On a Quantum Theory of Relativity: Re-Defining the Fourth Spatial Dimension to Solve the Theory of Everything

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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 (4-3=) one stand-alone spatial dimension .

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

This quantum theory of relativity can then be projected to fully explain black hole mechanics, which solves dark matter, which predicts dark energy, which explains the big bang in a cyclic universe -- which completes the "theory of everything."

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

I. Space is quantized on a compactified fourth spatial dimension about 10^-30 centimeters in radius.

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; Brockman, John, Science at the Edge, pg 405.

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 (Baggott at 203) -- make up the dark matter of our universe. Hooper, Dan, Dark Cosmos, pg 131.

Current experimental constraints tell us an extra dimension cannot be any larger than 10^-17cm. Randall (2006) at 359.

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. Id.

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 high 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.

II. Quantum gravity is the "force" of gravity at 100% -- with no other forces -- in the fourth spatial dimension.

Gravity is an illusion caused by curvatures in space-time. Kaku (1995) at 92, Fig. 4.1.

In standard three-dimensional physics, the weakness of gravity is a huge puzzle. Randall (2006) at 06.

In general relativity, since gravity is seen as a distortion of space -- implying an extra (ambient) dimension in which that distortion can take place -- it is the leakage of gravity in the extra dimension that makes the force of gravity so relatively weak. Clegg, Brian, Before the Big Bang (2011), pg 208.

If we could measure gravity's strength over distances smaller than the size of the extra dimension, we would find it to be stronger. Greene, Brian, The Hidden Reality (2011), pg 94.

Gravity 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 than 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. Through the Wormhole (TV Series): Are There More Than 3 Dimensions?; Greene, Brian, The Fabric of the Cosmos (2005), pgs 395-396; Cox, Brian and Forshaw, Jeff, The Quantum Universe (2013), pg 15; Kaku (2005) at 231.

If there are a total of four spatial dimensions, but we experience three-dimensional gravity, this leaves the fourth spatial dimension (hyperspace) operating as (4-3=) one stand-alone spatial dimension, where gravity is the same (effectively 100%) whether two objects are together or apart.

If hyperspace gravity is effectively 100%, then there is no "room" for any other forces.

Thus gravity is as weak as it is because of the small curvature of the fourth spatial dimension. Unzicker, Alexander & Jones, Sheilla, Bankrupting Physics, pg 165.

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If space-time is quantized, then nothing, not even a singularity, can be without dimension, as there is no meaning smaller than one lump. Clegg, Brian, Gravity (2012), pg 219.

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." Chown, Marcus, The Universe Next Door, pg 64.

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. Id.

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 (2012) at 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 concentrated in the fourth spatial dimension.

One criteria for the unified field theory is that it reproduce the uncertainty principle in some approximation. Kaku (2005) at 174.

Before the force symmetry is broken, all the particles involved are identical (Baggott at 139) -- which can be thought of as not yet "particles," but pure energy (radiation).

In a dimension of pure energy, we would not know where any one "particle" is located.

Furthermore, Roger Penrose stated: "I see no escape from a gross time-asymmetry being a necessary feature of Nature's quantum-gravity union." Penrose, Roger, The Road to Reality, pg 818.

A strange thing happens when you use the Wheeler-DeWitt equation to reconcile Einstein's relativity with quantum mechanics: you're left with an equation that has no "T" for time. Through the Wormhole (TV Series): Does Time Really Exist?

Time is an illusion, and this is consistent with space being quantized on a hyperspace dimension operating as one stand-alone spatial dimension with no dimension for time.

III. Black Hole Mechanics

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

For a collapsing star with a mass of more than about three solar masses total, the pressure at its CENTRE (emphasis added) -- see Penrose, supra at 709 (there is no resting configuration for a cold object of more than roughly two solar masses (and probably not more than 1.6 solar masses)) -- would be too large for the compressed neutrons to resist, and it would collapse into a black hole. Woolfson, Michael, Time, Space, Stars, Man, pg 107.

Normally, to accelerate any object carrying mass to the speed of light requires an infinite amount of energy. Baggott 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. Halpern, Paul, Cosmic Wormholes (1992), pg 29.

But gravity is different; there is no stopping the force of gravity. Clegg (2012) at 203.

Because gravity is a form of energy, it can behave like matter, creating yet more gravity. Schnittman, Jeremy, A Brief History of Black Holes, Astronomy Magazine, pg 32 (Oct. 2016).

Gravity 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.

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

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 the neutron accelerates, its mass increases and it shrinks, until, upon hitting the speed of light, it is finally small enough to enter hyperspace.

If the fourth spatial dimension were larger than 10^-30cm, say 10^-27cm, the speed of light would be slower, and if it were smaller, say 10^-33cm (the Planck length), the speed of light would be faster.

The extreme of huge mass and small size leading to large density invalidate the sole use of general relativity and require quantum mechanics. Greene, Brian, The Elegant Universe (2010), pg 344.

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.

A "singularity" is always produced by gravitational collapse (Pickover, Clifford, Black Holes -- A Traveler's Guide, pg 87), 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." Gribbin at 151.

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. Id.

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

The mouth of a wormhole is a sphere, the three-dimensional equivalent of a porthole (Ferris, Timothy, The Whole Shebang, pg 100); but a trapped surface is a two-dimensional surface. Wald, Robert, Space, Time, and Gravity, pg 86.

Roy Kerr found that a massive rotating star does not collapse into a point, the spinning flattens until it is compressed into a ring. Kaku (1995) at 226.

Rather than a point singularity, a rotating Kerr black hole has a ring singularity. Halpern, Paul, Edge of the Universe (2012), pg 164; Scharf, Caleb, Gravity's Engines, pgs 107-108.

Adding rotation to a black hole transforms the nature of the singularity, thereby opening the gateway to another dimension.

[III.-B. omitted here]

C. The Cosmic Censorship Hypothesis is correct -- "God abhors a naked singularity."

Just as it takes money to make money, it takes matter to accelerate matter to the speed of light.

But all matter is not under the same amount of pressure.

The core of a neutron star is under more intense gravity than its crust. Pagels at 50.

If we know that it takes about three solar masses total for the pressure at the CENTRE (emphasis added) to collapse into a black hole (Gribbin at 77), and Penrose calculated there is no resting configuration for a cold object of more than roughly two solar masses (and probably not more than 1.6 solar masses)(see above) -- then we can speculate that it takes about 1.5 solar masses on the outside to luminally accelerate a core of about 1.5 solar masses on the inside.

The wormhole forms because the outer 1.5 solar masses push down on the inner 1.5 solar masses, accelerating the matter in the core to the speed of light -- thus making it small enough to enter hyperspace.

The outer 1.5 solar masses is not under enough pressure to accelerate to the speed of light, so the outer mass becomes the event horizon -- which is causing the force needed to maintain the center 1.5 solar masses under enough pressure to remain in hyperspace.

When matter is added to the outer event horizon, an equal amount of matter on the inner event horizon will now be under enough pressure to accelerate to the speed of light and enter hyperspace, thus expanding the interdimensional wormhole.

Gravitational collapse always results in a black hole -- a wormhole into hyperspace -- but since only matter can accelerate matter to the speed of light, naked singularities (and primordial black holes) cannot be produced.

A "naked" singularity is lacking an event horizon, and since the event horizon is the matter needed to accelerate the core and create the wormhole, a singularity cannot exist without its event horizon.

[III.-D. omitted here]

[Dark Matter: Facts and Procedural History omitted here]

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.

Tim 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.

IV. 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 (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). Pickover, Clifford, Surfing Through Hyperspace, Appx H, pg 229.

So 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.

Thus, once photons pass through the wormhole and into the fourth spatial dimension, they should no longer be thought of as traveling at the speed of "light" -- but instead at the speed of "dark."

As in "dark" matter.

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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 (Ferris at 38-39) -- 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 26% of critical density. Freese, Katherine, The Cosmic Cocktail, pg 61.

If dark matter consists of photons which traveled through black holes and into the fourth spatial dimension, then 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 microwave background. Lemonick, Michael, Echo of the Big Bang, pg 74.

Regions collapsed sooner in the presence of dark matter than would have been possible with only ordinary matter because the greater total matter energy density allowed matter to accumulate faster. Randall, Lisa, Dark Matter and the Dinosaurs (2015), pg 60.

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 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.

Regarding the Bullet Cluster and related mergers, dark matter photons in hyperspace explains why the cores of the two clusters (atomic material in our three spatial dimension) collides and settles, while the dark matter in the fourth spatial dimension passes through unhindered.

Finally, a sound theory needs to make at least one specific prediction that leads to observations. Panek, Richard, The 4% Universe, pgs 14-15, 18.

The more mass an object has, the stronger its gravitational pull; the stronger the pull, the faster the (change in) motion. Gates at 22.

If black holes create dark matter by absorbing photons, then the amount of dark matter is increasing. The bigger the black hole, the more dark matter. The more dark matter, the more gravity. The more gravity, the faster objects will move.

This effect has been observed, and existing data already produces the right values to support this theory.

The M-Sigma Relationship is an empirical correlation between the stellar velocity dispersion (sigma) of a galaxy bulge and the mass (M) of the supermassive black hole at its center. Wikipedia: M-sigma relation.

The bigger the black hole, the faster stars fly about in the bulge. Astronomy Magazine, The M-Sigma Relationship, pg 17 (Oct. 2016).

As the galactic supermassive black hole increases in mass, it absorbs more photons, creating more dark matter, causing more gravity, which increases the stellar velocity dispersion in the bulge.

And relatedly, as dark matter increases from stellar black holes scattered throughout each galaxy, the rotation curves will rotate faster in the future (slower in the past) -- but it is unknown if this data could be observed on a human time-scale.

V. Dark energy is the fourth spatial dimension warping in the presence of energy from dark matter photons.

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.

“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.

Pressure is the negative change of energy divided by the change of the volume enclosing the energy amount. Bojowald at 146.

One main property of dark energy: strongly negative pressure (in hyperspace) with positive energy (in our four space-time dimensions). Id at 147.

Every black hole that collapses to the same "point" of the four dimensional hypersphere is like another valve added to the hyperspace balloon.

Instead of someone blowing "air" into the "balloon," wormholes allow photons into hyperspace, adding energy, blowing up the hyperspace balloon, and driving an ever-accelerating expansion of our three flat spatial dimensions.

Once space-time itself is quantized -- as ours is quantized on the fourth spatial dimension -- that, too, must be subject to an uncertainty principle. Clegg (2012) at 201.

Relativity places no limit on how fast space can swell (Greene (2011) at 44), but applying quantum theory to space-time itself does not require this extension to general relativity. Clegg (2012) at 200.

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 enter hyperspace, it is reasonable to theorize that the expansion rate seems fated to also accelerate to the speed of light -- to complete fragmentation of space. Halpern (2012) at 80.

The hyperspace balloon will pop, and every quanta of the fabric of space-time will effectively snap -- leading to a dimensional inversion.

[VI. omitted here]

VII. The Big Bang is the beginning of three flat spatial dimensions in a cyclic universe of snap, crackle, and pop.

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.

Since a black hole "singularity" is a wormhole into the fourth spatial dimension, 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, 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 expansion, when the force of gravity -- concentrated in hyperspace -- separated off from the other forces. Tucker, Wallace & Karen, The Dark Matter, pg 211.

Within a tiny fraction of a second, the geometry of the universe was frozen into the dimensionality it would maintain until this day. Halpern (2012) at 93.

Quantum relativity always provides time before the Big Bang, but not a starting point of the universe a finite time ago. Cf. Bojowald at 255.

Thus, with its four total spatial dimensions (one/three), the universe really is the only -- and the minimum -- perpetual motion machine.

[VIII. omitted here]

IX. The Mind of God

Einstein wanted to read the mind of God; he wanted to know: If I were God, how would I create a universe?

The only way God could: with three flat spatial dimensions on the surface of a four-dimensional hypersphere.

The universe is perfectly flat. That means 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. Id.

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.

Thus God created the universe the only way he could with nothing.

The universe is entirely self-contained; it does not need anything outside to wind up the clockwork and set it going. Hawking, Stephen, The Illustrated The Universe in a Nutshell, pg 85.

Instead, everything in the universe is determined by the laws of science and by rolls of dice within the universe. Id.

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

Finding the answer to the Theory of Everything is the ultimate triumph of human reason -- for now we know the mind of God.

X. Conclusion

In conclusion, if space is quantized on a compactified fourth special 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 explains a black hole “singularity” 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: the structure formation problem, galactic halos, flat rotation curves, the M-Sigma Relationship, and the Bullet Cluster and related mergers.

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, it possesses zero net total energy and can be created from nothing.

Thus, now we know the mind of God.

References

Astronomy Magazine, The M-Sigma Relationship, pg 17 (Oct. 2016)
Baggott, Jim, Farewell to Reality
Bojowald, Martin, Once Before Time
Brockman, John, Science at the Edge
Chown, Marcus, The Universe Next Door
Clegg, Brian, Before the Big Bang (2011)
Clegg, Brian, Gravity (2012)
Clegg, Brian, The God Effect (2009)
Cox, Brian and Forshaw, Jeff, The Quantum Universe
Ferris, Timothy, The Whole Shebang
Frebel, Anna, Searching for the Oldest Stars
Freese, Katherine, The Cosmic Cocktail
Gates, Evalyn, Einstein's Telescope
Great Courses, The Inexplicable Universe: Unsolved Mysteries (Neil deGrasse Tyson)
Greene, Brian, The Elegant Universe (2010)
Greene, Brian, The Fabric of the Cosmos (2005)
Greene, Brian, The Hidden Reality (2011)
Gribbin, John, Unveiling the Edge of Time
Halpern, Paul, Cosmic Wormholes (1992)
Halpern, Paul, Edge of the Universe (2012)
Hawking, Stephen, The Illustrated The Universe in a Nutshell
Hooper, Dan, Dark Cosmos
Kaku, Michio, Einstein's Cosmos (2005)
Kaku, Michio, Hyperspace (1995)
Keeton, Charles, A Ray of Light in a Sea of Dark Matter
Lemonick, Michael, Echo of the Big Bang
Levin, Janna,How the Universe Got Its Spots (2002)
Pagels, Heinz, Perfect Symmetry
Panek, Richard, The 4% Universe
Penrose, Roger, The Road to Reality
Pickover, Clifford, Black Holes -- A Traveler's Guide
Pickover, Clifford, Surfing Through Hyperspace
Ralphs, John, Exploring the Fourth Dimension
Randall, Lisa, Dark Matter and the Dinosaurs (2015)
Randall, Lisa, Warped Passages (2006)
Scharf, Caleb, Gravity's Engines
Schnittman, Jeremy, A Brief History of Black Holes, Astronomy Magazine, pg 32 (Oct. 2016)
Through the Wormhole (TV Series): Are There More Than 3 Dimensions?
Through the Wormhole (TV Series): Does Time Really Exist?
Tucker, Wallace & Karen, The Dark Matter
Unzicker, Alexander and Jones, Sheilla, Bankrupting Physics
Violette, John, Extra-Dimensional Universe
Wald, Robert, Space, Time, and Gravity
Wikipedia: M-sigma relation
Woolfson, Michael, Time, Space, Stars, Man
Yau, Shing-Tung & Nadis, Steve, The Shape of Inner Space