Intrinsic Spin Quantum Gravity Universe metatheory
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Abstract
Everything in the universe rotates of spins; except the universe as portrayed in the classical Λ-CDM Standard Cosmic (big bang) Model implicit metatheory.

This intrinsic spin quantum gravity universe is a working metatheory. It is not a working model. What it brings to the table is a different way to connect and interpret our extraordinary physics and astronomy subspecialties. This intrinsic spin quantum gravity universe metatheory visualizes a more credible universe than the Λ-CDM model. What it lacks in mathematical detail and rigour; it gains in physical logic and usefulness.

A metatheory is not a patchwork of subspecialties. It is an overall framework based on generalization of specific observations into a physical and logical whole. By definition, it misses much detail. Charles Darwin's evolution is the best scientific example of a metatheory. It gave a useful big picture without specifying the detailed mechanisms of how evolution works. Genetics and epigenetics were unknown.

In a certain sense, Darwin's evolution provided the framework for the Λ-CDM model. But Darwin's framework of evolution, while appropriate for life on Earth and the life cycle of a galaxy, is not so useful for building an understanding of our entire Universe.

Nevertheless, the classical Λ-CDM model of our visible universe has many proponents. Their help will be needed to turn this intrinsic spin quantum gravity universe metatheory into a robust quantum metatheory.

In this intrinsic spin quantum gravity universe metatheory, everything in the Universe rotates of spins; including our visible universe and the Universe.

A Working Quantum Metatheory of Our Universe is Needed
After nearly 100 years of the big bang theory; its successor the Λ-CDM model is only 5% successful. The Λ-CDM model has got that 5% very correct; because that 5% represents all of the known matter and energy in our visible universe. But the Λ-CDM model doesn't know much about the other 95%, the so-called missing dark energy or dark matter. As well baryon asymmetry remains a thorn.

Cosmic inflation that separates galaxies without them moving is mathematical magic; it needs to be replaced at least by spooky quantum action. An Λ-CDM model universe

expanding towards a thermodynamic big freeze, is similar to the "electromagnetic catastrophe" of electrons crashing into atomic nuclei, predicted by classical physics. As well, the thermodynamic big freeze is unscientific in that predictions of events 100's of trillions of years from now is not about phenomena that can, in principle, be measured or observed. A more scientific prediction might be that the radius of the visible universe for any observer in our visible quantum universe will always be 13.8 billion light years. But instead the official scientific radius of the visible universe is 46 Billion light years (per inflationary calculation) and expanding towards a big freeze. Is there not a better explanation of our visible universe that is 10% or even 50% correct in the big picture; rather than the Λ-CDM model that is 5% massively correct in the detail.

Baryon asymmetry is a bafflement; the concept of time is a mischief; baby universes or cosmic foam are implied necessary precursors to the Λ-CDM mode. Yet, physics and astronomy subspecialties continue to make exceptional progress in theory, experiment and observation. But that progress is shoehorned into the classical Λ-CDM model, which, after a century of quantum insights, is no longer credible.

To paraphrase Niels Bohr, "We are all agreed that "Λ-CDM model" is crazy. The question which divides us is whether it is crazy enough to have a chance of being correct. My own feeling is that it is not crazy enough". I assert that the classical Λ-CDM model is no longer crazy or quantum enough.

To build a quantum cosmic metatheory, I will bring together evidence from experiments, observations, theories and maths that tie together concepts and conjectures. At first, these puzzle pieces won't quite fit into a coherent whole; because they are speculative, theoretical, without direct evidence,etc. But please, give a listen with your full imagination; as I have given a listen with my full imagination, to your physics, astronomy, cosmology and math explanations in blogs, books, papers and other media.

A working quantum metatheory needs to do better in the big picture and in the guiding detail than the 5% correct/95% bafflement of the current classical Λ-CDM model.

Towards a Working Metatheory of Our Universe

We begin visualizing right away. As I explain, you will question and be skeptical. But try to accept and see this big picture better than I am sketching. When I am done building this visualization; then I will discuss the many challenges/ problems that I see with this metatheory. Then will be your turn to tear down or build better, by working on your relevant subspecialty that you understand better than most. This is a big project that we have to do in stolen time; because a CERN or Fermi Lab or university will not fund

pieces of ambiguity. Though some pieces can only be tested at big science labs; and all will need your expert theoretical, experimental and observation clarification and rigor.

We start with the Λ-CDM model universe. We accept the laws of physics, the evidence of experiment and observation, and recognize the challenges and problems of the Λ-CDM model. Then we add Turok's CPT symmetric antimatter universe to the Λ-CDM model. "On the right is a universe flowing forward in time; on the left, a universe flowing backward in time. In the middle is the singularity". Turok's is a good start because in both the Λ-CDM model universe and the Turok CPT symmetric antimatter universe the identical laws of physics apply. But though Turok CPT symmetric antimatter universe solves the baryon asymmetry problem, it doesn't address the dark energy and dark matter problems. Next I rename these two model universes as follows:

- Λ-CDM model universe $\underline{=}$ $subUniverse_{Matter}$ or $\mathbf{subU_M}$ and
- Turok's CPT symmetric antimatter universe $\underline{=}$ $subUniverse_{Antimatter}$ or $\mathbf{subU_A}$

This Universe composed of $subU_M$ and $subU_A$ retains all the laws of physics in its two subUniverses; but so far, it only solves the baryon asymmetry problem. And this Universe is still flat, has a beginning singularity, has cosmic inflation, dark matter and dark energy. And is not spinning yet. Everything in our visible universe rotates of spins; except the universe (as portrayed in the Λ-CDM. It will be difficult conceptually, mathematically and physically to imagine an intrinsically spinning quantum gravity universe; but it will solve a great many problems, bring conceptual clarity that compensates for the mathematical difficulties and will suggest new physics.

I reserve the term "Universe" for the whole thing, however many subUniverse are required. I avoid the word "multiverse"; because it is associated with 10^{500} universes and is without a focus on any particular extra physical universe.

I connect $subU_M$ to $subU_A$ by:

- $Wormholes_{M\rightarrow A}$ and $Wormholes_{A\rightarrow M}$ (or the quantum equivalent), and
- particles and antiparticles (which are virtually quantum connected to each other, and virtually connect subUniverses)

Now, I will quickly bring to together a number of concepts which are necessary to visualize an intrinsically spinning Universe; and which are hopefully crazy enough to interest even a Bohr.

- $subU_M$ and $subU_A$ are 3-sphere quantum subUniverses that are orthogonal to each other (i.e. occupy different spacetime dimensions)
- $subU_M$ and $subU_A$ spin relative to one another at or close to the speed of light.
- spinning quantum mechanically (as in intrinsic spin)
- T-duality (the string theory tool) transforms $subU_M$ to $subU_A$

- Time and chirality
- The Standard Model of Elementary Particles (electrons, W and chirality)
- Newton Gravity Gedanken Experiment explains the kick between subUniverses
- Cosmic Quantum Gravity Diffraction Cycle (between subUniverses)
- The Standard Model of Elementary Particles Must Be Altered
- The 2 Quantum Photons
- The Quantum Graviton
- Hawking-Unruh radiation

All of these concepts need to be visualized simultaneously; but first I need to explain and help you visualize each one separately. Asking that you hold your disbelief and questions; until you can visualize the whole group of concepts cosmically together.

$subU_M$ and $subU_A$ are 3-sphere quantum subUniverses that are orthogonal

Einstein thought that our general relativistic $subU_M$ was a 3-sphere. Of course that was just the spatial dimensions. Then the flat big bang universe was accepted. Also, Godel famously made a 3-sphere general relativity universe that rotated in time; which then was misinterpreted to mean that the equations of general relativity permit someone to travel backwards in time. Despite these conceptual mis-starts, I suggest there is much merit in these ideas, especially when thinking geometrically of quantum subUniverses.

Now, when I talk about $subU_M$ and $subU_A$ as 3-sphere spatially or as hyperspheres of spacetime in a bulk classical spacetime sense; I'm vague. Because at this point of building a working metatheory; it doesn't matter whether these intrinsically spinning subUniverses are mathematically 3-spheres, toruses or Calabi–Yau manifolds. Because before deciding maths and interpreting equations; we need to first visualize the physics, logics, and relations necessary to build a cosmic metatheory. Then with a big picture in mind, mathematicians and physicists can debate, decide, build or not.

$subU_M$ and $subU_A$ spin relative to one another at or close to the speed of light

This is a quantum statement. Fermion matter in $subU_M$ moves at speeds less than the speed of light; and I assert that fermion antimatter in $subU_A$ are tachyons that move at speeds greater than the speed of light. But there is more complexity to this assertion. The intersections between these two subUniverses are wormholes and particles.

Elementary particles are not simple objects; they are quantum superpositions of particles, antiparticles, virtual particles, and virtual antiparticles, any one of which can manifest in particular interactions with other particles or measurements by an observer. The point is that this quantum cloud of possibility is swirling or state transforming quantumly all the time. But if measured, the particles would be observed traveling close

to the speed of light (but a wee bit slower than c); while the antiparticles would be observed traveling close to the speed of light (but a wee bit faster than c).

Now the difficulty of measuring the “native” speed of antimatter (or even matter) is daunting. And then there is the question, Is antimatter the same “antiparticle” in subU$_M$ as it is in subU$_A$? And finally, much theoretical and some experimental research has been done on tachyons. But most tachyon research is flat Λ-CDM, and mostly NOT to test or suggest that tachyons are real. But neglecting this tachyon criticism for the moment, I will say that every particle in subU$_M$ and every antiparticle in subU$_A$ is a quantum event/interaction between both subUniverses. Yes, we will need direct or indirect measurable phenomenon evidence.

spinning quantum mechanically (as in intrinsic spin)
When I assert that subU$_M$ and subU$_A$ are spinning relative to one another with intrinsic spin; I mean that subU$_M$ is spinning intrinsically relative to its time coordinate, and that subU$_A$ is spinning intrinsically relative to its time-like coordinate. So in our subU$_M$, for example, there is no spatial dimensional evidence that our subU$_M$ is spinning. And we have been taught to avoid thinking of spinning relative to the time dimension, as being nonsensical and full of causality paradoxes. But how well do we understand time and causality in quantum mechanics? As well, the temporal/causality paradoxes that show up in Godel’s general relativity universes are misinterpreted. And as I’ll discuss and assert later, there is no time travel paradox at a quantum or relativistic level. When I hold up a ruler in my line of sight and measure a giant sequoia tree some distance away; my first conclusion might be, “that tree is only 5 inches tall.” In that simple case, we have correctly measured a phenomenon, but misunderstood what we are measuring. We use time and space measurements because they are useful. Or is the mass change in special relativity real or not; and if not how do we interpret the math physically?

I suggest that elementary fermions, protons and neutrons and black hole singularities are quantum objects have non zero intrinsic spin. These are classical only in the simplest of senses/cases. These quantum objects are quantum superposition existences, that are continuously quantumly connected or interacting (e.g. entangled, superimposed) with the other particles, antiparticles, virtual and real and in either subUniverse, in a manner that manifest in indirect measurable phenomena.

T-duality (the string theory tool) transforms subU$_M$ to subU$_A$

T-duality has the form: R x 1/R = Constant.

To invent a T-duality, to transform spacetime coordinates from subU$_M$ to timespace coordinates of subU$_A$. I pondered the standard physics:

$\lambda * v = c$ and (x, y, z, ict)

Then I replaced λ with x and v with 1/t; kept i = imaginary number in the 4th coordinate and keep c = the speed of light, to get

$x \times 1/t = c$, my T-duality coordinate transformation.

Thus T-duality transform spacetime coordinates (x_1, x_2, x_3, ict) in subU$_M$ into timespace coordinates (ct_1, ct_2, ct_3, ix) in subU$_A$. (Yes, I've used fuzzy math, but the physics will make sense). In this transformation, regardless of names or symbols, I think of the first 3 coordinates as spatial coordinates and the 4th coordinate as temporal. I keep the nomenclature from our large R subU$_M$ POV for consistency, which means that the small 1/R subU$_A$ has timespace coordinate names. But regardless of the names that I retain, I interpret the first 3 coordinates in the R and the 1/R subUniverses as spatial in function and the 4th imaginary number coordinate as temporal in function. Because then, we get laws of physics in subU$_A$ that are identical in how they work in subU$_M$.

Also worth noting, in general relativity it is often suggested that space and time switch places at the singularity of a black hole. I agree that switching places is necessary.

In this telling, the larger R subUniverse is subU$_M$ and
The smaller 1/R subUniverse is subU$_A$
But a real observer in either subUniverse is not able to tell if he is in subU$_M$ to subU$_A$

This T-duality transformation is analogous to special relativity case of two observers on two trains moving in opposite directions at relativistic speeds. Each observer feels stationary (in his inertial frame); and each observer sees the other train and observer contracting in length (since it is moving a relativistic speed). Paradox versus reality.

Now in our T-duality transformation, subU$_M$ spacetime is spinning intrinsically at relativistic speeds in the opposite direction relative to subU$_A$. But this relativistic spinning T-duality relationship is more complicated than the inertial special relativity trains.

- The physics of subU$_M$ versus subU$_A$ is more important to understand and visualize than the mathematics of T-duality. The mathematics is a tool that later will helps clarify quantify physical understanding, predictions and measurements.
- In this metatheory, subU$_M$ and subU$_A$ are intrinsically spinning orthogonally to one another at relativistic speeds. One subUniverse is moving a bit slower than the speed of light; white the other is moving a bit faster than the speed of light.

    - At those speeds, each subUniverse is invisible to the other due to relativistic length contraction.
    - The intrinsic spin of each subUniverse is around its 4th coordinate (the temporal coordinate, which is invisible and only indirectly deduced).
    - Despite the intrinsic spinning; each observer reasons and measures no rotational accelerations and determines that he is in an inertial frame.
    - However in each subUniverses, the observer is accelerating (his inertial frame is only apparent)
    - As a practical local matter, most phenomenon/events can usefully be approximated as occurring in an inertial system, rather than actually an accelerating system. This paradox/contradiction is similar to the fact that every physically measurable system is thermodynamically open, in the detail; but an approximate closed system idealization can give a good enough pragmatic result.
    - A word here about measurements. In the early quantum days, physics thought that we were classical observers using classical apparatus to measure either classical or quantum phenomenon/events. Heisenberg's uncertainty principle was brought into many physical and philosophical discussions. Today we understand a bit more about the pervasiveness of the quantum. We also have a little less hubris and think of ourselves as observers in whichever way makes sense.
- After I've done my T-duality transformation; I've made the 4th coordinate of the 1/R subU_A an imaginary number unit as in special relativity. We also have an imaginary number mass unit in subU_A, that is associated with tachyons, also of special relativity. I will not try to show that this math is consistent.
- Now various undecidables are worth discussing here. This Universe system (i.e. quantum metatheory) is intended to be a complete logical system (as should be any Universe model, such as Λ-CDM model). Therefore according to Godel's Incompleteness Theorems, there should be undecidable stuff from within such a complete logical system. The undecidability by an observer, as to whether he is in subU_M or subU_A is one such undecidable. The undecidability of an observer of whether entropy is increasing, decreasing, or staying the same in subU_M, subU_A or the Universe is another example of a Godel undecidable in this intrinsic spin quantum gravity universe (working metatheory). There are other undecidables.

Time and chirality

- Time is many useful things and many fictions. But being useful doesn't make time fundamental in the sense that intrinsic spin, charge and mass are fundamental properties in the Standard Model of Elementary Particles.
- Space also is many useful things and also not fundamental.

- In T-duality, the coordinate transformations reflect and suggest physical reality, i.e. how phenomena might be measured directly or indirectly. In particular, the timespace coordinates (ct_1, ct_2, ct_3, ix) in $subU_A$, needs to be interpreted carefully, if any use is to be obtained from the transformation of coordinates and equations. In my interpretation, the first 3 coordinates in $subU_A$ are spatial in function (despite their temporal name). Remember that in general relativity, space and time switch places inside a black hole. We don't like to remember that.
- In a bulk classical universe sense, time is perpendicular to space. In relativity, the temporal coordinate is usually given an imaginary number, while the spatial coordinates are real numbers, hence ((x_1, x_2, x_3, ict). Time apparently is always perpendicular to every spatial dimension of bulk/classical space, hence the imaginary number. And we use place (i.e. spatial) terminology to describe the time dimension; because spatial metaphors, verbal and mathematical work; not because we understand the invisible mischievous time dimension. We continually discover that we misunderstand time, even when our equations usefully predict observed phenomena. (e.g. Newton's gravity)
- Time in physics is mostly a concept that struggles continually to redefine itself to be more useful and less fiction. To physics, it doesn't matter if the concept of time is fundamental or an illusion; if it can predict observed phenomena and drive new theories, experiments, observations and understandings that are useful.
- I assert that time points in the direction (the chirality) of intrinsic spin. Chirality is a fundamental property of elementary particles. And like mass and charge, it is a key to much physics from elementary particles to subUniverses.

<u>The Standard Model of Elementary Particles (electrons, W and chirality)</u>

Cosmology depends directly upon particle properties. I will particularly focus upon the electron and the W and chirality

The Electron and W in $subU_M$ (according to the Standard Model)

Electrons are 4 distinct quantum particles:

- **Electron:** m_e, left-chiral, charge -1, CAN interact with *W-*
- **Anti-electron**: m_e, right-chiral, charge +1, CANNOT interact with *W*
- **Positron**: m_e, left-chiral, charge +1, CAN interact with *W +*
- **Anti-positron**: m_e, right-chiral, charge -1, CANNOT interact with *W*

The physical electron and physical positron are quantum mixtures of the above

- ***Physical electron*** (i.e. the mass-basis-electron) is a quantum mixture of Electron (above) and the Anti-positron (above) and Higgs effects
- ***Physical positron*** (i.e. the mass-basis-positron) ia a quantum mixture of the Positron (above) and the Anti-electron (above) and Higgs effects

Much particle research is underway to understand chirality, weak force, anti-matter, and to define additional particles or particle properties.

Chirality is a Fundamental Property of elementary particles

- Chirality is constant for an elementary particle; whereas handedness changes from left to right as the coordinate system changes.
- Chirality is a fundamental property of matter like charge or mass.

Our visible Λ-CDM "universe" or subU$_M$ is a left-chiral subUniverse.

- The reason intrinsic spin is not given a direction is because it is an angular momentum that is not spinning around any spatial dimension in our visible subUniverse. And spinning around the dimension of time is taboo; because such time loops are misinterpreted as going backwards in time and violating causality.
- But I assert that in our Λ-CDM or subU$_M$ subUniverse, the intrinsic spin of electrons and other leptons is perpendicular to all 3 spatial dimensions; and hence around the direction of the time dimension.
- In our visible Λ-CDM "universe" or subU$_M$, the weak force only interacts with left-chiral particles.
- And this left-chiral intrinsic spin of fermions creates a magnetic field (which in the absence of another external magnetic field) self aligns with the magnetic fields created by the other left-chiral leptons and to a much lesser degree quarks, proton, neutrons and other particles in our Λ-CDM or subU$_M$ subuniverse.
- This dominant left-chirality, associated with the intrinsic spin of matter of our visible universe, braces all of the matter into a curved matter subUniverse or subU$_M$. Some may object that the left-chiral intrinsic spin magnetic field of leptons is too weak a phenomenon to brace and curve the topology of our visible subUniverse into a 3-sphere. But we must remember that a part of that accomplishment in shaping subU$_M$ into a 3-sphere is gravity. And gravity the weakest force is considered the dominant force cosmically. So the accomplishment of curving subU$_M$ into a 3-sphere is due to two weakest forces, gravity and the weak force (i.e. chirality), seems ponderably reasonable.
- Likewise the antimatter subuniverse subU$_A$ is curved by the dominant right-chirality, associated with the intrinsic spin of antimatter leptons of subU$_A$, the invisible T-duality subUniverse; and similarly braces all of the antimatter into a curved 3-sphere subU$_A$. (The standard model of elementary particles will need to be slightly altered to accommodate the weak force in subU$_A$).
- Quarks and leptons (e.g. electrons) are not just moving, they are zigging and zagging, popping in and out of existence and transitioning in quantum jumps and participating quantum states that are incomprehensible to the classical bulk idea of inertial frame of reference. It is reasonable to assert that leptons, quarks and bosons, (i.e. all of the elementary particles of the standard mode)l, are in continual states of acceleration as they continually change direction in atoms,

nuclei, etc.. Such quantum direction changes are not inertia in any Newtonian or Einstein sense.

- The direction of intrinsic spin of $subU_M$ is left-chiral in the direction of time which is orthogonal to all 3 spatial dimensions of $subU_M$. And the direction of intrinsic spin of $subU_A$ is right chiral in the direction of x (the 4th coordinate of the timespace coordinates of $subU_A$) which is orthogonal to the first 3 coordinates of the timespace of $subU_A$. This is hard to visualize; so let's try with 1-spheres.
- Imagine two 1-spheres that are orthogonal to each other, like the equator and a polar great circle. Now imagine that the equator 1-sphere is spinning intrinsically in the left chiral direction; and the polar 1-sphere is spinning intrinsically in the right chiral direction. The problem in visualizing even this simplified construction is that we are already talking about 4 or 5 dimensions. 2 spatial dimensions, 1 for each 1-sphere; and 2 temporal dimensions (1 for each chiral intrinsic spinning direction). But we visually cheated by putting both chiral spins in the 3rd spatial dimension, which we also use to precess the two orthogonally spinning 1-spheres. Thus we can just barely visualize this 4-D construction (within a 5-dimension space) in our 3-D imagination.
- Then by analogy we proceed to construct 6 spatial dimensions, 3 for each 3-sphere subUniverse; and 2 temporal dimensions (1 for each chiral intrinsic spinning direction). So 8-dimensions $\pm$ 2-seems best.
- Next is the tricky part. Why are these 2 subUniverses spinning orthogonally relative to each other? What is kicking these 2 subUniverses (like kicking a potter's wheel) to keep these 2 subUniverses intrinsically spinning relative to one another at the speed of light?
- Bear several things in mind:
    - The particles in $subU_A$ have not been accelerated to beyond the speed of light. That is not possible in special or general relativity. And remember there can be quantum interactions that occur between $subU_M$ and $subU_A$, that are symmetric, in the sense; that an observer will not be able to decide (by measurements) which subUniverse he is in, the subLuminal or superLuminal. (another expression of Godel's Incompleteness Theorems).
    - Chirality aligns the matter in $subU_M$ to curve into a 3-sphere; and chirality aligns the antimatter in $subU_A$ to curve into a 3-sphere.
    - But gravitational mass is kicking $subU_M$ and $subU_A$ so that they eternally intrinsically spin relative to one another. Newton's gravity is sufficient to illustrate this continuous cosmic kicking between $subU_M$ and $subU_A$.

Newton Gravity Gedanken Experiment explains the kick between subUniverses

Richard Feynman asserted, “Every particle in Nature has an amplitude to move backward in time and therefore has an anti-particle.” That is metaphorically and mathematically quite true; but I believe reality is a bit more complicated.

Nevertheless, Feynman’s assertion is sufficiently correct to be a starting assumption for this gravity gedanken experiment:

- In our time forward matter subU_M, anti-particles move backward in time.

I consider two non-relativistic matter particles a and b of equal mass. I further assume for this gravity gedanken experiment that:

- The only force is Newton’s gravity, no other force is involved.

In this time forward matter subU_M, these two matter particles a and b attract according to Newton’s gravity. Thus as the clock tics, the distanceI between matter particles a and b decreases; according to Newton’s law. Thus:

- For 2 matter particles a and b:
  - $F_g(m_a, m_b) = G\, m_a m_b/(x_{ab})^2$ = + real number, attractive force

Next in this gedanken experiment, we replace the two matter particles with two antimatter particles a and b. Now since antimatter particles move backward in time (Feynman assumption), the distance x_{ab} between antiparticles a and b increases (i.e as in a video of the gravity gedanken experiment run backward).
Now the increase in distance x_{ab} between antiparticles a and b means that F_g = - real number, is a repulsive gravitational force.

So visualizing we see that these two non-relativistic antimatter particles gravitationally repel one another (according to Newton’s law, with Feynman’s assumption). Thus:.

- For 2 antimatter particles,
  - $F_g(m_a, m_b)$ = - real number, repulsive force

We realize that F_g can only be a negative real number, if m_a and m_b (i.e. the two antiparticles’ gravitational masses, m_{ga}, m_{gb}) are imaginary number gravitational masses. Hence, antimatter has imaginary number mass in our time forward universe

- i.e. $m_{ga}i$, $m_{gb}i \in I$ in our time forward matter universe (this statement will need additional interpretation later; that is not important yet in our visualization).

From bubble chamber experiments, we know that a particle’s inertial mass equals it’s antiparticle’s inertial mass (which equals that particles’ gravitational mass). But an antiparticle’s gravitational mass is still “undecided”.

Next, I replace the two matter particles a and b with one matter particle (i.e. $m_{ga} \in R$) and one antimatter particle (i.e. $m_{gb}i \in I$) and apply Newton's gravity to determine the force of gravity between:.

- 1 antiparticle and 1 particle
    - $F_g(m_{ga}, m_{gb}i) = G\, m_{ga}m_{gb}i/(x_{ab})^2$ = +i imaginary number force, whose real number part = 0 exactly

  For an $observer_M$ in $SubU_M$
    - The gravitational constant G is a + real number constant
    - The distance x_{ab} must be + real number for an observerM in $subU_M$
        - As well the antimatter particle is assumed to be in both $subU_M$ (so its distance x_{ab} can be observed by $observer_M$) and $subU_A$ (so particle m_a and m_b can give a kick to one another to participate in the relative spinning of the 2 subUniverse)
    - So that imaginary Force of gravity, $F_g(m_{ga}, m_{gb}i) = +i$
      $F_g(m_{ga}, m_{gb}i) = +i$ gives an orthogonal acceleration to $subU_M$'s which sets $subU_M$ intrinsically spinning relative to $subU_A$.

But Richard Feynman explains, "actual forces have no imaginary part, only a real part. We shall, however, speak of the "force" F_oe^{iwt}, but of course the actual force is the real part of that expression."

In this quote, I disagree with Feynman. Once we allow the quantum possibility of multiverses, many worlds, extra curled dimension; we also allow the possibility of objects including subUniverses spinning relative to one another; and the possibility that an imaginary number force may have a physically real interpretation.

Here I must also caution that an imaginary number force or direction can have several different meanings. An imaginary number force may just be a mathematical convenience that asserts that this force is orthogonal to other forces in our 3-spatial-dimensions. Period! Or the imaginary number force may share properties of other complex number forces in the orthogonal j and k complex directions. But of course complex numbers with i, j and k orthogonal directions open a whole set of new mathematical rules that may or may not apply to my visualization. So in my use, I use i as a math symbol simply to assert 1-single orthogonal dimension. Period!

Summarizing the gedanken experiment: the gravitational force between a matter particle and an antimatter particle in our time forward matter universe is:

- $F_g(m_a, m_bi) = +i$ imaginary number force, **gives a kick between particles in $subU_M$ and antiparticles in $subU_A$**.
  (In the Appendix A, I will discuss CERN's antihydrogen free fall experiment, which suggests that antimatter has the same gravitational mass as matter)

- Newton's gravity suggests an imaginary number mass for antiparticles, similar to special relativity's imaginary number mass faster than light tachyons.
- And suggests a kick between subU_M particles and subU_A antiparticles that keeps these two subUniverses intrinsically spinning due to a gravitational repulsive force in the orthogonal direction of the time dimension from subU_M's point of view.

Cosmic Quantum Gravity Diffraction Cycle (between subUniverses)

The intrinsic spinning of our visible subU_M relative to the invisible subU_A is not a relativistic effect; it is a quantum effect. Effectively, it is an intrinsic quantum spin (quantum acceleration) around the time dimension. This quantum spin around the invisible time dimension is an intrinsic phenomena of elementary particles; that does not directly manifest (like mass or charge) in classical/bulk phenomenon. As Feynman advises, "actual forces have no imaginary part"; which is to say that the imaginary number repulsive force which sets our subU_M spinning intrinsically relative to subU_A (at the speed of light relative to one another) is not directly measurable by an observer$_M$; because it is an imaginary force in the Feynman sense.

But Feynman is incorrect, in that an imaginary number force may have indirect non-local quantum consequences. Just as our observed Earth appears flat and not rotating even after we have learned that it is curved and rotating. So too our visible subU_M, which appears flat and expanding; may indirectly deductively be shown to be curved and spinning quantumly relative to the non-local subU_A. Indirect experiments, observations and interpretations may allow us to deductively physically reason and reach these quantum conclusions.

In our visible universe, we are aware of 2 astronomical event horizon phenomena. Black hole event horizons and the 13.8 Billion light year subU_M "cosmic" event horizon.The black hole event horizon is explained as a general relativity phenomenon; while the 13.8 billion light year cosmic event horizon is explained as a special relativity phenomenon (despite the fact that "cosmic" inflation supposedly does not violate the speed of light). As well "cosmic" inflation is often attributed to the lambda Λ of general relativity. These explanations are mathematically usefully correct; but physically problematic.

Each black hole singularity (in our subU_M) is a pinhole (or single slit) in a quantum single slit/diffraction of antiparticles which continuously pattern the entire boundaryless 3-sphere volume of subU_A. Reciprocally, each black hole singularity (in subU_A) is a pinhole (or single slit) in a quantum single slit/diffraction of particles which continuously pattern the entire boundaryless 3-sphere volume of subU_M with particles. These 1 trillion black hole singularities (at the center of galaxies in subU_M) most likely must be thought of as a 1 trillion multiple slit. The key visualization is that black hole singularities in one

subUniverse are quantumly connected to white hole diffraction patterns in the other subUniverse. And since the black hole singularity is a gravitationally driven phenomena; the entire cycle of phenomena $BH_A \rightarrow WH_M \rightarrow BH_M \rightarrow WH_A \rightarrow$ continuously cycles with a presumed time of 13.8 billion years; since 13.8 billion years is the largest physical time phenomenon observed (i.e. measured) in our $subU_M$.

At this point just as an aside, I would suggest that just as their is the Heisenberg uncertainty principle, which enforces a lower limit on measurements

$$\Delta x \, \Delta p \geq h \, 4 \pi$$

$$\Delta E \, \Delta t \geq h \, 4 \pi$$

There also should be an upper limit uncertainty principle, which enforces an upper limit on measurements. I would suggest that my T-duality formula is a possible candidate

$$\Delta x \, \Delta 1/t \leq c$$

Each black hole singularity in our $subU_M$ is part of a quantum gravity diffraction event that patterns the entire $subU_A$ with antiparticles. The description of this continuous cycling of phenomena between the 2 subUniverse can be summarized as follows:

$BH_A \rightarrow$Quantum Diffraction$\rightarrow WH_M \rightarrow$General Relativity$\rightarrow BH_M$-->QD$\rightarrow WH_A \rightarrow$GR$\rightarrow$

- BH to WH are Quantum Gravity Diffraction phenomenon
  (like evaporating water from ocean to the clouds)
- WH to BH are classical gravity/general relativity phenomena
  (like water raining down mountains into rivers to the ocean)

Without this 4 part cosmic cycle; the Λ-CDM model is only of half a universe and much less than half an explanation of how our Universe works.

At the beginning of this paper I suggested

- We need to connect $subU_M$ to $subU_A$ with wormholes (or quantum some/such)
  - $Wormholes_{M \rightarrow A}$
  - $Wormholes_{A \rightarrow M}$
- And of course, particles and antiparticles will connect between subUniverses.

I assert that the connection between $subU_M$ to $subU_A$ is not a general relativistic wormhole; but a $subU_M$ quantum gravity diffraction singularity (pinhole/diffraction pattern) that projects a diffraction pattern of antiparticles upon the entire subUniverse $subU_A$. (and vice versa). This continuous quantum gravity diffraction across our visible subUniverse $subU_M$ explains the cosmic background uniformity; which is the linchpin evidence in any CMB explanation. That linchpin no longer relies upon the mathematically convenient cosmic inflation hypothesis; which occurred exactly when needed in those first-ish moments (before the big bang or after the big bang as the explanations changed) and only for those exact tiny moments of time. Thus I assert:

- **quantum black hole pinholes (multiple slits) in $subU_A$ quantum diffract particles into our $subU_M$ continuously, while**
- **quantum black hole pinholes (multiple slits) in $subU_M$ quantum diffract antiparticles into $subU_A$ continuously, thus**
- **Completing an this eternal cosmic cycle.**
- The interference patterns of this quantum diffraction should be theoretically calculable; and those predictions can be compared to the evidence in the CMB radiation patterns in astronomical surveys.

As for the cosmic redshift, every quantum photon as it travels across our visible subUniverse feels the continuous quantum intrinsic spin acceleration that cumulatively redshifts each photons frequency (general relativity time dilation) as it travels across our visible $subU_M$ in any direction.

- IF the intrinsic spin (acceleration effect) accumulated in our visible $subU_M$ in a classical Newtonian sense; then the cosmic redshift would be linear like the Hubble effect.
- SINCE the intrinsic spin (quantum acceleration effect) accumulates relativistically, then the observed cosmic redshift is exponential (in exactly the same way that an inflationary/big bang type redshift is exponential).

Cosmic inflation is only an apparent expansion and an apparent explanation; intrinsic quantum spinning of our visible $subU_M$ relative to $SubU_A$ is the quantum reality.

Our $subU_M$ is continuously inflating and deflating in a totally different way:

- Quantum BH_A singularities to WH_M diffraction across $SubU_M$ continuously brings new matter into $subU_M$. (i.e. inflates $subU_M$)
- Quantum BH_M singularity to WH_A diffraction across $SubU_A$ continuously exits matter from $subU_M$ (i.e. deflates $subU_M$)

These two inter-subUniverse quantum/general relativistic phenomena create a dynamic intergalactic pressure dynamic; which neither inflates nor expands; but stabilizes the our $subU_M$. Within our $subU_M$ there is a continual increase of intergalactic pressure from new particles diffracting into our $subU_M$; while there is a continually negative intergalactic pressure caused by black holes at the center of every galaxy draining particles from $subU_M$. This is half of the Cosmic Quantum Gravity Diffraction Cycle (between subUniverses $subU_M$ and $subU_A$. But:

The Standard Model of Elementary Particles Must Be Altered

As explained earlier, the current Standard Model of Elementary Particles understands electrons and W particles properties as follows:

The Electron and W in subU$_M$ (according to the Standard Model)

Electrons are 4 distinct quantum particles:

- **Electron:** m_e**,** left-chiral, charge -1, CAN interact with *W-*
- **Anti-electron**: m_e**,** right-chiral, charge +1, CANNOT interact with *W*
- **Positron**: m_e**,** left-chiral, charge +1, CAN interact with *W +*
- **Anti-positron**: m_e**,** right-chiral, charge -1, CANNOT interact with *W*

The physical electron and physical positron are quantum mixtures of the above

- ***Physical electron*** (i.e. the mass-basis-electron) is a quantum mixture of Electron (above) and the Anti-positron (above) and Higgs effects
- ***Physical positron*** (i.e. the mass-basis-positron) ia a quantum mixture of the Positron (above) and the Anti-electron (above) and Higgs effects

This seems quite incorrect; because in this form the intrinsic spin quantum gravity universe metatheory, that I've just built, is missing a weak force in subU$_A$. So I need to alter the Standard Model of Elementary Particles. Supersymmetry didn't work. The question is, what works? And that hypothesized Altered Standard Model of Elementary Particles will imply new theory, experiments, observations and predictions.

Now we need to hypothesize an Altered Standard Model of Elementary Particles. And by the way, the reason the classical Λ-CDM model of the visible universe has survived os long is that; if you try to change one thing, then you have to change a dozen things. And my quantum metatheory has changed many things. Fortunately, it is a consistent enough quantum metatheory that it suggests simple alterations to the Standard Model of Elementary Particles. This is a much needed symmetry alteration to the Standard Model of Elementary Particles.

To make the intrinsic spin quantum gravity universe work; the properties of the current Standard Model of Elementary Particles have to be expanded. We need:

- imaginary number mass (for the anti-electron and the anti-positron)

This alteration in addition to allowing weak force interactions in subUA also gives us two additional quantum particles.

- 1 additional photon for subU$_A$
- 1 graviton for both subUniverses

The Altered Standard Model of Elementary Particles

The with my metatheory was that some of the particle properties need imaginary number values to work in subU$_A$. And we need to reflect the reality of the relationship between the two subUniverses without interfering with the reality of subU$_M$. In other

words, the Altered Standard Model of Elementary Particles has to work identically as the current Standard Model of Elementary Particles works in $subU_M$. This is not a problem because the altered model only changes unused pieces of the current model. There are part of the current standard model of elementary particles that aren't understood or doing much of anything; so altering them to effectively do an important quantum physical thing may be an improvement.

Of course, theorists and experiments will need confirm this improvement and dream up very complicated and difficult collateral work. The theoretical work to make robust mathematics supporting visualizations is very difficult or non-existent math. The necessary supporting experiments will need to be even more difficult and imaginative.

So here's how I've altered the standard model of elementary particles. I made the following change:

- I've altered 2 of the 4 distinct quantum Electron particles by adding imaginary number mass to the anti-electrons and anti-positron distinct particles:
- I've described weak interactions between the W+ and the anti-electron and the W- and the anti-positron in $subU_A$, which are not part of the current Standard Model of Elementary Particles.
    - **Electron:** m_e**,** left-chiral, charge -1,
        - **CAN interact with *W*- (in $subU_M$)**
        - CANNOT interact with *W*-(in $subU_A$)
    - **Anti-electron**: i#m_e**,** right-chiral, charge +1,
        - CANNOT interact with *W* (in $subU_M$)
        - **CAN interact with *W*+ (in $subU_A$)**
    - **Positron**: m_e**,** left-chiral, charge +1,
        - **CAN interact with *W*+ (in $subU_M$)**
        - CANNOT interact with *W* (in $subU_A$)
    - **Anti-positron**: i#im_e**,** right-chiral, charge -1,
        - CANNOT interact with *W* (in $subU_M$)
        - **CAN interact with *W*- (in $subU_A$)**

The physical electron and physical positron have the same quantum mixtures:

- ***Physical electron*** (i.e. the mass-basis-electron) is a quantum mixture of Electron (above) and the Anti-positron (above) and Higgs effects
- ***Physical positron*** (i.e. the mass-basis-positron) ia a quantum mixture of the Positron (above) and the Anti-electron (above) and Higgs effects

As well as the imaginary number mass property values that replaced real number mass values for 2 of the 4 distinct quantum Electron particles; I will make a similar alteration

for 2 or the 4 distinct quantum particles for every fermion in the Standard Model of Elementary Particles. These alterations to the Standard Model of Elementary Particles are the fewest/simplest adjustments that I could make; that will allow the weak force to work in subU_A. (there are more/complex ways too)

A word is necessary about the names of fermions in the current standard model of elementary particles. The Electron is unique in that it has 4 distinct quantum particles names. That is not true for the other fermions. The other fermions have only 2 distinct particle names that are shared by the 4 distinct quantum particles.

Look up above at the names of the 4 distinct quantum Electrons.
Notice that the

- electron has different properties than the anti-positron
- anti-electron has different properties than the positron

In contrast the strange quark which has 4 distinct quantum particles has only 2 distinct particle names that are shared between the 4 distinct quantum particles

- Strange
- anti-strange

This isn't a problem too often; because for example, the distinction between an anti-electron and a positron is usually too much detail even for physicists) Because it is even to ignore even when talking about the weak force; because in current physics there is not even a consideration of interpreting observable phenomena as indirect evidence of phenomenon/events between particle in subU_M and antiparticles in subU_A.

But having only 2 distinct quantum names for most fermions explicitly biases theory, experiment, predictions and evidence! We don't share, analyze or think about the possible superposition detail in the detail of quantum interactions.

If I were to rename the fermions so as to cause the least confusion I would have

- strange, anti-strange, pstrange, and anti-psterange

The p is taken from the work positron and is added in front of the particle analogous to a positron in the Standard Model

- electron, anti-electron, pelectron (formerly positron), anti-pelectron (formerly anti-positron)

Just a suggestion. I would not use the supersymmetry nomenclature, too confusing.

The two unintended consequences of these fermion changes is that 2 other particles are implicitly defined. A separate photon for subU_A and the quantum graviton for both subUniverses.

The 2 Quantum Photons

In $subU_M$, consider a physical electron and a physical positron annihilate into a photon. What happens in this altered standard model of elementary particles is that the electron part (of the physical electron superposition) and the anti-electron part (of the physical positron superposition) combine into a stable quantum particle of light.

electron + anti-electron → $Photon_M$ (in $subU_M$)

(left-chiral particles quantumly superimpose into $Photon_M$ (in $subU_M$)

Now in $subU_A$, consider a physical electron and a physical positron annihilate into a photon. What happens in this altered model is that the anti-positron part (of the physical electron superposition) and the positron part (of the physical positron superposition) combine into a stable quantum particle of light

. anti-positron + positron → $Photon_A$ (in $subU_A$)

(right-chiral particles quantumly superimpose into $Photon_A$ (in $subU_A$)

$Photon_M$ and $Photon_A$ can be the quantum superpositions of many other quantum events using Feynman diagrams. I prefer the term “superposition” rather than “annihilation”; because it implies quantum interaction are still guided by the underlying quantum properties (particularly relevant for $subU_A$ vs $subU_M$)

So we end with a 2nd distinct physical photon in $subU_A$. With this, now all the physical laws of $subU_M$ also work in $subU_A$. Without these alterations, the physical laws of $subU_A$ would not work identically to those of $subU_M$.

But of course, one other missing necessary particle is the quantum graviton; which is a collateral result of the intrinsic spin quantum gravity universe metatheory.

The Quantum Graviton

$Photon_M$ + $Photon_A$ → Graviton

electron + anti-electron + anti-positron + positron → Graviton

(i.e. 4 distinct quantum fermions superimpose as above → Graviton)

So a quantum graviton quantum superposition double copy of the

- 2 distinct quantum photons or a
- quadruple copy of the 4 distinct quantum fermions

perhaps similar to the gravity double copy of 2 distinct gluons results.

Hawking-Unruh Radiation

Hawking radiation is theoretical radiation that escapes or evaporates from black holes; while the Unruh effect is a similar radiation from an accelerating observer. While neither effect has been observed; the theories suggesting such radiation are convincing. But both Hawking radiation and Unruh effect radiation implicitly assume that such radiation is into our visible $subU_M$. I suggest otherwise, that both Hawking and Unruh effect radiation from our $subU_M$ is into $subU_A$ (and vice versa). Thus each subUniverse continually receives a continuous thermal bath of such particles from our quantum intrinsically spinning partner subUniverses.

Furthermore, the Unruh effect is perhaps the same phenomenon as imaginary number force, F= +i in the gravity gedanken experiment, discussed earlier. If $subU_M$ is intrinsically spinning at the speed of light relative to $subU_A$; then all the particles in $subU_M$ are continually accelerating; then all of those accelerating particles are emitting a warm bath of Unruh effect radiation that is pushing between the two subUniverse. And I assert that the direction of that Unruh radiation is orthogonal to the motion of $subU_M$, which is into $subU_A$. (and vice versa for antiparticles in $subU_A$.)

The gravity gedanken experiment explicitly gives an orthogonal direction of force (i.e. imaginary number force), while the Unruh effect does not. The gravity gedanken gives a classical imaginary number force effect; while the Unrah effect gives a quantum effect. Nevertheless, I view these two different visualizations as descriptions of the same quantum phenomenon that accelerates $subU_M$ intrinsically spinning relative to $subU_A$.

Similarly, I view Hawking radiation as the same phenomenon that I describe as Quantum BH_A singularity to WH_M diffraction across $SubU_M$ (and vice versa).

Conclusion
This intrinsic spin quantum gravity universe metatheory (composed of subU_M and subU_A) gives a rich understanding of subU_M through its many assertions regarding elementary particles, quantum diffraction patterns, CMB radiations, cosmic redshift interpretation, etc that can be tested theoretically, experimentally and observationally.

Please use your subspecialty expertise and imagination to address the challenges presented by this metatheory. If you see the possibility of such a metatheory (not this particular one even); accept the challenge to bring your experimental, observational, theoretical expertise and network of other such experts to discuss and build a better cosmic quantum metatheory than the implicit classical Λ-CDM model metatheory.
My short list of challenges that need attending:

1. Experimentally test to confirm the weak interactions described by my altered standard model of elementary particles.
2. Help to make my use of T-duality math more rigorous.
3. Build/assure consistent mathematical use of imaginary and complex numbers in mass, time (and possibly spin) in general relativity and quantum mechanics elementary particles in subUniverses of this metatheory.
4. Support Intrinsic spin subUniverse with calculations on CMB and cosmic redshift
5. Replacement and reinterpretation of general relativistic black holes as rigorous quantum mechanical singularity (multiple slits) / white hole diffractions patterns across subUniverses
6. Strengthen the physical reasoning throughout about time, intrinsic spin and inertial classical frames being also intrinsic spin accelerating frames
7. Determine whether the graviton of this metatheory is identical to the theoretical graviton determined by the gravity double copy gluon method
8. Determine whether this intrinsic spin quantum gravity universe metatheory is better with 8 dimensions or with 10-D as suggested by string theory. (if 10-D, then separating intrinsic spin direction/dimension from time would add 2 additional dimensions to make 10-D as in string theory).

These challenges are a list of weaknesses with this intrinsic spin quantum gravity universe metatheory. Obviously this metatheory cannot answer these challenges; rather it needs your detailed working subspecialty expertise to address them. This metatheory is a big picture framework meant to encourage and guide, in a consistent quantum measurable phenomenon direction, on possible topics (e.g. shapes and interactions between subUniverses or alterations to the standard model of elementary particles).

Thank you for your consideration.

The end

Appendix A: regarding CERN antihydrogen gravity free fall results

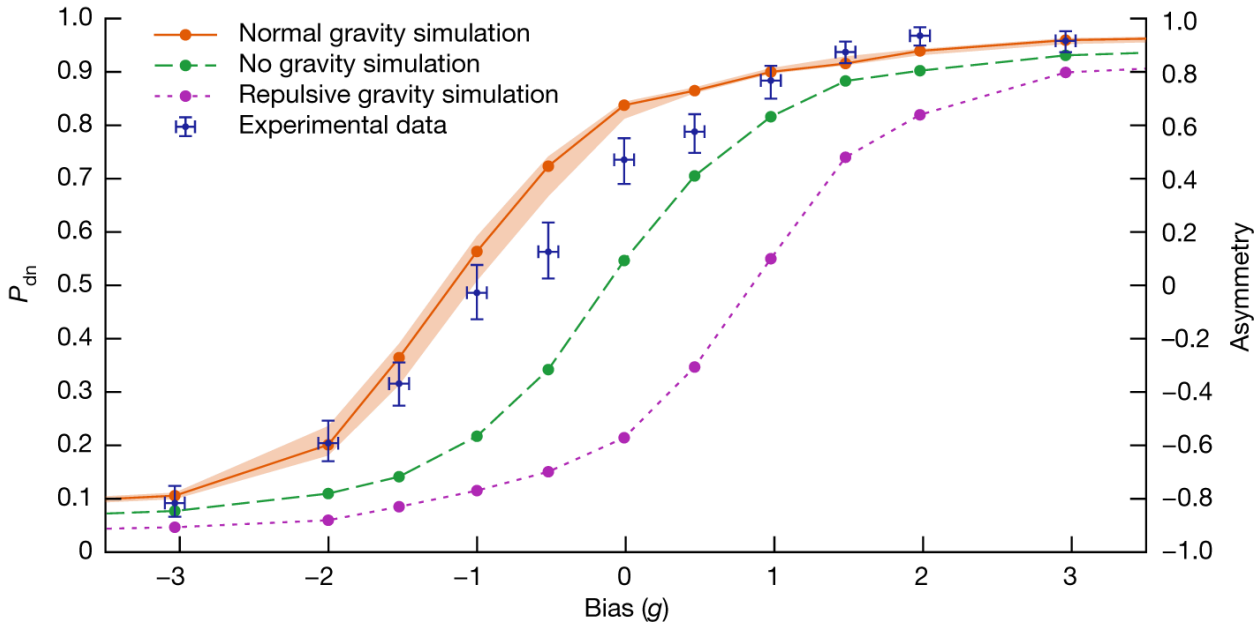
Cern's experimental results Published: 27 September 2023, nature, **Observation of the effect of gravity on the motion of antimatter** reach a different conclusion than I.

> "Here we show that antihydrogen atoms, released from magnetic confinement in the ALPHA-g apparatus, behave in a way consistent with gravitational attraction to the Earth. Repulsive 'antigravity' is ruled out in this case. This experiment paves the way for precision studies of the magnitude of the gravitational acceleration between anti-atoms and the Earth to test the WEP."
>
> https://www.nature.com/articles/s41586-023-06527-1

1. At first I must agree with CERN's tentative experimental conclusion. It is foolish to disagree with the evidence. Who am I to question the diligent experimentalists, who have accomplished such extraordinarily difficult work? I can't; their evidence is correct. BUT..
2. Did CERN do control studies, exactly the same for all steps in the process with normal hydrogen atoms. Were the magnetic containment fields the same for normal hydrogen atoms as for the antihydrogen atoms? Yes I understand that normal hydrogen can be contained in a normal container. But the question is, can normal hydrogen atoms and antihydrogen atoms be contained magnetically with identical magnetic fields. The issue is, is there a chirality difference between hydrogen atoms and antihydrogen atoms?
3. The Earth's magnetic field and equipment magnetic fields have been accounted for; but have they been accounted for identically for hydrogen atoms and for antihydrogen atoms. The only certain way to know that systemic magnetic bias has been removed is to do 2 identical case studies, the first with hydrogen atoms and the second with antihydrogen atoms.
4. Next the antihydrogen atoms, the magnetic containment field is turned off and the antihydrogen atoms are released by the top of the container and the bottom of the container being opened. But nowhere in the paper do we see experimental results for hydrogen atoms.
5. Look at figure 5 in the Nature,27 September 2023 , **Observation of the effect of gravity on the motion of antimatter**
   The problem is normal gravity simulation should be normal gravity experimental data. I know this adds much complexity; but our understanding of antimatter and chirality is so little; that we must assume bias in our experiments.
   https://www.nature.com/articles/s41586-023-06527-1,

Fig. 5: Escape curve and simulations.

From: Observation of the effect of gravity on the motion of antimatter



The derived *P*dn values are plotted versus bias for the experimental data and for simulations of the experiment for three values of the gravitational acceleration a_g: 1g (normal gravity, orange), 0g (no gravity, green) and −1g (repulsive gravity, violet). See the text for the definitions of the uncertainties. The right ordinate is the down-up asymmetry $A = 2P_{dn} - 1$. The confidence intervals on the no- and repulsive gravity simulations are comparable to those for the normal gravity simulation and have been omitted for clarity.

6. It is had to be critical of such excellent work as has been presented in Nature. But we are not done discovering the intricacies and paradoxes of the Standard Model of Elementary Particles. To discover them, we must assume that everything we measure may contain inadvertent biases (theoretical and experimental). (in particular about chirality and antiparticles and weak force)
7. With that critical state of mind, some brilliant theorists and experimentalists may perform the next Wu experiment.