Cosmological Considerations in the Quantum Theory of Relativity: An Observationally Verifiable Quantum Theory of Gravity that Defines Black Holes, Explains Dark Matter, Predicts Dark Energy, and Establishes the Big Bang

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Abstract

If space is quantized on a compactified fourth spatial dimension as outlined in Kaluza-Klein theory -- with the extreme curvature of the fourth spatial dimension causing the 'effect' of gravity -- but we experience three-dimensional (inverse-square) gravity, then the fourth spatial dimension must operate as one stand-alone spatial dimension.

In one spatial dimension, quantum gravity is the same (effectively 100%) whether two objects are together or apart.

This deductive quantum theory of relativity can then be projected to: (1) define black holes as wormholes into the fourth spatial dimension; (2) explain dark matter as photons which traveled through black holes and into the fourth spatial dimension; (3) predict dark energy to be the warping of the fourth spatial dimension in the presence of dark matter photons; and (4) establish the big bang as the beginning of three flat spatial dimensions in a cyclic universe.

Key words: quantum gravity, black hole mechanics, dark matter, dark energy, big bang

1. Introduction

In 1919, Theodore Kaluza examined Einstein's equations generalized to a five-dimensional space-time in which the "extra" fifth (fourth spatial) dimension was a small compact circle. Pagels, Heinz, Perfect Symmetry, pg 326.

Kaluza showed that if the fifth dimension is SEPARATED FROM THE OTHER FOUR (emphasis added), Einstein's equations naturally emerged along with Maxwell's equations for electromagnetism. Kaku, Michio, Einstein's Cosmos (2005), pg 154; Baggott, Jim, Farewell to Reality, pg 183.

In 1926, Oskar Klein calculated the radius of the little circle in the fifth dimension to be about 10^-30cm. Pagels at 327.

There is no foreseeable means by which we could see this miniscule dimension; nor could we detect movements within it. Yau, Shing-Tung & Nadis, Steve, The Shape of Inner Space, pg 13; Kaku, Michio, Hyperspace (1995), pg 106.

Because we would not know about the additional spatial dimension unless we could detect evidence of structure on its minute scale, the Kaluza-Klein universe would look three-dimensional. Randall, Lisa, Warped Passages (2006), pg 39.

After the 1930's, Kaluza-Klein theory fell out of favor (Pagels at 327), in part because Einstein could not derive the electron from his gravitational field equations as expressed in five space-time dimensions, and in part because it predicted a particle that has never been shown to exist. Yau & Nadis at 13.

However, Einstein's inability to derive the electron in four spatial dimensions is consistent with both the original basis of Kaluza's theory -- the extra spatial dimension being separated from the other three (Kaku (2005) at 151) -- and observation, because we can simply ignore an extra spatial dimension that is too small to have effects at the distance in question. Randall (2006) at 28-30.

Further, as will be shown below, KK particles -- mass projections into four space-time dimensions of momenta carried by particles (photons) moving in the extra dimension -- make up the dark matter of our universe.

Current experimental constraints tell us an extra dimension cannot be any larger than 10^-17cm. This means an extra dimension could be much bigger than the Planck scale length (10^-33cm) -- say the size Klein calculated of 10^-30cm -- and still have evaded detection. Randall (2006) at 359.

Since Einstein could not derive the electron from four spatial dimensions because the extra dimension is separate from the other three and too small to be seen, and experiments cannot probe for KK particles smaller than 10^-17cm, the best way to think about the dimensionality of our universe is that we live in three spatial dimensions, and the fourth spatial dimension operates as one stand-alone spatial dimension (with no dimension for time).

This paradigm is supported by deductions from general relativity indicating that space is curved, and suggesting that our universe consists of the flat three-dimensional surface of a four-dimensional hypersphere. Ralphs, John, Exploring the Fourth Dimension, pg 56.
This also makes sense because space-time itself is four-dimensional and would require an even higher dimensional ambient space. Bojowald, Martin, Once Before Time, pg 27.

Finally, our flat universe being imbedded in a higher dimensional hyperspace still yields the Standard Model because the Yang-Mills equations operate within the context of our four-dimensional space-time. Yau & Nadis at 65.

Therefore – if Klein's calculations are correct – space is quantized on a compactified fourth spatial dimension about 10^-30 centimeters in radius.

2. Quantum Gravity

If the fourth spatial dimension operates as one stand-alone spatial dimension, then quantum gravity is the 'effect' of gravity at 100% in the fourth spatial dimension.

According to general relativity, gravity is an illusion caused by curvatures in space-time. "Gravitation is not to be regarded as a force; for, to an observer who is falling freely, there is no gravitational force to be felt. Instead, gravitation manifests itself in the form of space-time curvature." Penrose, Roger, The Road to Reality, pg 459.

If space is quantized on a compactified fourth spatial dimension, then it is the extreme curvature of this fourth spatial dimension that causes the 'effect' of gravity.

The strength of the gravitational effect is tied directly to the number of spatial dimensions: in one dimension it is the same if objects are close together or very far apart; in two dimensions it is twice as much if objects are closer that if they are far apart; in three dimensions it obeys an inverse-square law; and in four dimensions it should decrease as the inverse cube of the distance. Kaku (2005) at 231.

If our universe consists of four spatial dimensions, implying gravity should decrease as the inverse cube of the distance, but we experience three-dimensional (inverse-square) gravity – then the fourth spatial dimension ("hyperspace") must operate as:

1/x^3 - 1/x^2

If x = 4 (representing four spatial dimensions total), then hyperspace = ¼ of x, or one spatial dimension.

In plain English, inverse cube minus inverse square operates as one stand-alone spatial dimension.

In one spatial dimension, quantized gravity is the same (effectively 100%) whether two objects are together or apart.

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Physicists believe that, at the ultrahigh energies and temperatures that existed in the first split second of the universe's existence, the forces of nature actually merged, or unified, into a single "superforce." According to the generally accepted picture of this unification, the three non-gravitational forces merge first; then at a higher energy, gravity joins the party. Chown, Marcus, The Universe Next Door, pg 64.

When bits of matter approach one another to within the hyperspace length (10^-30cm), gravity has not become "stronger" than the other forces, gravity is effectively the only force operating in the fourth spatial dimension, and there are no other forces.

This should be thought of – not as the four forces unifying into one superforce, but – as the three nuclear forces merging into gravity.

If gravity is a source of energy (Clegg, Brian, Gravity (2012), pg 157), and energy and mass are interchangeable (via E=mc^2), then gravity is equivalent to mass in the fourth spatial dimension.

The three other forces merging into gravity in hyperspace explains why the subatomic field equations look so vastly different from the field equations of Einstein – why the nuclear forces seem so different from gravity. Kaku (1995) at 26.

They operate in different dimensions that refuse to intersect. Clegg (2012) at 184.

The Standard Model operates in our three spatial dimensions, and gravity is quantized in the standalone fourth spatial dimension of hyperspace.

Therefore, quantum gravity is the effect of gravity at 100% in the fourth spatial dimension.

3. Black Holes

A black hole is a wormhole into the fourth spatial dimension.

Normally, to accelerate any object carrying mass to the speed of light requires an infinite amount of energy. Baggot at 93.

Hence, the speed of light cannot be reached because it is impossible to transfer an infinite quantity of energy to a moving body.

But gravity is different; there is no stopping the force of gravity – which must crush objects all the way to 10^-30cm, the hyperspace length, because once we establish that space is quantized, then nothing, not even a singularity, can be without dimension, as there is no meaning smaller than one lump. Clegg (2012) at 189, 203.

Thus, during a complete gravitational collapse, matter is actually accelerated to the speed of light; with each particle shrinking to 10^-30cm and entering the fourth spatial dimension.

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Taking the neutron view of the collapse, the Pauli Exclusion Principle will not allow wave-functions to overlap, so to keep neutrons from invading each other, they all start to vibrate frenetically – accelerating faster as gravity forces the core to collapse. As each neutron accelerates, its mass increases and it shrinks, until, upon reaching the speed of light, it is finally small enough to enter hyperspace.
This explains the speed of light as a fundamental constant: if the fourth spatial dimension were larger than 10^-30cm, the speed of light would be slower, and if it were smaller, the speed of light would be faster.

According to Heisenberg's uncertainty principle – one cannot determine both the location and the velocity of a particle at the same time. Kaku (2005) at 164.

If you knew exactly what momentum a quantum particle had, it literally could be anywhere in the universe. Clegg, Brian, The God Effect (2009), pg 18.

When a particle accelerates to the speed of light, and thus its momentum is known with certainty, it actually is anywhere (or everywhere) because it has entered the fourth spatial dimension.

A star becomes a black hole precisely when the escape velocity from the collapsing star reaches the speed of light. Gribbin, John, Unveiling the Edge of Time, pg 79.

As matter accelerates to – and then actually achieves – the speed of light, time comes to an end at the heart of a black hole because hyperspace operates as one stand-alone spatial dimension with no dimension of time. This implies that time is an illusion caused by our three large, expanding spatial dimensions.

A "singularity is always produced by gravitational collapse, and the equations tell us that a black hole consists of an event horizon, a singularity, and nothing at all in between the two." Gribbin at 130.

If one has a hyper-spherical space [four spatial dimensions], then the view that all the singularities are the same point is consistent with all black holes being connected mathematically; but they are also physically connected through hyperspace because the fourth spatial dimension connects all three dimensional objects and every point in them. Violette, John, Extra-Dimensional Universe, pg 32.

The equations of general relativity provide for the possibility of such hyperspace connections -- "wormholes." Einstein with Rosen discovered that Schwarzschild's solution to Einstein's equations actually represents a black hole as a bridge between two regions of space-time -- an Einstein-Rosen bridge. Gribbin at 151.

Therefore, a black hole is really a "wormhole" -- connecting two separate regions of our universe; our four-dimensional space-time and the stand-alone fourth spatial dimension of hyperspace.

4. Dark Matter

4.1 Dark Matter Primer (the "what")

Any particle that is moving must have energy, and according to E=mc^2, if you have energy, you have mass. Through the Wormhole (TV Series): Are There More Than 3 Dimensions?

That gave [UC Irvine] physicist Tim Tait a flash of inspiration about what dark matter particles might actually be and how they might lead us to discovering the fourth dimension. Id.

"So photons are particles of light, but if there's another direction that photons can travel in, we can actually get a dark matter particle by just taking these massless photons and letting them move around in a circle in the extra dimension." Id.

Professor Tait is right, dark matter is actually made of light -- massless particles that appear to have mass because they are racing around a tiny fourth-dimensional loop that is too small for us to see. Id.

But how and when did these photons leave our three-dimensional world and enter the fourth dimension? Id.

Through black holes -- wormholes into the fourth spatial dimension.

4.2 Dark Matter Explanation (the "how")

Dark matter consists of photons which traveled through black holes and into the fourth spatial dimension.

Time stops at the event horizon of a black hole, where matter is gravitationally accelerated to the speed of light, becoming small enough to enter hyperspace -- which operates as one stand-alone spatial dimension with no dimension for time.

But what is time to a photon?

Nothing.

Photons do not "experience" time.

Thus photons, traveling at the speed of light, will pass right through a black hole's singularity/wormhole and into hyperspace -- effectively becoming Kaluza-Klein (KK) particles (with momentum in the extra dimension).

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Photons transfer electromagnetic force because they carry energy and momentum. Frebel, Anna, Searching for the Oldest Stars, pg 21.

In three dimensions, light oscillates in a two-dimensional fashion while moving forward through the third dimension -- the electrical and magnetic fields oscillate at right angles to one another.

Thus dark matter is "dark" -- meaning electrically neutral -- because when "light" exists in one spatial dimension, "light" cannot oscillate through any dimensions, and can only move forward through the one dimension available to it. One-dimensional "light" is not visible to us.

4.3 Dark Matter Observations

4.3.1 The Structure Formation Problem

If to be accurate over small distances, computer simulations need more dark matter and shorter time steps, and to be accurate over large distances, simulations need less dark matter and larger time steps (Gates, Evalyn, Einstein's Telescope, pg 181) -- then dark matter is not a constant; it must be increasing over time.

The question of how, in a generally homogeneous universe, primordial fluctuations produced the vast structures represented by superclusters of galaxies -- can finally be answered if at

Time = 0 (the Big Bang)

there is no dark matter, it increases over time, and at

Time = Present

it makes up about 27% of critical density.

If dark matter consists of photons which traveled through black holes and into the fourth spatial dimension, then (what appears to be cold) dark matter's gravity would have jump-started the formation of structure after the first pre-galactic generation of stars collapsed to form black holes -- without leaving any imprint on the cosmic microwave background.

4.3.2 Super-Massive Black Holes

Enormous black holes weighing one-thousand to ten billion solar masses are ubiquitous in the universe, and until now there has been no good explanation of where they came from.

Super-massive black holes must have formed almost contemporaneously with the first generation of stars in the universe -- and indeed, dark matter begins to collapse at about 210 million years after the Big Bang, into the filament web seen today, 13.5 billion years later. Gates at 230.

Astronomers have discovered billion solar mass black holes that already existed nine billion years ago, but starting from small seed objects, there is not enough time to produce these ancient super-massive black holes by mergers or accretion.

Enter the additional gravitational attraction of each black hole caused by dark matter. Regions collapsed sooner in the presence of dark matter than would have been possible with only ordinary matter because the greater total mass-energy density allowed matter to accumulate faster. Randall, Lisa, Dark Matter and the Dinosaurs (2015), pg 60.

Thus, the very first generation of stars in the universe are responsible for producing giant black holes. And every one of them likely provided the gravitational impetus for galaxy formation, because dark matter is what initially attracted the visible matter to the denser regions where galaxies could emerge. Id.

4.3.3 Galaxy Formation

The centrality and ubiquity of super-massive black holes in galaxies strongly suggests that they played important roles in how galaxies formed.

The earliest visible galaxies emerged half a billion years after the cosmic microwave background, and in 2004, astronomers claimed to find a galaxy formed less than one billion years after the Big Bang.

Dark matter started the collapse into structure. Each galaxy has a super-massive black hole at its center - which came first, allowing dark matter photons to accumulate.

As with all galaxies, dark matter then attracted the ordinary matter that makes up what we see. Id at 67. Without dark matter, there would not have been enough time to form the structure that we now observe. Id at 04.

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The Milky Way and all other galaxies are surrounded by a large halo of dark matter. Frebel at 268.

Importantly, the roughly spherical dark matter halos have density highest in the center. Gates at 179.

Stellar motions (flat rotation curves) imply that galaxies contain a lot of unseen mass, but do not tell us precisely where it is located. Keeton, Charles, A Ray of Light in a Sea of Dark Matter, pg 26.

But there is a super-massive black hole at the center of every galaxy, even our own. Randall (2006) at 113; Gribbin at 112.

There are also plenty of stars in our galaxy, probably between 200 and 400 billion. Frebel at 73.

The inference from Cygnus X-1 is that there are hundreds of millions of black holes in our galaxy alone -- though very few of them have actually been detected. Gribbin at 111.

Just the disk of the Milky Way should be home to millions of stellar-mass black holes. Gates at 112.

Since there is nothing unusual about our own galaxy, this calculation also suggests that every galaxy in the universe must contain stellar mass black holes in comparable profusion. Gribbin at 112.

Further, all evidence suggests mass distributions in elliptical galaxies similar to mass distributions that give rise to flat rotation curves in spiral galaxies. Keeton at 30.

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Our Milky Way is surrounded by only about 40 dwarf galaxies, not over a hundred as found in the simulations. Frebel at 272.

This discrepancy between observations and simulations can likely be attributed to dark matter not being a constant since the Big Bang -- but increasing over time from black holes.
Ultra-faint dwarf galaxies have particularly high concentrations of dark matter (Id at 144) -- which can now be explained because dwarf galaxies consist of old stars, larger because of their low metallicity, which collapse into black holes and absorb photons.

4.3.4 Groups and Clusters of Galaxies

From observations it appears that all of the dark matter in groups of galaxies can be explained in terms of the dark matter around individual galaxies.

Further, there is no evidence for additional dark matter (beyond that of each individual galaxy) in the intergalactic space of groups and clusters (Tucker, Wallace & Karen, The Dark Matter, pg 139), or the local supercluster (Id at 145), or in the voids (Id at 162).

4.3.5 The Bullet Cluster

On 21 August 2006, NASA released observations of a massive collision between two clusters of galaxies - known collectively as the Bullet Cluster.

The cores of the two clusters collided about 100 million years ago, and astronomers found that dark matter had separated from normal matter. The atomic material lost a great deal of energy and settled into a single clump at the interaction region, while the dark matter underwent no interactions as it passed right through the center, emerging on either side of the collision.

The supposition that dark matter consists of photons which traveled through black holes and into the fourth spatial dimension perfectly explains why the cores of the two clusters -- atomic material in our three spatial dimensions -- collided and settled, while the dark matter in the fourth spatial dimension passed through unhindered to emerge on either side.

As a thought experiment, what would happen to the individual galaxies comprising the Bullet Cluster once the atomic material collided and the dark matter passed through unhindered?

In theory, a galaxy effectively stripped of its dark matter in a collision/merger should rotate slower and weigh less.

4.3.6 NGC 1052-DF2

On 28 March 2018, NASA released observations of a unique galaxy called NGC 1052-DF2 that is missing most of its dark matter.

Observations revealed that globular clusters in 1052-DF2 were moving at relatively slow speeds (less than 23,000 miles per hour) -- while stars and clusters in the outskirts of galaxies containing dark matter move at least three times faster. DF2's mass was calculated from those measurements, and the stars in the galaxy can account for all of the mass -- i.e., the galaxy weighs less than it should.

Importantly, NGC 1052-DF2 lies not far from giant elliptical galaxy NGC 1052, whose previous merge is likely what stripped the dark matter from DF2 after formation -- as opposed to what donated the atomic material for DF2 to form without dark matter.

5. Dark Energy

If dark matter consists of photons which traveled through black holes and into the fourth spatial dimension, then dark energy is predicted to be the fourth spatial dimension warping in the presence of energy from dark matter.

The fabric of our familiar four space-time dimensions warps in the presence of matter-energy. Kaku (1995) at 91.

Thus, the fourth spatial dimension should also warp in the presence of matter-energy -- just inversely to our large dimensions, and at an ever-accelerating rate if dark matter is increasing.

"A moving internal dimension could alter the expansion of the universe, just as squeezing one direction of a balloon inflates the free direction." Levin, Janna, How the Universe Got Its Spots, pg 196.

To continue the balloon analogy: every black hole that collapses to the same "point" of the fourdimensional hypersphere is like another mouth added to the hyperspace balloon -- but instead of air blowing into a balloon, black holes (wormholes) allow photons into hyperspace, adding energy, warping the hyperspace dimension, and driving an ever-accelerating expansion of our three flat spatial dimensions.

This is consistent with the strong implication that whatever is causing the acceleration of the universe now, was less important or even absent during the universe's early stages. After the cosmos spent its first seven billion years slowing down, dark energy appeared about halfway through the universe's expansion and has been accelerating (to become dominant) ever since.

Therefore, dark energy is predicted to be the fourth spatial dimension warping in the presence of energy from dark matter.

6. The Big Bang

If dark energy is the fourth spatial dimension warping in the presence of energy from dark matter, then the Big Bang is the beginning of three flat spatial dimensions in a cyclic universe.

Once space-time itself is quantized -- as ours is quantized on the fourth spatial dimension -- that, too, must be subject to an uncertainty principle. Relativity places no limit on how fast space can swell, but applying quantum theory to space-time itself does not require this extension to general relativity. Clegg (2012) at 200-201.

Thus, applying quantum mechanics to space-time itself effectively discounts inflation as a theory because space cannot expand faster than light.

Since matter must be accelerated to the speed of light to become small enough to enter the fourth spatial dimension, it is reasonable to theorize that the dark energy expansion rate seems fated to also accelerate to the speed of light -- to complete fragmentation of our three spatial dimensions.
The hyperspace balloon will pop, with a Big Snap -- the fabric of space revealing a lethal granular nature when stretched too much -- leading to a dimensional inversion.

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The expansion of the universe out of the Big Bang is the mirror image -- as far as the equations of general relativity are concerned -- of the collapse of a dense star into a black hole. Gribbin at 93.

Thus, if a black hole is a wormhole into the fourth spatial dimension, then the Big Bang must be an inversion out of the fourth spatial dimension.

As dark energy expands the fabric of space-time to the speed of light, space itself will SNAP -- essentially vaporizing our entire three-dimensional universe; hyperspace will CRACKLE as pure energy; then a new three-dimensional universe will POP into existence. Snap -- Crackle -- Pop.

The first great fragmentation of the forces occurred at the beginning of the universal expansion, when the effect of gravity -- quantized in the fourth spatial dimension -- separated from the nuclear forces. Within a tiny fraction of a second, the geometry of the universe was frozen into the dimensionality it would maintain until today.

With three flat spatial dimensions on the surface of a four-dimensional hypersphere, the entire universe possesses zero net total energy. The Great Courses, The Inexplicable Universe: Unsolved Mysteries (Neil deGrasse Tyson).

If the universe is flat and possesses zero net total energy, you can create the entire universe out of nothing, because nothing has no net energy associated with it. The fact that we live in a zero energy universe bypasses the line of questioning regarding where the energy came from, and what was the original source. Id.

Quantum relativity always provides time before the Big Bang, but not a starting point of the universe a finite time ago. Cf. Bojowald at 225.

Thus, with its four total spatial dimensions (one compactified spatial dimension separated from three large, flat, expanding spatial dimensions), the universe really is the only -- and the minimum -- perpetual motion machine.

"When the solution is simple, God is answering." Albert Einstein.

Therefore, the Big Bang is the beginning of three flat spatial dimensions in a cyclic universe.

7. Conclusion

If space is quantized on a compactified fourth spatial dimension, but we experience three-dimensional (inverse-square) gravity, then the fourth spatial dimension must operate as one stand-alone spatial dimension.

In one spatial dimension, quantum gravity is effectively 100%, which defines a black hole as a wormhole into the fourth spatial dimension.

If black holes are wormholes into the fourth spatial dimension, then dark matter consists of photons which traveled through black holes and into hyperspace.

This theory perfectly explains every single dark matter observation available, including: (1) the structure formation problem, (2) super-massive black holes, (3) galaxy formation, (4) groups and clusters of galaxies, (5) the Bullet Cluster, and (6) newly published observations of NGC 1052-DF2 as a galaxy without dark matter.

Further, if dark matter consists of photons in hyperspace, then quantum relativity predicts dark energy to be the warping of hyperspace from dark matter.

The expansion rate of dark energy seems fated to accelerate to the speed of light -- leading to the complete fragmentation of space and a dimensional inversion causing another Big Bang as the beginning of three flat spatial dimensions in a cyclic universe.

Since our universe has three flat spatial dimensions (on the surface of a four-dimensional hypersphere), it possesses zero net total energy and can be created from nothing.

Regarding his work on the unified field theory, Einstein said he would give anything for a simple physical picture to guide his [mathematical] path. Now we have that picture. Finding the answer to the Theory of Everything is the ultimate triumph of human reason -- for now we know the mind of God.

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