Beyond the Multiverse

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Abstract

One way to comprehend the very smallest frames of reference is to model the largest. Boundaries of the universe of universes help us better understand the smallest real dimensions, plus intermediate local universe visible dimensions. Challenges regarding infinity, plus the Second Law of Thermodynamics, gravity, and other physics puzzles are more easily resolved.

"To infinity and beyond!" – Buzz Lightyear

Everybody smiles when we recall the ever-optimistic Buzz Lightyear launching out toward his ideal view of infinity and beyond. Because Buzz is actually a cartoon toy, it is easy to appreciate the absurd math joke involving his idea of going out beyond infinity.

The *Platonic world of idealistic math* fails to model the real foundational physical world of *simultaneous energy/matter Coulombic spheres, including* Coulomb's inverse-square law. His inverse square law helps unlock several physics puzzles.

Archaic humans perceived their tribal villages as the center of the flat world hosting their simple visions of protective divinities and ancestors hovering in the sky just above, and demons lurking just below. Today's global humans have come a long way since then, or have we, really?

Today's experimental physics has failed through deficient verifiability to comprehend the actual multiverse of universes. I call the state of astrophysics today the physics paradox. This essay exploring the largest real dimension is needed to help causally frame 21st-century physics inside all physics frames of reference, even the smallest frames we cannot directly measure.

Science is now called to examine the edges of the actual 4D Multiverse, to help mathematically frame every thing and energy therein. It is hard to talk about the contents of a box, or virtual box, without seriously considering the enclosing "box" itself. Extrapolation from frames we think we can verify, outward to what we can never "verify" at high sigma levels is not elegant, and often absurd. It is furthermore dishonest to model gods (or God) beyond space and time, and beyond cause and effect.

Even if there were one or more hypothesized gods "beyond space and time," photonic time itself has a frame-related vector element, which brings forth absurd ideas of what existed before eternal gods existing before space and time. This type of looping inquiry makes as much sense as embracing M-Theory's 10^500 curved hologram universes (still not infinite) which try to ignore the elegant model of 4D vector time itself.

Fancy thought can lead to the totally weird idea of 2D holistic quantum universes with no time/distance dimension, and all their imagined contents being 2D holograms. This is where Hawking's black hole cosmology crashed before clueless fans placed his "Pi Day" cremains between Newton and Darwin. In contrast, Mozart, the great musical genius, was previously tossed into an unknown and unknowable pauper's grave. Where is fair? This cosmological essay considers the 4D multiverse and all frames of reference within its constituent local universes. It seeks to find a way to explain the "edge" of the full multiverse, if there is a zonal edge; and to find how to express in 21st-century terms the proper 4D gravity model that goes down to sub-Planck levels, and equally up to multiversal levels. Without a unified physics gravity model among all actual dimensions there can be no elegant theory of everything (TOE), nor any grand unified theory (GUT).

Why our visible universe is not The Universe

In traditional prehistory there were enough daily challenges to occupy humans without their speculating about unknowable deep space. Puffy clouds were just high enough to keep our floating tribal gods close, and our ancestor spirits closer. Skygazers developed complex astrologies [literally, the "logos," or logic, of the astral stars and visible planets] to augment self-serving ideas of predestination. Cyclical traditions and other comfortable ideas appeared to make the fundamentally unknowable dimensions beyond their everyday consciousness seem knowable.

As societies developed within places like China, Mesoamerica, the Fertile Crescent, Egypt, and later Greece and Rome, studying the skies became more "professional" and very culturally absurd, thanks to correlating math sustaining each sky/destiny model.

Only much later did the great Galileo and experimentally clear thinkers progressively transcend imaginary celestial fantasies. This was not a seamless transition, as Galileo barely escaped being burned at the stake in Rome in 1610, thanks to a personal friendship with the Pope.

Accelerating laboratory science flowered in the 19th and 20th centuries. Local experimental data could appear congruent with Euclidean and Newtonian theory, and thereby too easily assumed to reflect causation. The full paradigm of many more dimensional

levels of linear physics, with vastly more frames of reference, was not yet available. *Logical positivism* became the operational standard, where something unknowable to laboratory scientists became "meaningless," even if potentially central to physics itself.

Today, with much more knowledge about our limited range of verifiable data without extrapolation, scientific models are still restricted by antique correlative theories. The trick was, and still is, to extend laboratory hypotheses – with low-sigma standard deviation extrapolations – to the dimensionally unverifiable. As for the truly "distant" dimensions of physical reality, there is still much unknown and unknowable within popular classical and quantum physics paradigms. Some of the most meaningful new models remain "meaningless" to the intellectually lazy.

Failure to properly envision within reasonable dimensional extrapolation is largely how and why the myth of universal General Relativity took such a strong hold on cosmology a hundred years ago, and persists today despite much better experimental science already in this 21st century. Like it or not, genius Einstein is today's Roman Ptolemy. However, Einstein's cosmology will not last for 1,400 years.

Reverse engineering from (1) dimensionally limited and limiting experimental data; (2) low-sigma data extrapolations; (3) major dimensional frame-of-reference confusion; and (4) slippery math *renormalization* to defeat the tendencies of many cosmological equations to yield infinities – all have loosely cemented weird and limited misunderstandings of our cosmos. In some ways what we now think we comfortably know has made what we don't know that we don't know even more remote.

Emerging and increasingly verifiable scientific data has its own dialectical power. The 21st century will increasingly embrace an elegant cosmology that emphasizes correlation only after quality causation. We can now envision the approaching emergence of a unified physical science that joins causally simultaneous energy and matter, using systems theory tools in new ways. Going beyond the limiting models of SR and GR, it is now possible to better envision the emergence of net push/shadow 4D local universes within the overall "bubble-bath" 4D multiverse. Gravity that really exists can also be somewhat mathematically correlated with the maths that seem to verify GR within limited local dimensions, but don't. Today's nifty but weak maths are similar to the 1,400-years-old maths of Ptolemy before Galileo.

Ideas of weird spacetime tractor-beam gravity must yield to the reality of omnidirectional streams of electromagnetic, interuniversal, yin/yang spherical particles and their beaded strings. Most particles are flowing within relatively diffuse "quantum seas" modeled as mysterious "quanta," which they are not quite.

The #1 problem within cosmology is trying to unify different gravities. To date the primary effort has been arbitrarily limited to our local visible universe, as if our local big-bang bubble is all there is. Post-Big-Bang GR field theory is not structured to model the entire 4D multiverse, even though 4D Totality could be fully correlated within the proper gravity model and EM paradigm.

Quantum gravity theory so far has not succeeded, because the odd particle ideas associated with early quantum mechanics (QM) make it seem impossible to harmonize quantum virtual particles with virtual vector slopes.

To help with what will follow, consider spinning yin/yang Coulombic spheres and 3D beaded strings to be the real physics "quanta" that in vast numbers populate any quantum concept of particulate field gravity.

Of course, a qualitatively modern version of the too-simple original 17th-century idea of impactor, push/shadow gravity allows better envisioning, and modeling the real net multiversal gravity. With an updated and transformed model, several amazing facts emerge, such as there being *no lambda Dark Energy*, only differentials of net push/shadow gravity among juxtaposed universal masses. What we need is a 21st-century version of *Plato's Cave*, where confused GR fans (inside that dark cave with shadow images on its walls) escape to discover the real reality just outside.

Einstein's Frame Error

Einstein's frame error was to confuse cosmic vacuum photon speed with the terminal speed of individual accelerating beaded strings. He didn't have a clue as to how and why "c" was always that vacuum speed, versus any other speed. This confusion led to a fundamental frame of reference error that was seductive in 1915. His seminal equation of $E=mc^2$ assumes that the right side has the number 1 as the unwritten denominator, as if all photons magically appeared at "c" speed.

He did not understand that the formula should be written: $E=mc^2/T$. In its correct form the "*T*" stands for the time it takes for a spinning beaded photonic string to vibrationally stretch and snap back while centrifugally launching from its rotating origin, most commonly a spinning neutrino. Because all new photonic strings snap back while escaping from their base of origin at the same rate, the vacuum velocity of all photonic strings equals "c" relative to their initial frame of reference. In other words, each photon string has its own frame of reference.

If Einstein's formula were to have "c" terminal vacuum speed appear instantly, then either photons would need virtually no mass, or there would need to be virtually an infinite power accelerating whatever small mass there is per string to instant "c." We are now looking at why gigantic particle accelerators cannot do much better than they already have.

Individual yin/yang particles have both mass (yin) and energy (yang) appearing simultaneously together within their magnetic Coulombic primary "event horizon" that functions as a virtual sphere shell. What has been needed is the pretty physics model that shows how this works so that every "c" is equal, regardless of beaded-string length.

It is possible to overlook Einstein's fundamental error, and still *create an as-if correlating SR and GR math within our local, measurable dimensional zones*. However, there is growing data suggesting that early GR was rife with math tricks, (such as lambda invented by Einstein to fudge apparent Dark Energy) and continues today to where correlating formulas seem serviceable only within dimensions larger than the Planck, and smaller than multiversal.

The dimensional distance in either direction from what we can directly or experimentally measure is much greater than what we can measure. Any theory of gravity "worth its salt" must be able to model net forces at all relevant dimensions, from sub-Planck to multiversal. General Relativity's being so limited puts a major dent in its antique claim for universality.

Relatively operational utility is both useful and ironic, even if causally false. Einstein's patched-up revisionist theory has math that often works OK within an as-if paradigm, so it need not be operationally discarded for now. We only need to re-invent part of the wheel, not all of it:

A good example is the math relating to GPS satellites. [See pages 15-16 of this GPS link.] Because the myth of spacetime gravity funnels seems easy when small objects are near massive objects such as the Earth, GPS has been tweaked to be accurate operationally with incremental learning. Even though the causal model is otherwise, the continually tweaked SR and GR math is still very operational with regard to GPS satellites.

On the other hand, GR in deep space involves a myriad of competing so-called spacetime funnels impossible to easily correlate. Another model more faithful to causality is required. Here is one of my essays comparing GR with net push/shadow gravity within a one-billion-light-years cube.

Comparing the two models of GR "tractor-beam gravity" and net push/shadow gravity is stark: On the GR side there are at

any time and place literally a myriad of competing frame-ofreference spacetime funnels around the virtual sphere of contact. Any object navigating these competing tractor beams cannot be easily modeled, but GR math imagines one or a few such vortices per gravity point, or somehow involving interacting large cosmic masses such as around the Dipole Repeller region.

In contrast, all net push/shadow interactions are focused on the objects of net gravitational forces itself without any looming slopes. This is the parsimonious frame of reference therein.

In deep space the omnidirectional, multiversal flows of beaded strings and other inter-universal primary units direct all objects in the same way everywhere. The net shadow effect only enters significantly where there is a sufficient mass near objects to yield an obvious net imbalance. *Here is a much more elegant model than oversimplified GR at nearly all dimensions, and it applies equally from smallest to largest dimensions anywhere within the multiverse.* In reality, between these two models there is no contest when examined without prejudice.

In other words, a new emerging math should help us in the 21st century to supersede the limited GR math that only works for a few obvious dimensions, and relatively nearby. Also, a *digital physics* net force is better suited to digital computers than is a sloping analog model. *An honest push/shadow math that causally works for all physics dimensions everywhere would be quite elegant. Within all dimensions we would now be able to better digitally model a theory of everything, and thereby reconcile most quantum/classical paradoxes.*

Approaching the Outermost Multiversal Zone

The Outermost Multiversal Zone (OMZ) is an amazing real idea. Correct theory can embrace it with elegant consistency. In no way can any finite beings directly measure experimentally that multiversal zone. However, the lack of direct and embracing access is somewhat transcended by inductive modeling using consistent physics that we already somewhat know down to the (10^{-18m}) atto dimension for electrons. That's still twenty dimensions larger than individual y/y spheres, but it's a start.

It is my thesis that the 4D multiverse is *not* host to vast numbers of curled-up, holographic, 2D string universes, each with unique laws of physics. The laws of 4D physics everywhere are controlled by the foundational reality of yin/yang Coulombic spheres streaming individually and collectively in beaded strings among dialectical architectural structures. These EM flows are equal in every real dimension near and far above the Planck linear dimension. They differ only in lengths and frequencies, not in vector speed. This logical paradigm is what is needed to help build a wholistic Totality.

Yin/yang spheres are individually unique in that they display the *simultaneous triple EM nature* of the very smallest matter/ energy dimension; yet they populate dialectically all dimensions. The fiercely cohesive energy aspect within each sphere is EMneutral (which I call *primary EM*), allowing strings of these Coulombic spheres to adhere as photons both bright and "dark." On the other hand, the ends of photonic strings can have opposing charges.

Consider what the dynamic outermost regions of the real 4D multiverse should be like: Surprisingly, the physics paradigm within *each* 4D local universe can be easily extrapolated to the "bubble-bath" physics model of the 4D universe of universes. This interfacing smoothness is because of consistent laws of congruent physics everywhere.

I have previously written extensively about how and why *Dark Energy does not exist by itself as a separate voodoo force*. What is being measured, such as red shifts by all sorts of instruments, are the interactive border regions between and among our post-Big-Bang "bubble" and other similar universal bubbles. The interesting idea of each local universe being oddly "like" a bath bubble makes additional sense when we notice that the overall region of local-universe bubbles is dynamic, with old bubbles vanishing, and with other bubbles taking their vacated space over many billions of Earth years. A "fertile community" of aggregated local universes is needed to model any 4D multiverse staying intact, rather than locals evaporating one after another into pure thermodynamic chaos and the true end of work time.

What we call accelerating Dark Energy is really the net push/ shadow attraction of our infant universe's expanding outer bubble accelerating toward more dense regions of juxtaposed matter.

Our new Big Bang universe will have some reciprocal push/ shadow attraction toward that which is outside the boundaries of our own visible universe – but *less* than the more established border masses outside our own. These dynamic interchanges are the same as we experience anywhere inside our Milky Way, and elsewhere within our own local universe, including standing on the Earth's surface. That's another twist on Newton's Third Law. *Laws of physics are multiversal, not just locally universal. There is only one correct gravity everywhere.*

For more than a century the imperfect Quantum Mechanics model of sub-Planck quantum units has strangely challenged Einstein's GR, but less so with SR. We can lift the fog by simply understanding that what has been called quanta within the sub-Planck (below 10^-35 logarithmic linear meters) regions is none other than the presence of yin/yang, matter/energy, Coulombic spheres and their beaded-string progeny.

The idea of *Dark Matter* does however fit in here: Unlike Dark Energy, Dark Matter does exist, and it can be described beyond its already known gravity effects. We don't need goofy voodoo math to understand that Dark Matter is matter with many of the same EM constituents as ordinary baryonic matter. This is a dimensional phenomenon, where a change in quantity size yields an apparent change in category of matter, such as going from inside the so-called quantum realm up to the more familiar baryonic realm of classical physics. This *illusory dimensional problem is ours, not any sort of deficient physics*.

Problems arise when we fail to account for the incredibly small size of primary Dark Matter units, and their smallest progeny, such as relatively short-length *electromagnetic (EM) beaded strings that can easily satisfy the challenges of passing through slits when they go through lengthwise, not widthwise*. It was thought that photons have mostly energy, not mass. That is an error of perception which we can correct with better physics that we already know.

There is a beloved idea within quantum theory (QT) called *quantum foam.* The seemingly empty space between large masses such as planets is understood to be full of "quantum foam," both stable and zipping around. This is exactly what happens dimensionally when multiversal yin/yang particles, strings, and small collections undetectably fill up by diffusion so-called empty space.

The so-called quantum sea is shorthand for a particles "sea" that we cannot see, but nevertheless reveals itself as real gravity. These "quantum" particles and particle strings are for humans too small to be otherwise detected interacting with baryonic matter.

The earliest particulate version of push/shadow gravity was developed by a close friend of Newton, *Nicholas Fatio*. He was theorizing in the late 17th century. His relatively large impactors model had fatal flaws – which have four centuries later been corrected by better 21st-century net push/shadow theory.

In brief, we now have the makings of a unified gravity theory among and between the local universes collectively constituting the 4D multiverse. This achievement is critical to constructing any truly universal theory of everything among all actual physics linear dimensions. Consider how tiny micro-physics dimensions, and grand-scale multiversal dimensions seamlessly interface: Nobody and no astronomical instrument can ever go to, or directly see, the edge of the multiverse, except with proper theory envisioned for that zone. Nor can we directly measure the smallest dimensions. We are thus *forever measuring a limited range of middle dimensions*. However, what we cannot see with vision and data acquisition, we can "see" with proper unified gravity envisioning.

Fortunately, because *the laws of physics operate at all linear scales in all places*, what we learn from Earth science can be properly applied to the active edge of the 4D multiverse. Again, because we can properly model matter/energy physics of the very smallest scales, we can now honestly extrapolate tiny dialectical knowledge to all the largest physics scales.

Elegant extrapolation does not absolutely require removal of deficient algorithms. We are only concerned with modeling well actual inter-universal physics, which of course is the highest goal of astrophysics. The general goal of all physics is to follow *the rule of parsimony: to simplify, but not to oversimplify*. Otherwise we risk placing defective "pure" math ahead of reality, even though physics math is properly used to describe reality.

Modeling the Outermost Dynamics

Philosophy, astrophysics, and of course religion, all speculate about humanity's place within it all. Religion comes on strong by hypothesizing an Aristotelian "unmoved mover" out beyond space and time. This too-clever math idea is absurd, but attractive to shallow thinkers, and to those with selfish theocratic agendas.

Discussing with certainty any number not tautological is an impossible task, because any frame of reference within any physics dimension is equally far away from infinity. Yes, *any number other than zero times infinity equals infinity*. *Also, any number times zero equals zero*. We can therefore only make as-if hypothetical progress toward absolute knowledge. Even the mind boggling number of math universes within M-Theory (10^{500}) is still just another finite number relative to infinity.

On the other hand, coherent "as-if physics" can be utilized to help model logical activities toward the edge of what we can know of the multiverse. The physical multiverse cannot by definition extend to trans-physical infinity. Infinity relative to any finite dimension is impossible to clearly understand. So we work the as-if aspect of cosmology within any study of the multiverse. This utility is quite possibly only within the understanding of universal (not universe-specific) laws of physics.

As long as we assume that the multiverse is not equal to a divinity or divinities beyond time and space, we can discuss hypothetical local universes at the very edge of all actual physics.

Discussing the edge of the multiverse within our mental ability to frame such things is equivalent to discussing the smallest apparent physical dimension (likely about negative 38 metric dimensions of ten from our own). In "pure Zeno math" Achilles never catches the turtle because of an infinite regression. There are literally an infinite number of pure math dimensions smaller than the amazingly small actual physics negative 38th dimension.

It is therefore practical to only discuss and build on the smallest actual matter/energy Coulombic components. It is not possible to continue down the endless path of reduction toward (but never reaching) a zero math dimension, which is pure point zero. This is the critical error of Euclidean plane geometry. Our task is to discover real 4D physics, not to play ancient Greek math games, or to concoct imaginary 2D math matter.

It is interesting to note that early 20th-century ideas of black holes were math driven, going down to a zero point dimension. Of course, zero math dimension absurdly yields zero mass and zero energy. All forms of gravity and Coulombic cohesion vanish therein. At zero there is no "in" therein. More modern models of the so-called singularities within black holes feature nifty event horizons, and high mass density at their cores.

I have explored this smallest real dimensionality to discover some very interesting things: My discoveries in this area also revealed the key difference between common black holes and very rare big bangs. No other theorist has achieved this elegant insight with their weak theory. If you are worried as to whether mad scientists could build a universe-ending big-bang bomb, don't worry. Coulombic theory at the yin/yang spherical level has the surprisingly elegant explanation.

We turn now from examining the very smallest dimensions, to what happens within the very largest dimensions along the most distal regions of the multiverse. We can use aspects of classical physics, along with responsible extrapolations, to reveal likely models for some core questions about "it all."

One of the key "laws" of physics is the scary Second Law of Thermodynamics. Briefly, it indicates that order (negentropy) degrades to thermal equilibrium (entropy) in a closed system, where total energy is not lost, but is rendered useless for work by ever-increasing thermodynamic chaos unable to restore order, or even to create new order. This law projects maybe trillions of years before everything everywhere goes dark. Or does it?

An analysis of our multiverse's "edge" offers a less gloomy prognosis. For existential humans, all of this remotely futuristic stuff is meaningless. For clear physics and astrophysics, the new multiversal paradigm turns out to be other than eternal chaos.

Here is how things at all dimensions work toward the outer edge of all edges: *Most initial impactor interactions everywhere are deflected with exchanged primary-EM energy. Photons have been measured in laboratories slowing down below* "*c*" *when passing through certain media, such as glass prisms. Impactor velocities are restored to* "*c*" *when absorbed y/y energies are reemitted.* The dynamic picture changes when we discuss the magnetism component of EM:

Toward the edge of all edges there is no equal push from all directions. Primary particles are so small that they can zip through all sorts of baryonic matter – such as do neutrinos, which at near negative 24 linear metric dimensions can also zip through masses like the Earth almost unimpeded. Yin/yang particles are at about negative 38 dimensions, so they are in size very much smaller. Primary y/y particles are proportionately like individual atoms compared to individual humans.

Nevertheless, even the smallest particles are all subject to *collective* Coulombic electro*magnetic* (EM) attractive forces, which I like to call primordial magnetism. Unlike ordinary electricity, magnetism is not restricted to nearby space. Both gravity and magnetism operate inversely without distance limits, though the greater the distance the less the force per attracted EM particle, which still remains. Distances are offset by the greater EM mass of everything inside the outside, when seen from the final edge.

Consider what happens to individual yin/yang particles, or beaded "dark matter" short strings, as they keep traveling virtually unimpeded along Newtonian straight velocity vectors. Eventually they may pass through possibly several universes to approach the common multiversal edge.

At the edge they would continue outward forever without the combined inward magnetic pull from within, which would mean that the multiversal edge would otherwise not really be an edge. Worse still, if all of these particles kept randomly shooting out beyond any edge for trillions of years, then the Second Law would eventually triumph over a fully random ex-multiverse.

If we talk about entropy, then the question arises as to "what" created the original negentropy. Only something like Aristotle's Unmoved Mover could make something from nothing. However, his divine model is highly unsatisfactory, because it is only fair to

inquire about how the Unmoved Mover, or God, got started in the first place. We are rapidly careening toward absolute absurdity, where every quasi-logical paradigm creates a new unanswerable paradigm question. Nevertheless, there is a working way out of this particularly frustrating Platonic cave:

If there were a way for otherwise would-be-escaping yin/yang "quantum" particles to be directed back into the total multiversal mass, then that would constitute a *virtual box in all directions* for negentropy to perpetuate. If Totality can avoid sliding into extra multiversal entropy over trillions of years, then the absurd search for first origins becomes both timeless and meaningless.

In sum: Each Coulombic EM yin/yang spherical particle is loaded with magnetism. Even at truly great distances the *collective* tiny magnetic attractions from multiple universes would be slowing down, and then pulling inward, would-be escaping y/y particles.

(It could also be hypothesized that the mere persistence of exiting individual y/y spherical particles themselves would be sufficient to perpetuate negentropy in theory, but not in practice. If everything exits outward so much that interactions among y/y particles would not be likely, negentropy would thereby be eternal only within the individual Coulombic spherical shells.)

Beyond the internal utility of cohesive primary EM within y/y spheres, the presence of bipolar EM charges in photon strings of all lengths is critical to this paradigm. If all such strings only had neutral EM charges at their ends, there could be no attraction by the great number of multiversal internal strings for the relatively few potentially escaping strings – which over *trillions* of years could see the victory of chaos everywhere. Due to both poles of EM, there is actual opportunity for the greater mass of Coulombic strings to attract either end of each would-be escaping string.

At the same time, the presence of like-repels-like from equal polarities at opposing ends of photonic strings keeps everything

from imploding into a *big crunch* on a multiversal scale. Here is *the perfect antidote for all sorts of ultimate big-crunch horrors*. Dual-polarity inverse-square power also works better than Isaac Newton's idealistic idea of only gravity being inversely attractive.

It's really that simple, and here is the secret sauce for why the Second Law may somewhat apply to individual local-bubble universes, but not to the universe of universes.

There is absolutely nothing of value in SR, GR, and similar field theories that operationally satisfies all thermodynamic questions. Quantum gravity theories help deliver the transition, but are not complete, and not yet able to merge with each other to create a *unified gravity theory*. None of the currently popular theories embrace the Law of *Parsimony* required for a TOE. The ultimate challenge for any TOE model is thus to correctly make the simple complex, while making the complex simple.

Ideally, we simplify without oversimplification. Such a working TOE will allow linear dimensions of the visible, and the invisibleto-us, to become more accessible models through honest induction and deduction.

Therefore, we here have strong theory for net push/shadow gravity in its 21st-century form, and for other key laws of multiversal physics. It all boils down to both Coulombic inversesquare EM between equal or opposite charges, and net push/ shadow gravity.

