Toward the Unification of Physics and Number Theory

Klee Irwin
At Quantum Gravity Research in Los Angeles, we are developing a fundamental physics unification model called **emergence theory**.
If we are successful, it will be the only microscopic first-principles theory of everything, providing analytical expressions for values such as the Planck constant – a first-principles theory of everything.
What clues does nature offer for what a first-principles theory of everything should look like?
I will show you seven clues and one solution that embraces them all.
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1. Information
I will show you seven clues and one solution that embraces them all.

1. Information
2. Causality Loops
I will show you seven clues and one solution that embraces them all.

1. Information
2. Causality Loops
3. Non-determinism
I will show you seven clues and one solution that embraces them all.

1. Information
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4. Consciousness
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5. Pixelation
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6. E8 Crystal
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1. Information
2. Causality Loops
3. Non-determinism
4. Consciousness
5. Pixelation
6. E8 Crystal
7. Golden Ratio
Nature’s Clue 1: Information
First, let us think about physical and mathematical ontology – the study of what is real and what is not.
Information

First, let us think about physical and mathematical ontology – the study of what is real and what is not.

Are spacetime and energy made of some unknown substance created by the big bang or by god?
Information

Or are they pure information?
If they are information, what is the form of the symbolism?
Information

If they are information, what is the form of the symbolism?

After all, information is meaning in the form of symbolism.
Information
And how can symbolism and information exist without some notion of consciousness to actualize them into existence?
Information

Nobel laureate and Herman Fashback Professor of Physics at MIT, Frank Wiczek, said:
Information

Nobel laureate and Herman Fashback Professor of Physics at MIT, Frank Wiczek, said:

“The relevant literature [on the meaning of quantum theory] is famously contentious and obscure...
“...it will remain so until someone constructs, within the formalism of quantum mechanics, an observer, that is, a model entity whose states correspond to a recognizable caricature of conscious awareness.”
Wilczek is speaking of the need to discover a new quantum mechanical formalism with a mathematical operator or entity capable of generating information via measurement.
Information

His motivation is on solid ground. Quantum mechanics boldly indicates the ontology of physical reality must be based on observation, where all that exists is that which is measured.
Information

It is too radical to suggest physical reality needs humans to measure it in order to be real.
Max Tegmark of MIT believes reality is made mathematical symbolism.
Information

His *mathematical universe hypothesis* states:
His mathematical universe hypothesis states:

“Our external physical reality is a mathematical structure...
His *mathematical universe hypothesis* states:

“Our external physical reality is a mathematical structure...

... that is, the physical universe *is* mathematics...
Information

...In those worlds complex enough to contain self-aware substructures, they will perceive themselves as existing in a physically real world.”
Information

Thousands of physicists agree with Tegmark.
Thousands of physicists agree with Tegmark.

But what does he mean by “physically real world”? 
He is pointing to the idea of an illusion, like in a virtual reality game, where the underlying information only appears to be our geometric spatial reality.
Information

However, mathematics is symbolic language dealing with the meaning of numbers.
And the fundamental information or meaning of physical reality is geometry and ratio.
So if reality were made of 3D numerical symbolism encoding both geometry as well as set and number theoretic meaning, would that form of symbolism be non-illusionary and “real”? 
Information

We suggest “shape-numbers” called *simplex-integers*.
Information

Information is meaning in the form of symbolic language.
For example, the subjective symbols “d-o-g” can represent the meaning of this animal here.
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Non-subjective geometric symbols represent themselves:
Information

Reality is geometric.
Information

Reality is geometric.

And both classic and quantum theory indicate reality is made of information.
Information

Reality is geometric.

And both classic and quantum theory indicate reality is made of information.

Geometric symbolism may explain how a geometric reality can be made of information.
Perhaps a mosaic-like language of 3D geometric symbols could express the meaning of a geometric reality like ours.
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Quasicrystalline codes are exactly such languages. And they are inherently non-local and described by non-commutative geometry.
In a pending paper, we introduce the notion of *simplex-integers* and show how simplexes are the most powerful numeric symbol expressing the counting function and set theoretic substructure of an integer.
We introduce a purely geometric primality test for simplex integers, which extends also to the $A_n$ lattice series:
We introduce a purely geometric primality test for simplex integers, which extends also to the $A_n$ lattice series:

A simplex-integer is prime if and only if its 0-simplexes divide evenly into each sum of its sub-simplexes.
Take, for example, the idea of the 99-simplex and its lattice analogue, $A_{99}$. 
Take, for example, the idea of the 99-simplex and its lattice analogue, $A_{99}$.

Embedded within these geometric structures are the distribution of 25 prime-simplexes and 25 prime moduli sub-spaces of the moduli space of the $A_{99}$ lattice.
Does anyone doubt there is a purely geometric reason for the distribution of the 25 prime simplexes within the 99-simplex?
Would that geometric explanation allow one to predict the 25 prime simplexes without using a prime sieving algorithm or other by-hand method?
Information

Prime simplexes have a certain *divisional symmetry* in their geometry, for lack of a better term.
Prime simplexes have a certain *divisional symmetry* in their geometry, for lack of a better term.

For example, the 5 vertices of the simplex-integer associated with the prime number 5 divides evenly into its ten 1-simplexes, ten 2-simplexes and five 3-simplexes.
Are there topological or symmetry based or volumetric aspects of prime-simplexes that stand out as a signature in simplex-integer symbols that are not apparent in digital number theory?
If there were a geometric approach that could predict the 25 prime simplexes within a 99-simplex or its lattice, the Riemann hypothesis would be solved.
Information

For example, the *prime number theorem* incorrectly predicts 21.7 primes within the same bound of numbers.
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For example, the *prime number theorem* incorrectly predicts 21.7 primes within the same bound of numbers.

And it is precisely this error value of 25 - 21.7 = 3.3 (or the error in any bound) that correlates to the non-trivial zeta zeros.
Of course, discovering an exact way to predict the number of prime-simplexes within any bound predicts the same number of primes within a bound of digital numbers.
Information

With simplex-integer number theory, there is less motivation to focus on probability theory.
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Perhaps the 157 years of stubbornness of this problem is due to the fact that nearly all number theorists focus on digital numbers, where geometric and set theoretic information is washed out.
An interesting difference between simplex-integer number theory and digital number theory is algebraic versus transcendental numbers.
An interesting difference between simplex-integer number theory and digital number theory is algebraic versus transcendental numbers.

Specifically, to force the additive series of digital numbers to converge, we must invert them in the zeta function and place a power on the denominator.
Information

When \( s = 2 \), we get the integers to converge relative to the transcendental expression:

\[
\frac{1}{(1^2)} + \frac{1}{(2^2)} + \frac{1}{(3^2)} \ldots = \frac{\pi^2}{6}
\]
Information

When $s = 2$, we get the integers to converge relative to the transcendental expression:

$$\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots = \frac{\pi^2}{6}$$

By contrast, the circumradii of the simplex-integer additive series converges without the zeta function to the algebraic expression $\frac{1}{\sqrt{2}}$. 
Similarly, the transcendental natural logarithm in the *prime number theorem* generates the erroneous prediction of 21.7 primes in the bound 1-100.
Information

Similarly, the transcendental natural logarithm in the *prime number theorem* generates the erroneous prediction of 21.7 primes in the bound 1-100.

By contrast, the analogous expression predicting the number of prime-simplexes within some bound should involve an algebraic irrational.
The philosophy of discreteness versus smoothness that is currently debated among quantum gravity theorists is related to the fundamental differences between “smooth” transcendental numbers like $\pi$ and $e$ versus algebraically “crisp” numbers like the golden ratio or $\sqrt{2}$. 
From cosmic to micro scales, nature exhibits fractality.
Information

From cosmic to micro scales, nature exhibits fractality.

Our quantum gravity framework is built upon a network of Fibonacci chains.
We discovered a fractal pattern in the discrete Fourier transform of Fibonacci chain intervals.
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The box-counting dimension is about 2/3.
Similarly, we discovered a fractal pattern in the Fourier transform of the logarithm of primes.
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Its fractal dimension is about .56 [box counting].
Freeman Dyson says the distribution of primes corresponds to a 1D quasicrystal, where that term is defined as an aperiodic pure point spectrum.
Every such quasicrystal corresponds to an irrational cut and projection through a higher dimensional crystal.
And the most fundamental higher dimensional crystals correspond to the $A_n$ lattice series because they correspond to the simplest possible cells, the $n$-simplexes.
A projection of an irrational slice through any A-lattice to 1D, encodes in that quasicrystal the distribution of prime-A-lattices within that bound.
Of course, Wigner’s universality pattern is evident in the distribution of non-trivial zeta zeros. And indeed, it is a 1D quasicrystal.
Nature’s Clue 2: Causality Loops
Causality Loops

Einstein showed how the future and past exist *simultaneously* in one geometric object.
Causality Loops

In 2014, scientists in Israel demonstrated that particles can be entangled over time and not just space.
Causality Loops

Daryl Bem of Cornell published rigorous evidence that retro-causality exists, where future events loop back in time to co-create past events.
Causality Loops

Obviously, the past co-creates the future.
Causality Loops

Obviously, the past co-creates the future.

But what happens when the future also co-creates the past?
Causality Loops

Obviously, the past creates the future.

But what happens when the future also creates the past?

An evolving co-creation feedback loop results.
Causality Loops

Like the feedback between two mirrors.
Causality Loops

Or the mathematical feedback loop of a fractal.
Causality Loops

If every moment is co-creating every other moment both forward and backward in time...
Causality Loops

If every moment is co-creating every other moment both forward and backward in time...

...reality is technically a neural network of information spanning space and time.
Causality Loops

This type of network would possess a strange quality...
Causality Loops

This type of network would possess a strange quality...

...it would be self-actualized – its own creator.
Nature’s Clue 3: Non-determinism
Non-determinism

Prior to the 1920s, it was popular to believe in the clock-work universe idea that reality is a deterministic program playing itself out.
Non-determinism

Prior to the 1920s, it was popular to believe in the clock-work universe idea that reality is a deterministic program playing itself out.

In that view, this fish didn’t choose to jump. It was just following a deterministic algorithm.
Non-determinism

The famous double-slit experiment ruled out determinism, ushering in the new paradigm of quantum indeterminism.
Non-determinism

But even without the double slit experiment, the existence of freewill rules out the clock-work universe hypothesis.
John Wheeler, who coined the term black hole, said reality is made of information created by observation—by consciousness.

Nature’s Clue 4: Consciousness
Consciousness

Bell’s theorem essentially states:

All that exists is that which is measured.
Consciousness

John Wheeler, who coined the term *black hole*, said reality is made of information created by observation – by consciousness.
Consciousness

It certainly exists in the universe - at least in us.
Consciousness

It certainly exists in the universe - at least in us.

And it relates deeply to quantum mechanics in ways not yet fully understood.
Consciousness

The definition of *information* involves the perception of *meaning*, and meaning is a subjective, freewill choice – an act of consciousness.
Consciousness

So when one realizes that energy is pure information, it becomes clear that reality itself deeply ties into consciousness in some way...
Consciousness

So when one realizes that energy is pure information, it becomes clear that reality itself deeply ties into consciousness in some way...

...as though the information based foundation of reality somehow lives in a substrate of self-organized emergent consciousness.
Consciousness

Did consciousness and information emerge in a causality feedback loop?

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
Nature's Clue 5: Pixelation
Werner Heisenberg deduced space and time are pixelated into indivisible Planck units, like a mosaic.
Pixelation

The mathematics indicated this ...
The mathematics indicated this ...

...and there was no solid experimental evidence for smooth space or time.
Pixelation

However, this new idea was too radical for most scientists of the day except for Niels Bohr, who agreed with Heisenberg.
Today, most scientists agree that a length can be no shorter than the Planck length – which suggest reality is pixelated.
Pixelation

What type of binary geometric code would describe a pixelated mosaic-like reality?

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
Nature’s Clue 6: 
E8 Crystal
E8 Crystal

The largest and most expensive object humans have ever built is the Large Hadron Collider in Geneva, Switzerland.
E8 Crystal

What is it?

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
E8 Crystal

What is it?

A microscope.
E8 Crystal

What is it?

A microscope.

It peers down into the subatomic realm by colliding particles together and giving us data on how they break apart.
E8 Crystal

So what have we learned from 80 years of smashing particles together?
E8 Crystal

We learned that all fundamental particles and forces, including gravity, convert into one another according to the geometry of an 8-dimensional Archimedean solid.
E8 Crystal

It forms a crystal structure in eight dimensions called the E8 lattice.
E8 Crystal

It can be built entirely from 3D simplexes-integers, regular tetrahedra...
E8 Crystal

It can be built entirely from 3D simplexes-integers, regular tetrahedra...

...rotated from one another into different 3D subspaces of $\mathbb{R}^8$ by a golden ratio based angle.
Nature’s Clue 7: Golden Ratio
Golden Ratio

The golden ratio may be the fundamental constant of nature.
Golden Ratio

Along with its rational form, the Fibonacci sequence, it is ubiquitous in the universe, from quantum to celestial scales.
Golden Ratio

Along with its rational form, the Fibonacci sequence, it is ubiquitous in the universe, from quantum to celestial scales.

Let’s explore a few examples starting with black holes.
Pay attention to the fact that these golden ratio equations are tying together (1) digital information theory, (2) thermodynamics, (3) general relativity and (4) quantum mechanics.
Golden Ratio

Carlo Rovelli said the heat of black holes is the Rosetta Stone of physics, written in a combination of three languages – quantum gravitational and thermodynamic – and still awaiting our decipherment.
The golden ratio is the precise point where a black hole’s modified specific heat changes from positive to negative.

\[
\frac{M^4}{J^2} = \phi
\]
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\[ \frac{M^4}{J^2} = \phi \]

And it is part of the equation for the lower bound on black hole entropy.

\[ \frac{8\pi S l_p^2}{e^{\frac{kA}{8\pi S l_p^2}}} \geq \phi \]
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And it is part of the equation for the lower bound on black hole entropy.

\[
\frac{8\pi S l_p^2}{e^{\frac{kA}{2\pi\gamma}}} \geq \phi
\]

The golden ratio even relates the loop quantum gravity parameter to black hole entropy.

\[
2^{\pi\gamma} = \phi
\]
Golden Ratio

Why does this support the claim that it is the fundamental constant of nature?

\[
\frac{M^4}{J^2} = \phi \\
2\pi\gamma = \phi \\
\frac{8\pi S i_p^2}{e kA} \geq \phi
\]
Golden Ratio

Because a theory of everything must unite general relativity with quantum mechanics.

\[ \frac{M^4}{J^2} = \phi \]

\[ 2\pi\gamma = \phi \]

\[ \frac{8\pi S l_p^2}{e kA} \geq \phi \]
Golden Ratio

And a black hole is where these two theories converge.

\[
\frac{M^4}{J^2} = \phi
\]

\[
2 \pi \gamma = \phi
\]

\[
\frac{8 \pi s l_p^2}{e k A} \geq \phi
\]
Golden Ratio

Black hole theory also tells us reality is made of binary information.

\[ \frac{M^4}{J^2} = \phi \]

\[ 2\pi\gamma = \phi \]

\[ e \frac{8\pi S_i^2}{kA} \geq \phi \]
Golden Ratio

The idea is known as the holographic principle...

\[
\frac{M^4}{J^2} = \phi \\
2\pi\gamma = \phi \\
2\frac{8\pi S l_p^2}{e k A} \geq \phi
\]
Golden Ratio

The idea is known as the holographic principle...

....and it comes from a mathematical proof called the Maldacena conjecture.
Golden Ratio

It states that the total amount of binary information from all the mass and energy pulled into a black hole is proportional to its surface area...
Golden Ratio

It states that the total amount of binary information from all the mass and energy pulled into a black hole is proportional to its surface area...

...where every four Planck areas of its surface encode the state of a fundamental particle that fell into it.
Golden Ratio

This is interesting because the 4-term 2x2 binary matrix is the most fundamental of all matrices.

\[
\begin{pmatrix}
1 & 1 \\
1 & 0
\end{pmatrix}
\]
Golden Ratio

7/8ths of the 16 eigenvalues are trivial as 0, 1 or 2.

\[
\begin{pmatrix}
1 & 1 \\
1 & 0
\end{pmatrix}
\]
Golden Ratio

1/8\textsuperscript{th} are non-trivial golden ratio values as:
Golden Ratio

1/8\(^{th}\) are non-trivial golden ratio values as:

\[ \phi \text{ and } -\frac{1}{\phi} \]
Golden Ratio

In fact, these are the most probable non-trivial or root values for any size random binary matrix.

\[ \phi \text{ and } \frac{1}{\phi} \]
Golden Ratio

Both black holes and quantum mechanics deeply relate to the golden ratio, binary information and the number 4...
Golden Ratio

Both black holes and quantum mechanics deeply relate to the golden ratio, binary information and the number 4...

...the number of vertices of a tetrahedron.

Information  Causality Loops  Non-determinism  Consciousness  Pixelation  E8 Crystal  Golden Ratio
Golden Ratio

In our quantum gravity program, 3-simplices act as “3D bits” that are registered as being “on” or “off” and form E8 related golden ratio orientations relative to adjacent 3-simplices.
Golden Ratio

The gravitational constant, $G$, ties time and length based values together as: $G = \chi \frac{c^2}{4\pi}$

\[
\frac{M^4}{J^2} = \phi \\
2\pi\gamma = \phi \\
\frac{8\pi S l_p^2}{e \frac{kA}{kA}} \geq \phi
\]
Golden Ratio

The gravitational constant, $G$, ties time and length based values together as: $G = \chi c^2 / 4\pi$

$\phi = 99.9997\%$ of $= h\chi$ as: $0.6180382(10^{-53})$ m$^3$/sec.
Golden Ratio

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$\phi = 99.9997\% \text{ of } = h\chi$ as: $0.6180382(10^{-53}) \text{ m}^3/\text{sec.}$

This deviation at the millionth place after the decimal is remarkable.
Golden Ratio

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$\phi = 99.9997\%$ of $= h\chi$ as:

$0.6180382(10^{-53}) \text{ m}^3/\text{sec}$.

This deviation at the millionth place after the decimal is remarkable.

But how can this be true if the meter and second are man-made metrics?
Golden Ratio

Well, it turns out they’re not so man-made...
Golden Ratio

Well, it turns out they’re not so man-made... thanks to the French.
Golden Ratio

The metric unit is simply the distance from the Equator to a pole, the minimally distorted ¼ circumference of Earth.
Golden Ratio

And the dimensionless ratio of the Earth to Moon pole through pole diameters is $\sqrt{\phi} - 1$. 

---

- Information
- Causality Loops
- Non-determinism
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- E8 Crystal
- Golden Ratio
Golden Ratio

And the dimensionless ratio of the Earth to Moon pole through pole diameters is $\sqrt{\varphi} - 1$.

If this ratio is used as a physical basis for a metric...
Golden Ratio

And the dimensionless ratio of the Earth to Moon pole through pole diameters is $\sqrt{\phi} - 1$.

If this ratio is used as a physical basis for a metric...

...the ratio of these values to $\frac{1}{4}$ of Earth’s diameter is 99.9% of 1.
Golden Ratio

So the French had good intuition about this even though they did not know about the golden ratio relationship.
Golden Ratio

Our quantum gravity model uses two fundamental lengths at the Planck scale, the Dirichlet integers:

1 and 1/ϕ.
Golden Ratio

These Fibonacci chains form a network in 3D exactly equal to our E8 derived quasicrystal made of 3-simplexes.
Golden Ratio

These Fibonacci chains form a network in 3D exactly equal to our E8 derived quasicrystal made of 3-simplexes.

It is based on the icosahedral rotational symmetries: 2-fold, 3-fold and 5-fold.
Golden Ratio

It is also made of the square roots of 2, 3 and 5 because it is based on 3-simplexes related by golden ratio spacing and rotation.
Golden Ratio

2, 3 and 5 are sequential Fibonacci numbers.
Golden Ratio

The unit of time called the second is not man-made. It’s based on the orbital time periods of the Earth Moon system, which are based on Fibonacci numbers.
Golden Ratio

The number of full Moons in a year is based on the Pythagorean triple triangle of two Fibonacci numbers, 5 and 13, and on $12 = (2^2)(3) = (F_3^2)(F_4)$.
Golden Ratio

Dividing the 5 side into the next two smaller Fibonacci numbers, 2 and 3, generates a line of length: 12.369.
Golden Ratio

Dividing the 5 side into the next two smaller Fibonacci numbers, 2 and 3, generates a line of length: 12.369.

This is the number of full Moons in a year to an accuracy of about 99.999%.
Golden Ratio

There are many other Fibonacci based time and space values in astrophysics.
Golden Ratio

There are many other Fibonacci based time and space values in astrophysics.

But for now, let us note that the significant digits of the number of seconds in a day is $864 = \text{the } 2, 3 \text{ and } 5 \text{ related factorization to Fibonacci powers as } (F_3^5)(F_4^3) = 2^5 3^3$. 

- Information
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Golden Ratio

In other words, we have an Earth-Moon “clock” with two spherical “gears” that have a size ratio of \( \sqrt{\phi} - 1 \) with a ratio to \( \frac{1}{4} \) of the Earth circumference of about 1, which we use as the unit value for our scientific metric system.
Golden Ratio

Consider that the rotation cycles of these two golden ratio based spherical gears might accordingly be based on their dimensionless ratios.
Golden Ratio

Consider that the rotation cycles of these two golden ratio based spherical gears might accordingly be based on their dimensionless ratios.

The Earth day itself is a geometric system based on the rotation of Earth’s mass, as acted upon by a golden ratio relationship with the Moon’s mass.
Golden Ratio

Then we get our fundamental time unit, the second, from this golden ratio Earth-Moon clock by taking the average Earth day divided by one of the most rudimentary Fibonacci power products \((F_3^5)(F_4^3)\).
Golden Ratio

And using these non-manmade approximations based on dimensionless values as our metric for length and time, we find that $c = 299,792,458 \text{ m/s} = 99.9\%$ of $3$, which is the first odd prime and the Fibonacci number $F_4$. 

- Information
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Golden Ratio

In other words, the $2^5 3^3$ based division of the golden ratio based Earth Moon “clock” may be no more man-made than the golden ratio related metric system based.
Golden Ratio

$\phi = 99.997\%$ of $= h\chi$ is interesting in light of our geometric first principles approach to fundamental physics on the *quasicrystalline spin network.*
Golden Ratio

\[ \phi = 99.9997\% \text{ of } = h\chi \text{ is interesting in light of our geometric first principles approach to fundamental physics on the quasicrystalline spin network.} \]

Our object starts at the Planck length and scales as the golden ratio power series.
Golden Ratio

All of physics can be built up from any two of the dimensional constants $c$, $h$ and $G$. 
Golden Ratio

All of physics can be built up from any two of the dimensional constants $c$, $h$ and $G$.

And the most important dimensionless value is the fine structure constant $\alpha$. 
Golden Ratio

All of physics can be built up from any two of the dimensional constants $c$, $h$ and $G$.

And the most important dimensionless value is the fine structure constant $\alpha$.

The relationships of $c$, $h$ and $G$ are expressed as $l_p = \frac{\sqrt{hG}}{c^3}$, the Planck length spatial “pixel” of reality.
Golden Ratio

All of physics can be built up from any two of the dimensional constants \( c, h \) and \( G \).

And the most important dimensionless value is the fine structure constant \( \alpha \).

The relationships of \( c, h \) and \( G \) are expressed as \( l_p = \sqrt{\frac{hG}{c^3}} \), the Planck length spatial “pixel” of reality.

And \( l_p = 99.9\% \) of \( \phi \) if the metric system is used.
Golden Ratio

All of physics can be built up from any two of the dimensional constants $c$, $h$ and $G$.

And the most important dimensionless value is the fine structure constant $\alpha$.

$$\alpha^{-1} = 99.7\% \text{ of } \frac{360}{\Phi^2}$$
Golden Ratio

I’ve presented golden ratio approximations with deviations as high as the millionth place after the decimal. Because different experiments give different values, the constants are only known to the 4\textsuperscript{th} place after the decimal.

| Method                          | Value of $h$ ($10^{-34}$ J\cdot s) |
|---------------------------------|-------------------------------------|
| Watt balance                    | 6.62606889(23)                      |
| X-ray crystal density           | 6.6260745(19)                       |
| Josephson constant              | 6.6260678(27)                       |
| Magnetic resonance              | 6.6260724(57)                       |
| Faraday constant                | 6.6260657(88)                       |
| CODATA 2010 recommended value   | 6.62606957(29)                      |

The nine recent determinations of the Planck constant cover five separate methods. Where there is more than one recent determination for a given method, the value of $h$ given here is a weighted mean of the results, as calculated by CODATA.
Golden Ratio

If the *quasicrystalline spin network* approach to quantum gravity is correct, why is the Planck length only about 99.9% of the golden ratio?

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**Golden Ratio**

To answer that, one should understand that our quantum gravity framework will predict that systems like the Earth-Moon clock settle into spatial and time based patterns that approximate the golden ratio substructure of spacetime because these will be energetically favorable.

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| Josephson constant            | 6.6260678(27)                 |
| Magnetic resonance            | 6.6260724(57)                 |
| Faraday constant              | 6.6260657(88)                 |
| CODATA 2010 recommended value | 6.62606957(29)                |

The nine recent determinations of the Planck constant cover five separate methods. Where there is more than one recent determination for a given method, the value of $h$ given here is a weighted mean of the results, as calculated by CODATA.
Golden Ratio

In other words, physical systems seek to find the best Fibonacci ratio approximation of the golden ratio, due to finiteness. For example, the two double helices of DNA are offset by a Fibonacci ratio of 13:21 angstroms = 99.8% of $\phi$.

| Method                          | Value of $h$ ($10^{-34}$ J⋅s) |
|---------------------------------|-------------------------------|
| Watt balance                    | 6.62606889(23)                |
| X-ray crystal density           | 6.6260745(19)                 |
| Josephson constant              | 6.6260678(27)                 |
| Magnetic resonance              | 6.6260724(57)                 |
| Faraday constant                | 6.6260657(88)                 |
| CODATA 2010 recommended value   | 6.62606957(29)                |

The nine recent determinations of the Planck constant cover five separate methods. Where there is more than one recent determination for a given method, the value of $h$ given here is a weighted mean of the results, as calculated by CODATA.
Golden Ratio

If we “normalize” the Earth-Moon ratio to be exactly our golden ratio values instead of just 99.9%, we get a slightly adjusted metric unit as 0.9990419 of the current value.

| Method                      | Value of $h$ ($10^{-34}$ J·s) |
|-----------------------------|--------------------------------|
| Watt balance                | 6.62606889(23)                 |
| X-ray crystal density       | 6.6260745(19)                  |
| Josephson constant          | 6.6260678(27)                  |
| Magnetic resonance          | 6.6260724(57)                  |
| Faraday constant            | 6.6260657(88)                  |
| CODATA 2010 recommended value| 6.62606957(29)                 |

The nine recent determinations of the Planck constant cover five separate methods. Where there is more than one recent determination for a given method, the value of $h$ given here is a weighted mean of the results, as calculated by CODATA.
Golden Ratio

This shorter metric unit then moves the approximation of the Planck length from the current value of 99.9% of Φ to about 99.99% and it moves the value of c to about 99.99% of 3. Again, the measured values for h and G are only known to about the 4th place after the decimal, the same range of accuracy we are speaking of here.

| Method                        | Value of h \(10^{-34} \text{ J} \cdot \text{s}\) |
|-------------------------------|------------------------------------------|
| Watt balance                  | 6.62606889(23)                           |
| X-ray crystal density         | 6.6260745(19)                            |
| Josephson constant            | 6.6260678(27)                            |
| Magnetic resonance            | 6.6260724(57)                            |
| Faraday constant              | 6.6260657(88)                            |
| CODATA 2010 recommended value | 6.62606957(29)                           |

The nine recent determinations of the Planck constant cover five separate methods. Where there is more than one recent determination for a given method, the value of h given here is a weighted mean of the results, as calculated by CODATA.
Golden Ratio

75% of the universe is made of hydrogen.
**Golden Ratio**

75% of the universe is made of hydrogen.

And the basis of all atomic theory can be derived from its values.
Based on work done by C. H. Suresh and N. Koga in 2001, Raji Heyrovksa showed the atomic radius of Hydrogen in methane to be the Bohr radius over the golden ratio.

\[ r_H = \frac{a_0}{\phi} \]
Golden Ratio

In 1993, Lucien Hardy, of the Perimeter Institute for Theoretical Physics, discovered that the probability of entanglement for two particles projected in tandem is:

\[ \phi^{-5} \]
Golden Ratio

The results were experimentally confirmed three times in peer reviewed papers during the period 1993 to 2009.

$\phi^{-5}$
Golden Ratio

In 2010, a multinational team of scientists found an E8 based golden ratio signature in solid state matter.
Golden Ratio

Cobalt niobate was put into a quantum-critical state and tuned to an optimal level by adjusting the magnetic fields around it.
Cobalt niobate was put into a quantum-critical state and tuned to an optimal level by adjusting the magnetic fields around it.
Golden Ratio

The optimal level occurred when the resonance to pitch was in a golden ratio based value specifically related to the geometry of E8.
Key to the Puzzle
Key to the Puzzle

Nature has given us 7 clues about a theory of everything. So what is the key to this puzzle?

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
Key to the Puzzle

Our research program is focused on projecting the E8 crystal to 3D and 4D, which creates a golden ratio based binary code of pixelated space and causality loops requiring emergent consciousness.

✔ Information ✔ Causality Loops ✔ Non-determinism ✔ Consciousness ✔ Pixelation ✔ E8 Crystal ✔ Golden Ratio
The cell shape of E8 that best represents it is the Gosset polytope with 240 vertices.
Key to the Puzzle

When we project this to 4D, it becomes two identical shapes of different sizes like these here.
Key to the Puzzle

The ratio of their sizes is:

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
Key to the Puzzle

The ratio of their sizes is:

\[ \phi \]
Key to the Puzzle

And each is made of 600 regular 3D tetrahedra rotated from one another by a golden ratio based angle.
Key to the Puzzle

The 600-cells intersect in seven golden ratio based ways and kiss in one particular way to form a 4D aperiodic mosaic tiling called a quasicrystal.

☑️ Information  ☑️ Causality Loops  ☑️ Non-determinism  ☑️ Consciousness  ☑️ Pixelation  ☑️ E8 Crystal  ☑️ Golden Ratio
A quasicrystal is a code or language.
Key to the Puzzle

This is because the ways you can arrange the building block geometric symbols or shapes are governed by rules (like a language).
Key to the Puzzle

But within the rules, you must make choices that are not forced by those rules.

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
Key to the Puzzle

So because it is not a deterministic or forced set of building instructions, there is freedom to create many patterns while still obeying the rules of the code.
Key to the Puzzle

It is a language in every sense of the word...

Information  Causality Loops  Non-determinism  Consciousness  Pixelation  E8 Crystal  Golden Ratio
It is a language in every sense of the word...

...specifically it is a language of waves or vibrations.
Key to the Puzzle

The 4D quasicrystal is represented in 3D with regular tetrahedra related by golden ratio based rotations and looks like this.
Key to the Puzzle

The language is binary, where tetrahedra form an invisible *possibility space* and are chosen to be “on” or “off” in each frame, according to the language rules.

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
Key to the Puzzle

Over many quasicrystal frames, dynamic wave and particle-like patterns emerge.
Key to the Puzzle

Remember, evidence prevents us from believing in the deterministic Newtonian clock-work universe.
Key to the Puzzle

And codes cannot be operated by randomness or they breakdown and cease to generate meaning.
Key to the Puzzle

So if reality is based on something like our E8 physics, WHO or WHAT is choosing the steps in the code that require freewill?
Key to the Puzzle

It is certainly not us because this is a code that operates down at the Planck scale.

- Information
- Causality Loops
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- Pixelation
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Key to the Puzzle

And again, randomness does not generate meaning in languages.
Key to the Puzzle

Plus, there is no first principles explanation for randomness or even experimental evidence for it.
Key to the Puzzle

Can a consciousness that emerges from the code be the origin of the code in the first place – making it a logically consistent causality loop?
Key to the Puzzle

A universal collective consciousness could be the answer.

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
Key to the Puzzle

A universal collective consciousness could be the answer.

But that sounds New Age and religious.
Key to the Puzzle

And besides, how could such a thing emerge from a universe made of information?
Key to the Puzzle

And how would the information emerge in the first place?
Key to the Puzzle

Clearly, evolutionary emergence by self-organization is how the universe works...
Key to the Puzzle

Clearly, evolutionary emergence by self-organization is how the universe works...

...where small and simple things self-organize into larger emergent things.
Key to the Puzzle

Our consciousness is an extreme example of emergence via self-organization.
Key to the Puzzle

The mathematical power of a neural-network like universe based on our quasicrystalline spin network is in its massive non-local connectivity – both forward and backward in time.
Key to the Puzzle

Networks harness the mathematical power of exponential connectivity and growth.

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
Key to the Puzzle

As an example, let’s fold this piece of paper four times.
Key to the Puzzle

As an example, let’s fold this piece of paper four times.

It’s still just a few millimeters thick.
Key to the Puzzle

How thick will it be if I folded it another 99 times for a total of 103 folds?
Key to the Puzzle

How thick will it be if I folded it another 99 times for a total of 103 folds?

It would be twice as big as...
The Universe
Key to the Puzzle

There are no laws in physics that place an upper limit on what percentage of the universe can exponentially self-organize into freewill systems like us humans.
Key to the Puzzle

Physics allows the possibility that all the energy of the universe can be converted into a single conscious system that is itself a network of conscious systems.
Key to the Puzzle

Given enough time, what can happen will eventually happen.

- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio
Key to the Puzzle

Given enough time, what can happen will eventually happen.

By this axiom, universal emergent consciousness has emerged via self-organization somewhere ahead of us in 4D space-time.
Key to the Puzzle

Given enough time, what can happen will eventually happen.

By this axiom, universal emergent consciousness has emerged via self-organization somewhere ahead of us in 4D space-time.

And because it is possible, it is inevitable.
Key to the Puzzle

In fact, according to the evidence of retro-causality time loops, that inevitable future is co-creating us right now just as we are co-creating it.
In summary, our geometric reality may be a lower dimensional code of shape-numbers called simplex-integers derived from a hyper-dimensional lattice via projective geometry.
