missing link to tie together all of the loose ends in modern theoretical physics. If so, this theory should help modern physics finally achieve what it has been working towards for nearly a century: a complete theory of quantum gravity.

Afterward

Having all of the questions of the fate of the universe answered all at once can set a person back, leaving one pleasantly perplexed, to bask in its magnificence for a moment. It gives a sense of resolve, a relief to finally be able to envision how it all works. Eventually however, this sanctity diminishes and one is lead to the next natural inquiry: Why? Upon reaching this, the first and final question to ever be asked, one has moved beyond the scientific realm and into that of the transcendental. It is an entirely separate task to attempt to find what can be argued philosophically about the age-old questions of origin, meaning, and destiny.

Still, even when considering only physics it seems that one must inescapably concede at some point to a Higher Power—as occurred twice in this text. Another issue in physics is the quantum enigma, which shows that according to quantum mechanics an observer is required for there to be any reality beyond probabilities. This would ultimately mean that there must be an Observer of the universe before any life evolves within it to solidify the probabilities and constitute one reality as opposed to only probabilities. This idea leads to the conclusion that God not only created the laws of physics that constitute reality, but that God's observation of the universe is what makes it reality.

These, of course, are the type of questions that no scientific theory will ever be able to answer resolutely. Instead, it seems it must have been the intention to leave these questions for each individual to give their own mindful response.