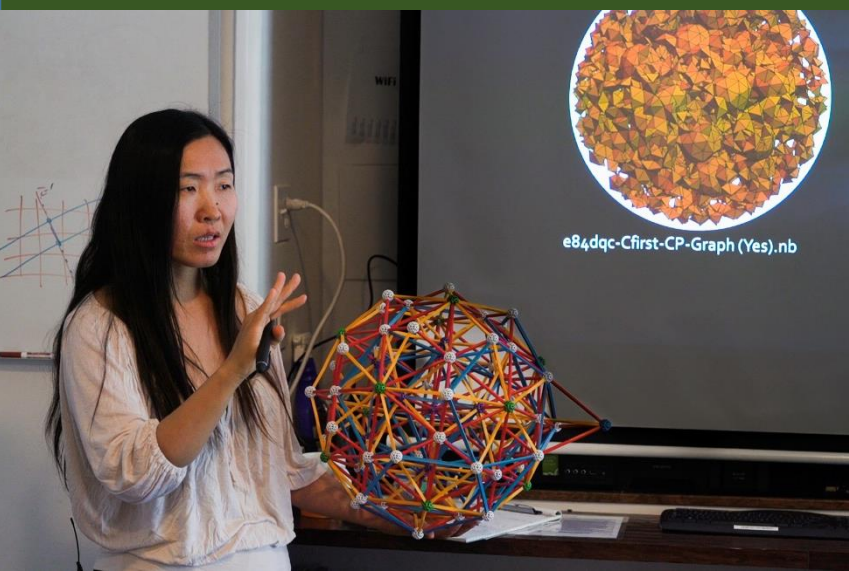


Toward the Unification of Physics and Number Theory

Klee Irwin



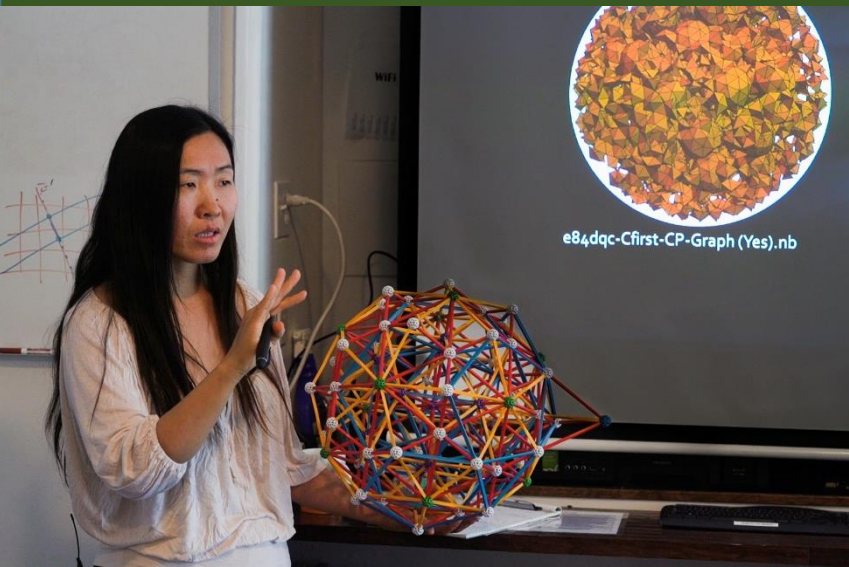
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At Quantum Gravity Research in Los Angeles, we are developing a fundamental physics unification model called *emergence theory*.



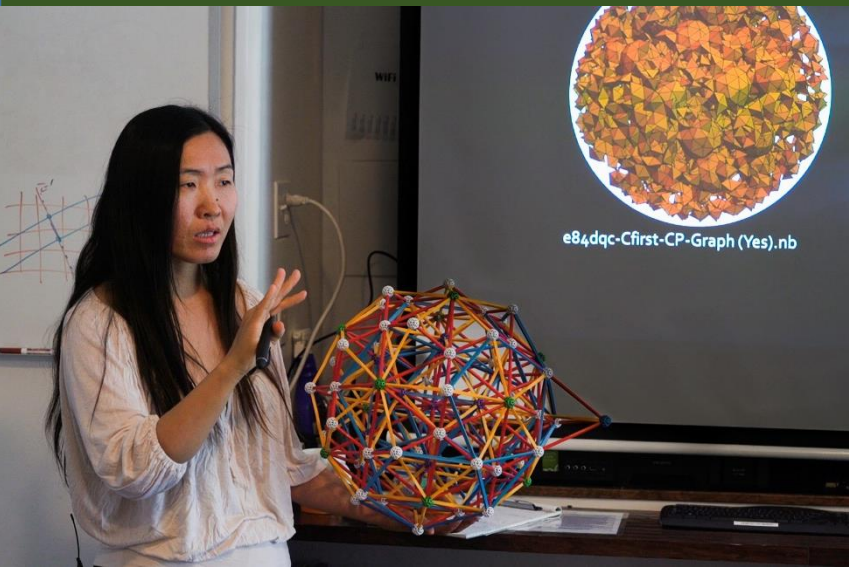
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If we are successful, it will be the only microscopic first-principles theory of everything, providing analytical expressions for values such as the Planck constant – a first-principles theory of everything.



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What clues does nature offer for what a first-principles theory of everything should look like?

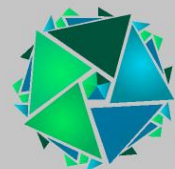


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I will show you seven clues and one solution that embraces them all.



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



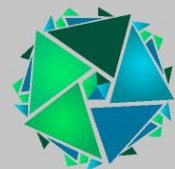
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I will show you seven clues and one solution that embraces them all.

1. Information



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



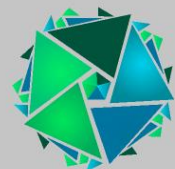
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1. Information
2. Causality Loops



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



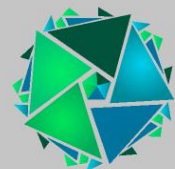
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1. Information
2. Causality Loops
3. Non-determinism



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



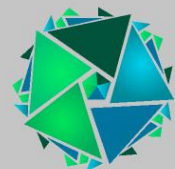
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4. Consciousness



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



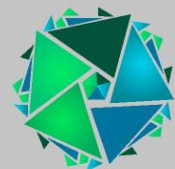
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4. Consciousness
5. Pixelation



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



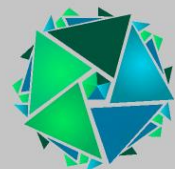
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3. Non-determinism
4. Consciousness
5. Pixelation
6. E8 Crystal



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



QUANTUM
GRAVITY RESEARCH

I will show you seven clues and one solution that embraces them all.

1. Information
2. Causality Loops
3. Non-determinism
4. Consciousness
5. Pixelation
6. E8 Crystal
7. Golden Ratio

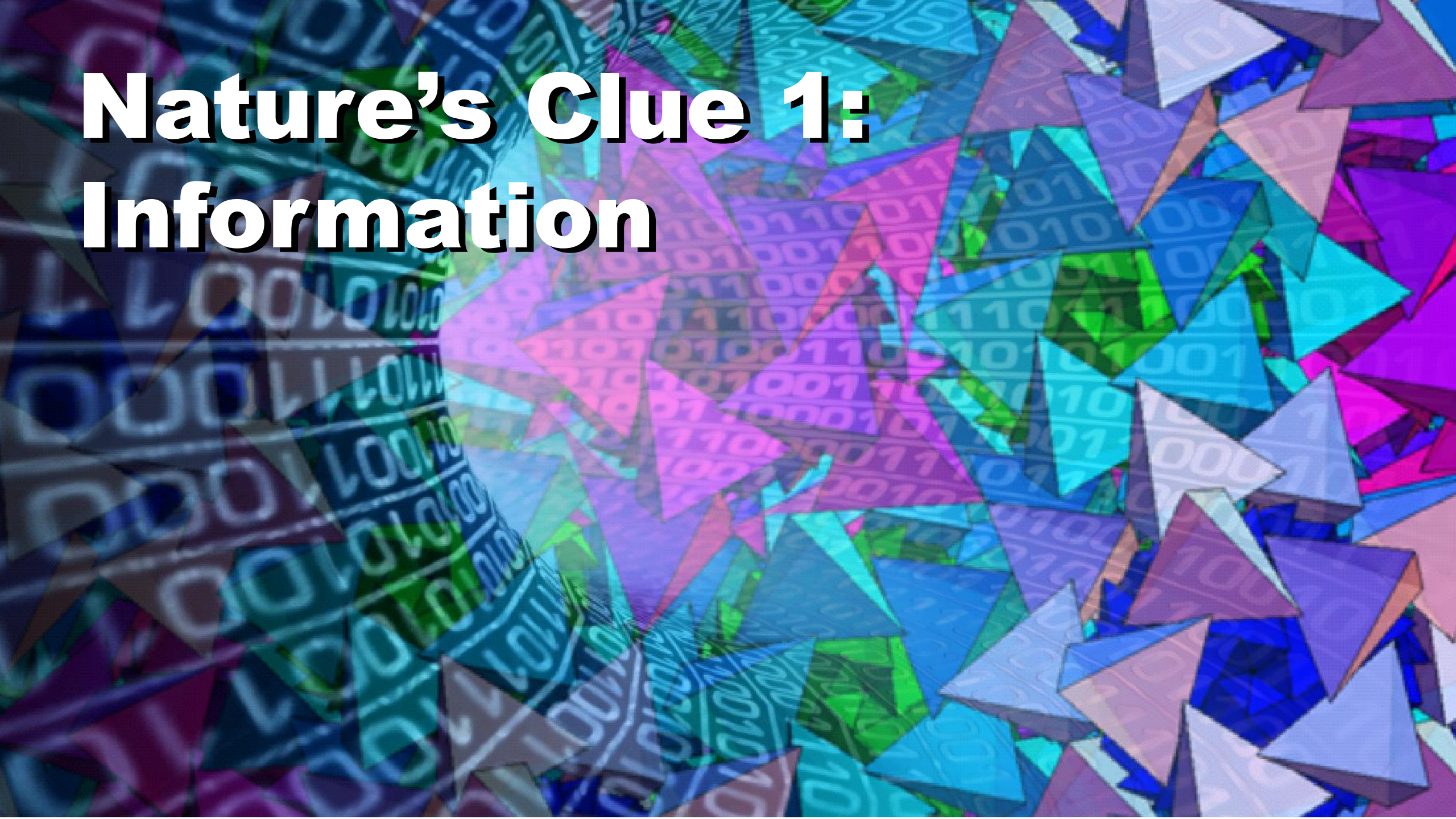


Information Causality Loops Non-determinism Consciousness Pixelation E8 Crystal Golden Ratio



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Nature's Clue 1: Information

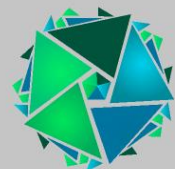


Information

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



- Information
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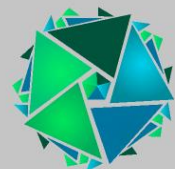
Information

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?



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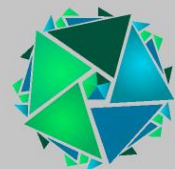
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Information

Or are they pure information?



- Information
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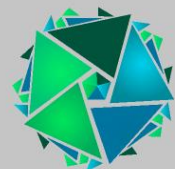
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Information

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



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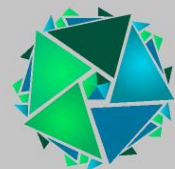
Information

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

After all, information is meaning in the form of symbolism.



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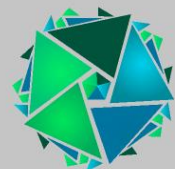
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Information

And how can symbolism and information exist without some notion of consciousness to actualize them into existence?



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Information

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



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



QUANTUM
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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...”



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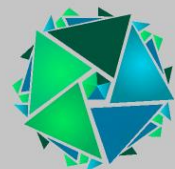
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Information

“...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.”



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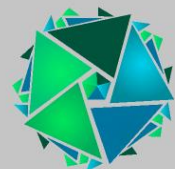
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Information

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.



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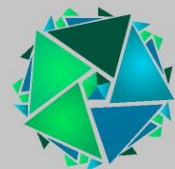
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Information

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.



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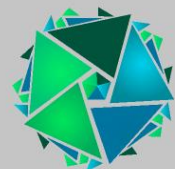
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Information

It is too radical to suggest physical reality needs humans to measure it in order to be real.



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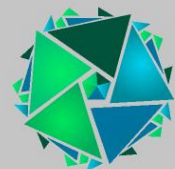
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Information

Max Tegmark of MIT believes reality is made mathematical symbolism.



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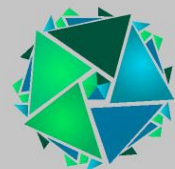
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Information

His *mathematical universe hypothesis* states:



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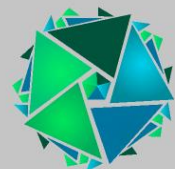
Information

His *mathematical universe hypothesis* states:

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



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Information

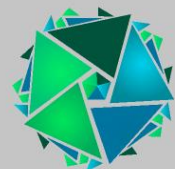
His *mathematical universe hypothesis* states:

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

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



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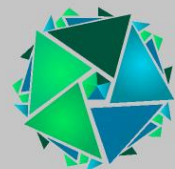
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Information

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



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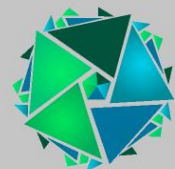
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Information

Thousands of physicists agree with Tegmark.



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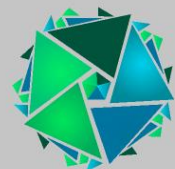
Information

Thousands of physicists agree with Tegmark.

But what does he mean by “physically real world”?



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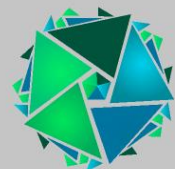
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Information

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.



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Information

However, mathematics is symbolic language dealing with the meaning of numbers.



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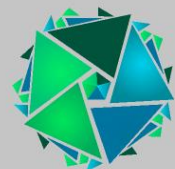
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Information

And the fundamental information or meaning of physical reality is geometry and ratio.



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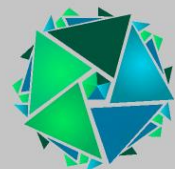
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Information

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”?



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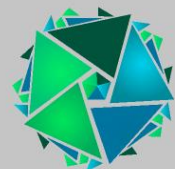
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Information

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



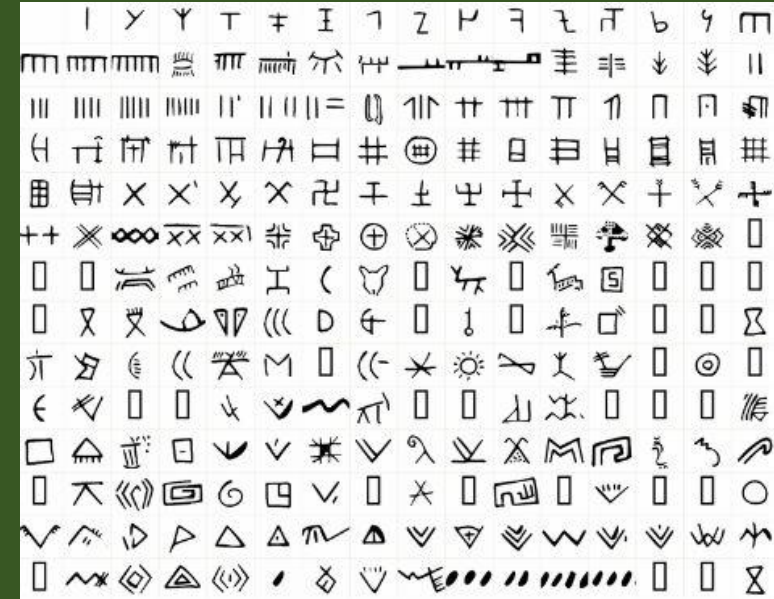
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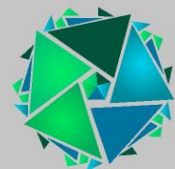
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Information

Information is meaning in the form of symbolic language.



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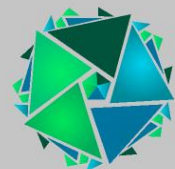
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Information

For example, the subjective symbols “d-o-g” can represent the meaning of this animal here.



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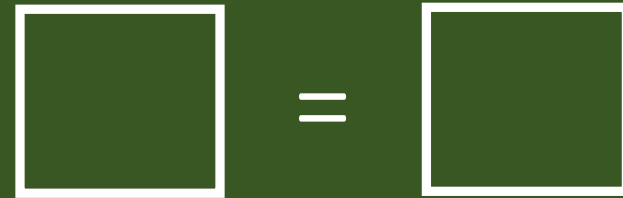
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Information

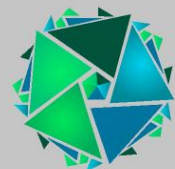
For example, the subjective symbols “d-o-g” can represent the meaning of this animal here.



Non-subjective geometric symbols represent themselves:



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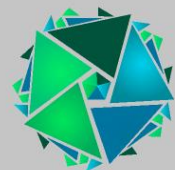
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Information

Reality is geometric.



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



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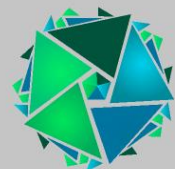
Information

Reality is geometric.

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



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Information

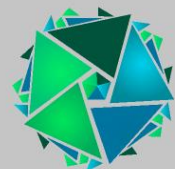
Reality is geometric.

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.



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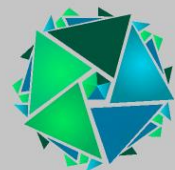
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Information

Perhaps a mosaic-like language of 3D geometric symbols could express the meaning of a geometric reality like ours.



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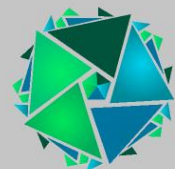
Information

Perhaps a mosaic-like language of 3D geometric symbols could express the meaning of a geometric reality like ours.

Quasicrystalline codes are exactly such languages. And they are inherently non-local and described by non-commutative geometry.



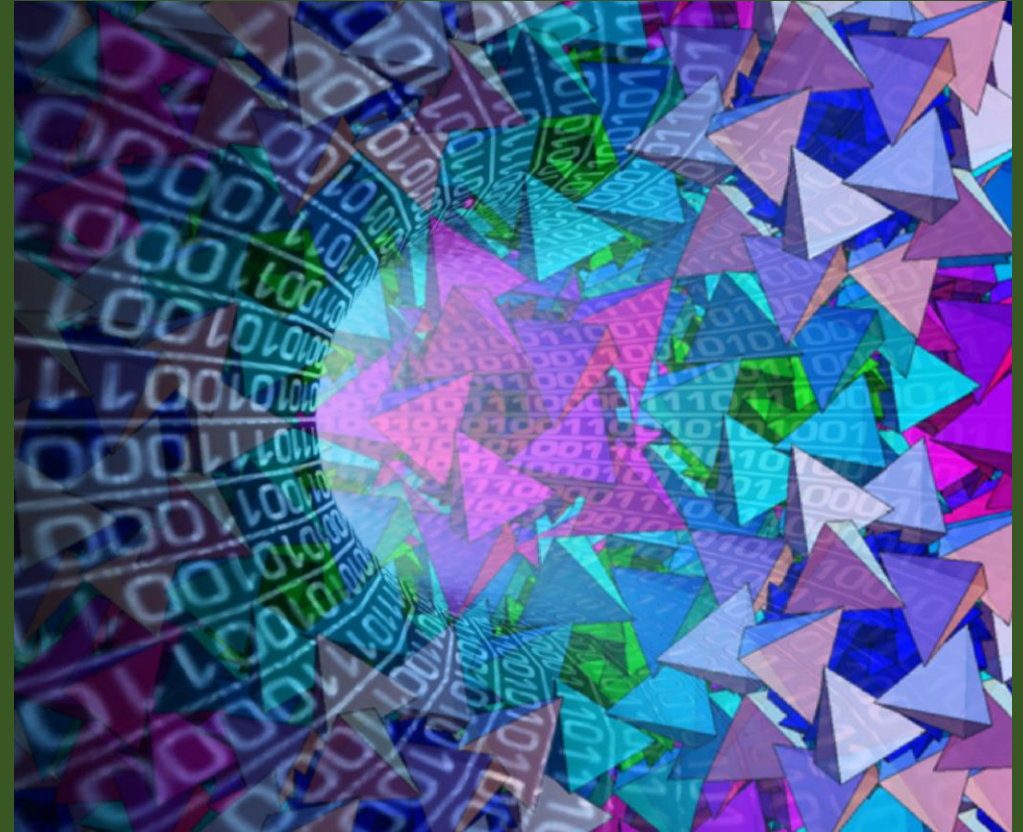
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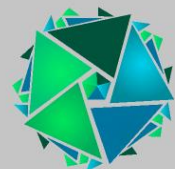
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Information

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.



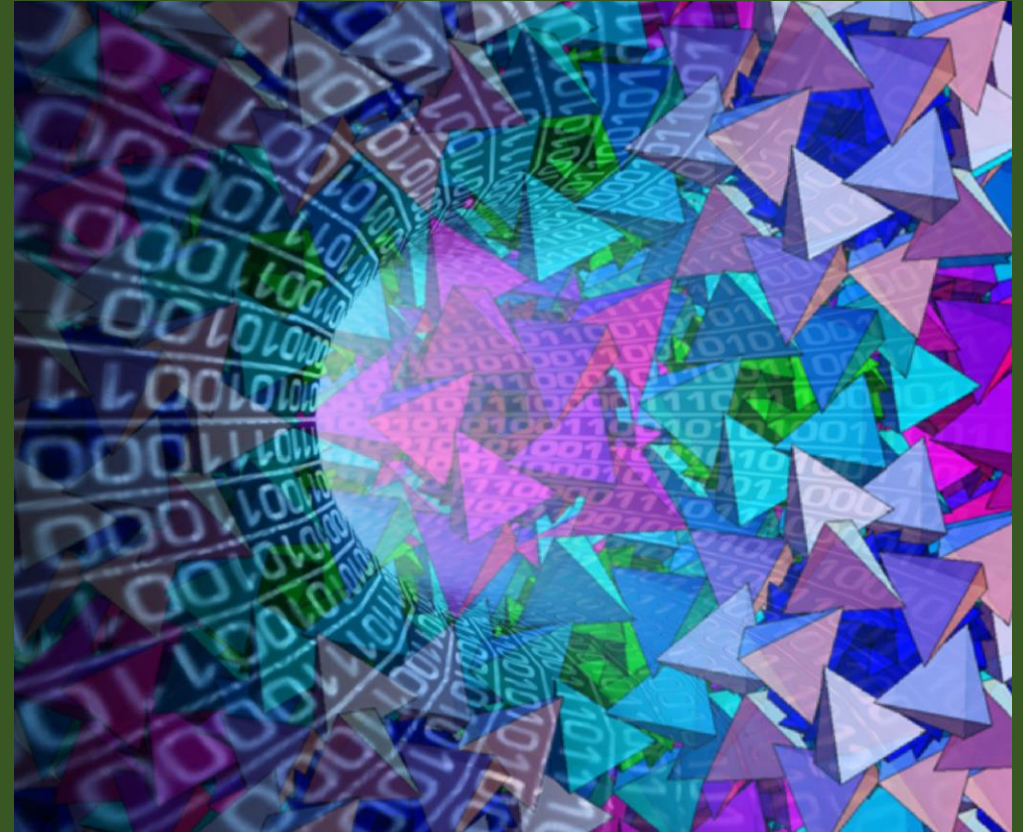
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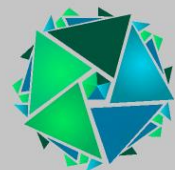
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Information

We introduce a purely geometric primality test for simplex integers, which extends also to the A_n lattice series:



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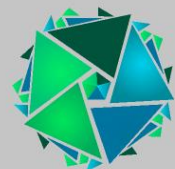
Information

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.



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



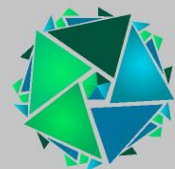
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Information

Take, for example, the idea of the 99-simplex and its lattice analogue, A_{99} .



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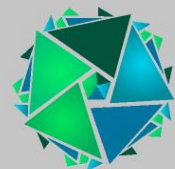
Information

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.



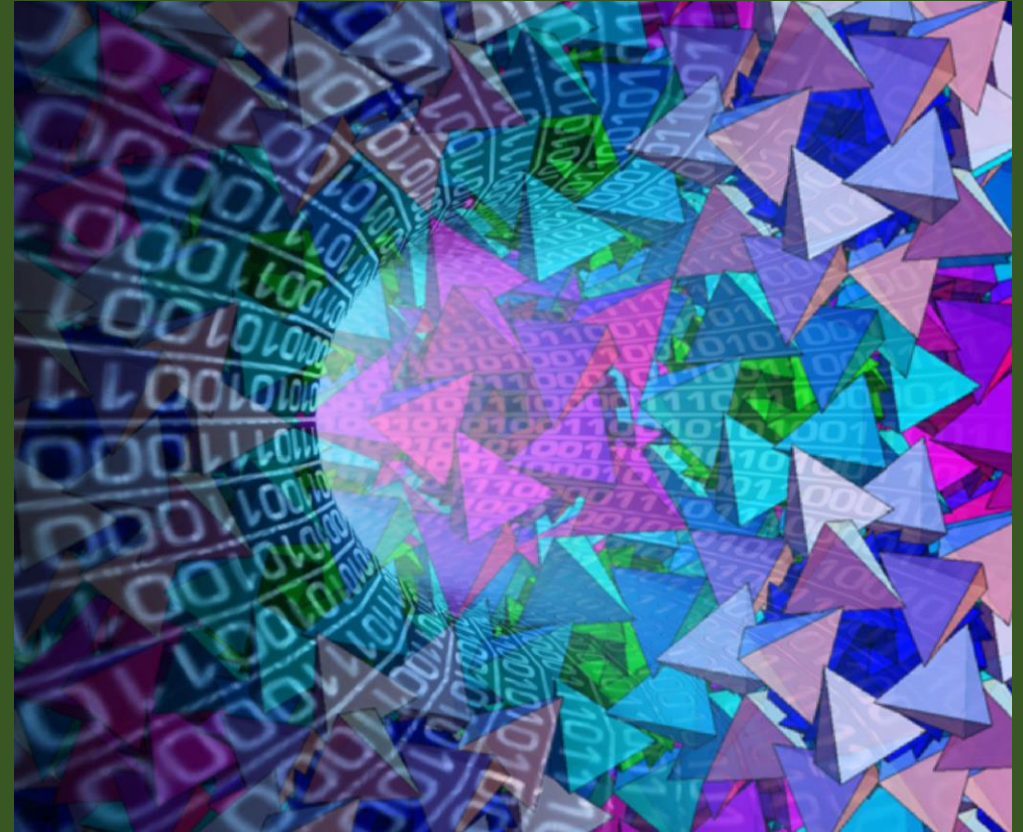
- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio



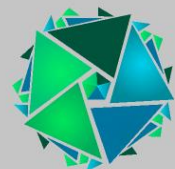
QUANTUM
GRAVITY RESEARCH

Information

Does anyone doubt there is a purely geometric reason for the distribution of the 25 prime simplexes within the 99-simplex?



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



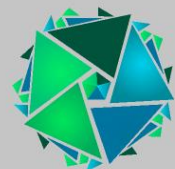
QUANTUM
GRAVITY RESEARCH

Information

Would that geometric explanation allow one to predict the 25 prime simplexes without using a prime sieving algorithm or other by-hand method?



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



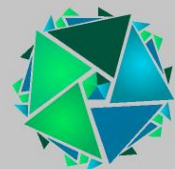
QUANTUM
GRAVITY RESEARCH

Information

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



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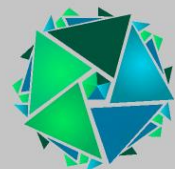
Information

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.



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



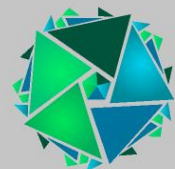
QUANTUM
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Information

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?



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



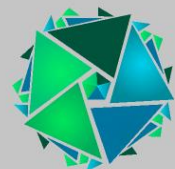
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Information

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.



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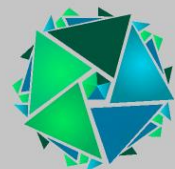
QUANTUM
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Information

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



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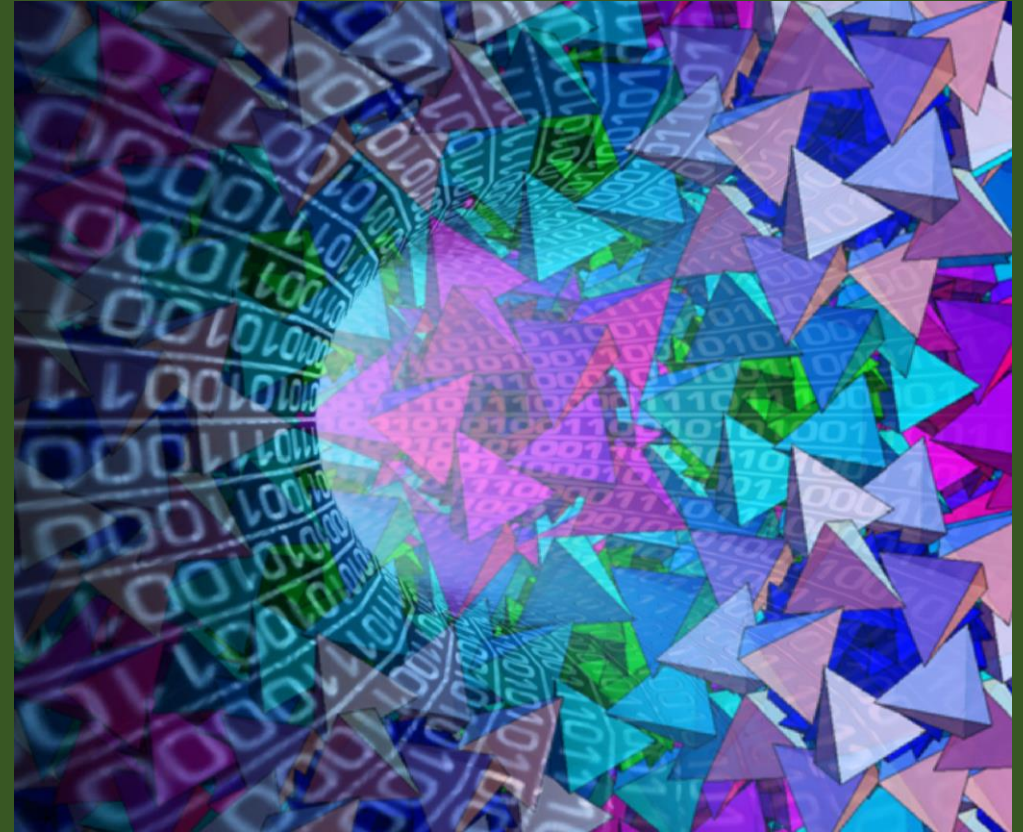


QUANTUM
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Information

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.



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



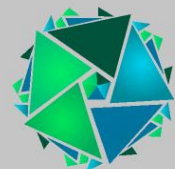
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Of course, discovering an exact way to predict the number of prime-simplexes within any bound predicts the same number of primes within a bound of digital numbers.



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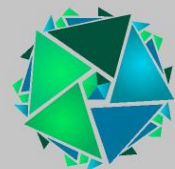
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Information

With simplex-integer number theory, there is less motivation to focus on probability theory.



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Information

With simplex-integer number theory, there is less motivation to focus on probability theory.

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.



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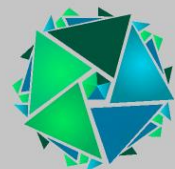
QUANTUM
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Information

An interesting difference between simplex-integer number theory and digital number theory is algebraic versus transcendental numbers.



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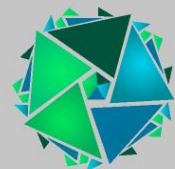
Information

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 Causality Loops Non-determinism Consciousness Pixelation E8 Crystal Golden Ratio

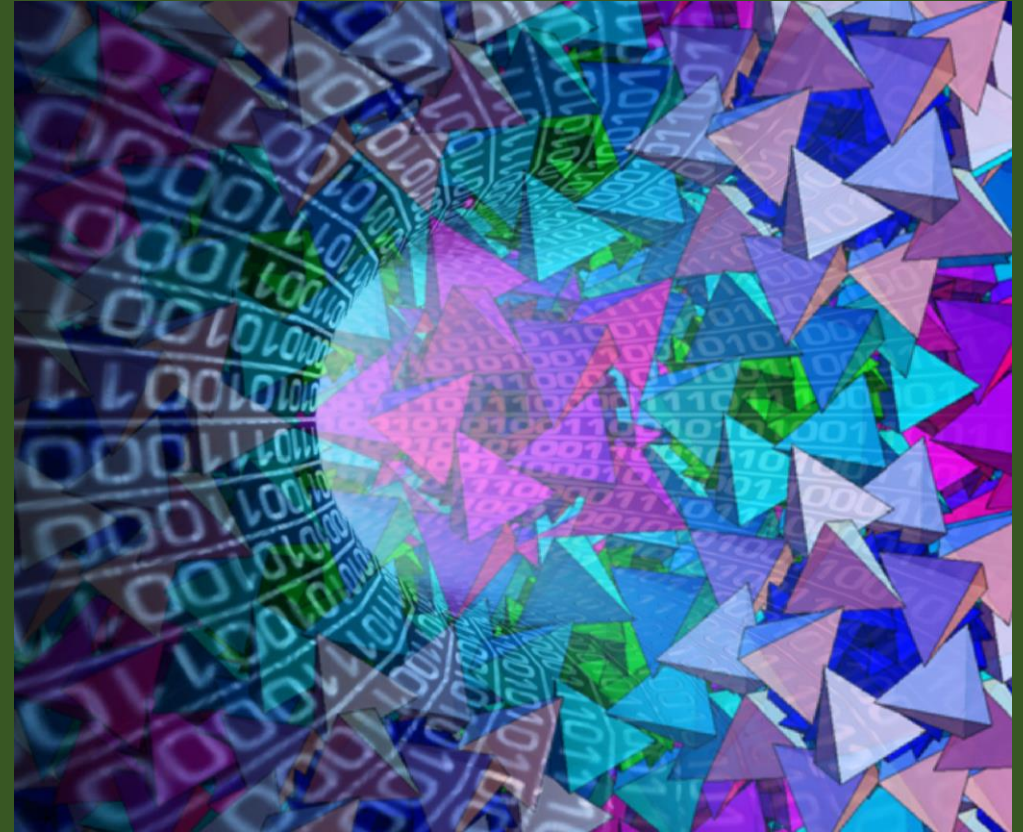


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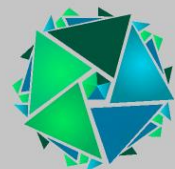
Information

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

$$1/(1^2) + 1/(2^2) + 1/(3^2) \dots = \pi^2/6$$



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



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Information

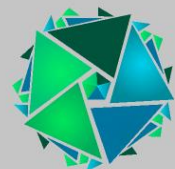
When $s = 2$, we get the integers to converge relative to the transcendental expression:

$$1/(1^2) + 1/(2^2) + 1/(3^2) \dots = \pi^2/6$$

By contrast, the circumradii of the simplex-integer additive series converges without the zeta function to the algebraic expression $1/\sqrt{2}$.



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



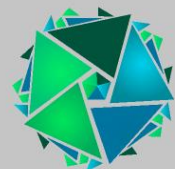
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Information

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



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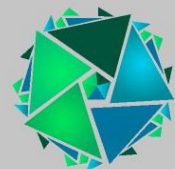
Information

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.



- Information
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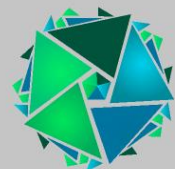
QUANTUM
GRAVITY RESEARCH

Information

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 π and e versus algebraically “crisp” numbers like the golden ratio or $\sqrt{2}$.



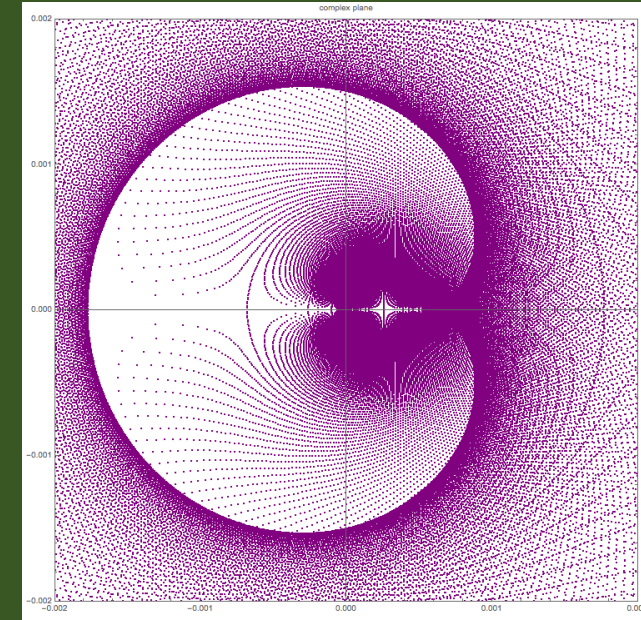
- Information
- Causality Loops
- Non-determinism
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- Pixelation
- E8 Crystal
- Golden Ratio



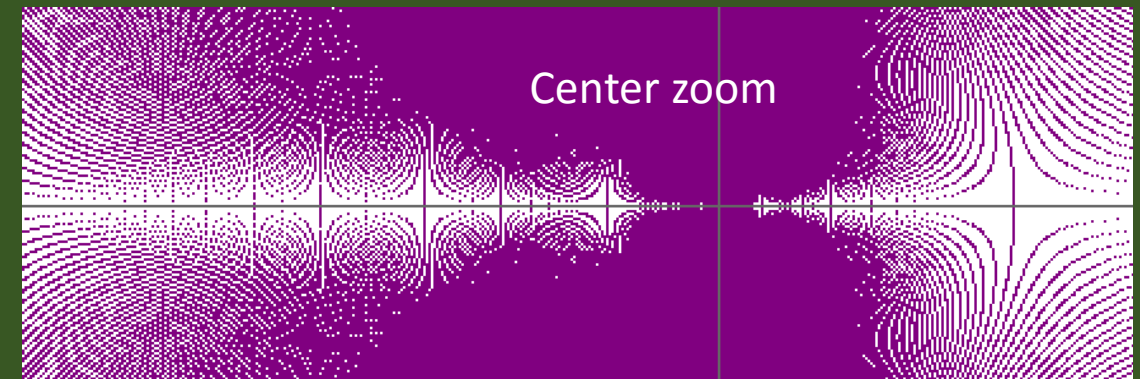
QUANTUM
GRAVITY RESEARCH

Information

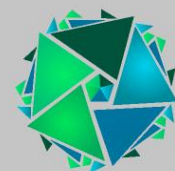
From cosmic to micro scales, nature exhibits fractality.



25 iterations



- Information
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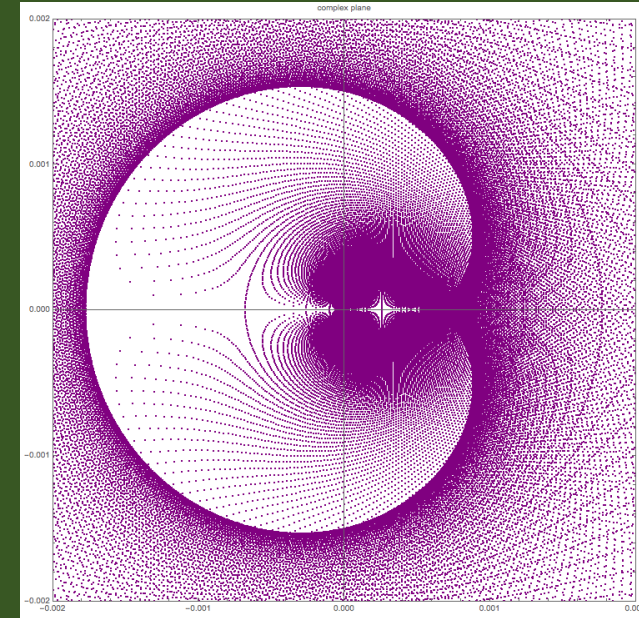


QUANTUM
GRAVITY RESEARCH

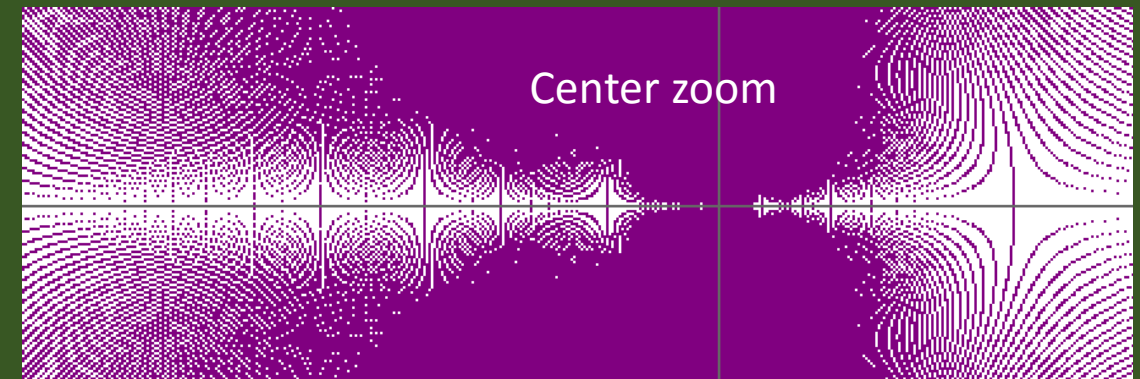
Information

From cosmic to micro scales, nature exhibits fractality.

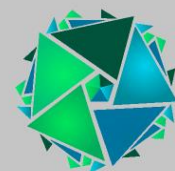
Our quantum gravity framework is built upon a network of Fibonacci chains.



25 iterations



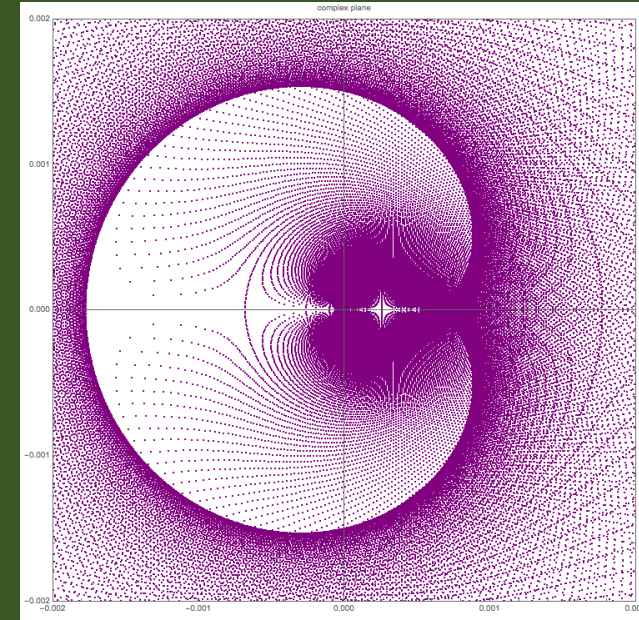
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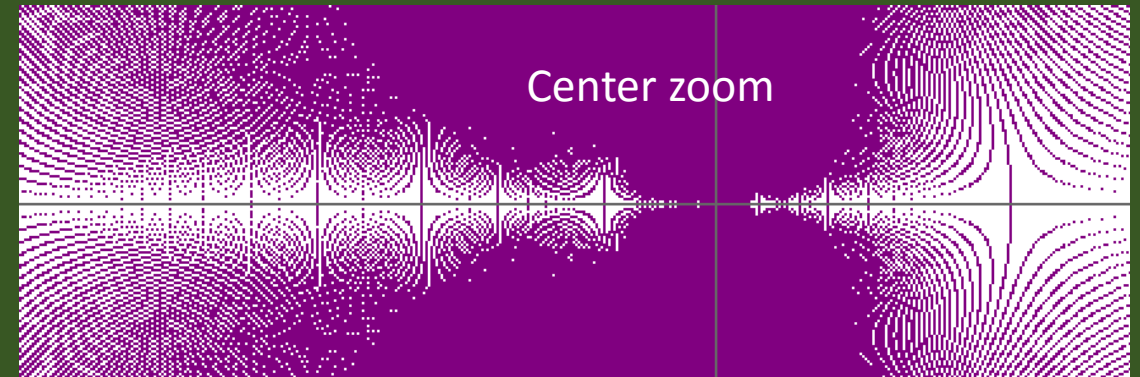
QUANTUM
GRAVITY RESEARCH

Information

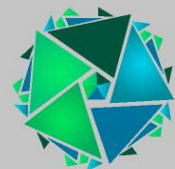
We discovered a fractal pattern in the discrete Fourier transform of Fibonacci chain intervals.



25 iterations



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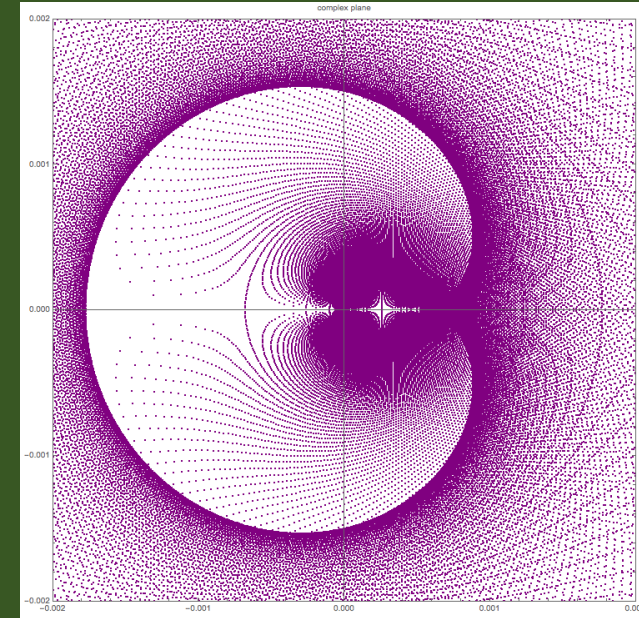


QUANTUM
GRAVITY RESEARCH

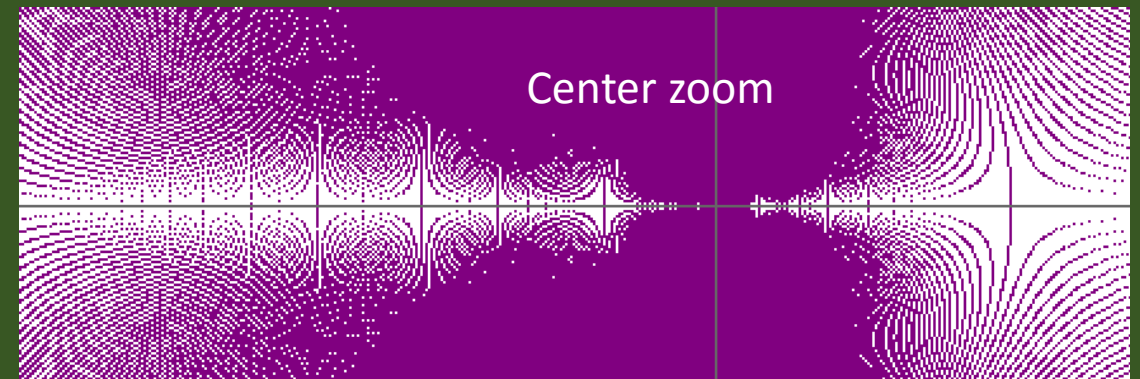
Information

We discovered a fractal pattern in the discrete Fourier transform of Fibonacci chain intervals.

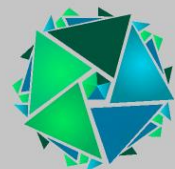
The box-counting dimension is about $2/3$.



25 iterations



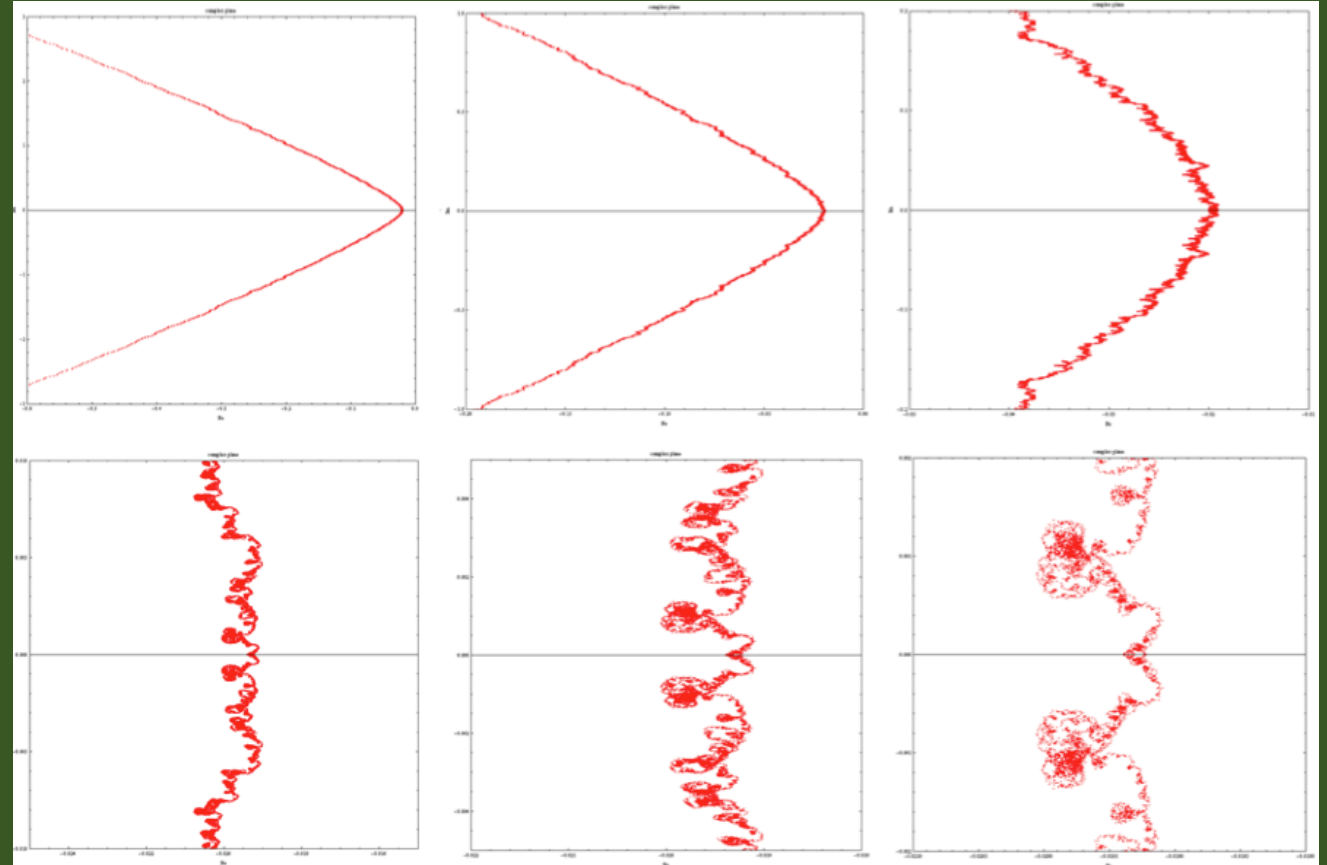
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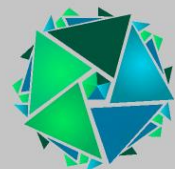
QUANTUM
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Information

Similarly, we discovered a fractal pattern in the Fourier transform of the logarithm of primes.



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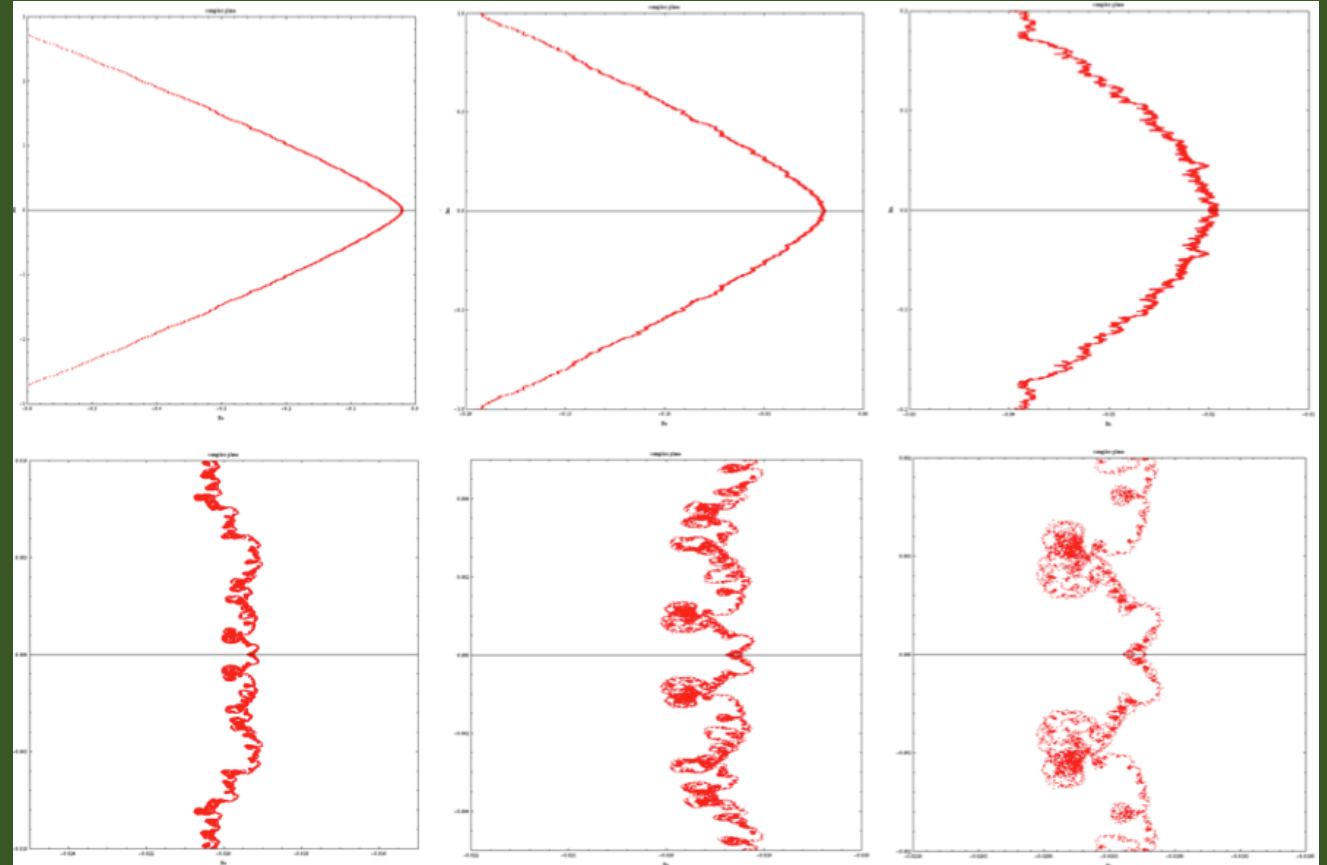


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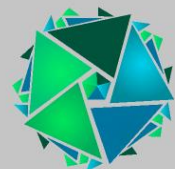
Information

Similarly, we discovered a fractal pattern in the Fourier transform of the logarithm of primes.

Its fractal dimension is about .56 [box counting].



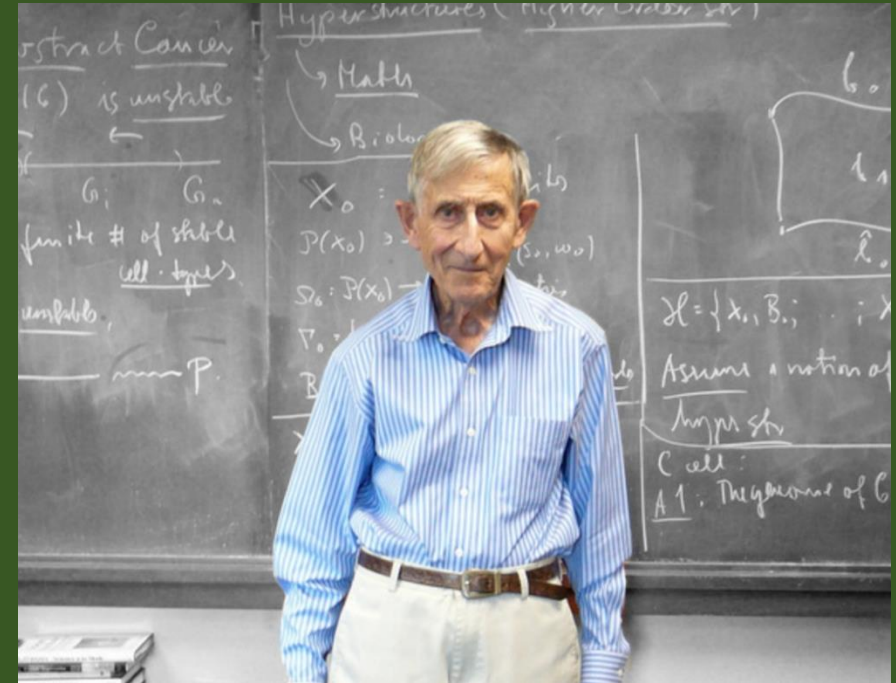
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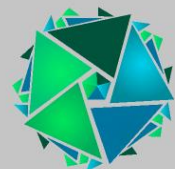
QUANTUM
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Information

Freeman Dyson says the distribution of primes corresponds to a 1D quasicrystal, where that term is defined as an aperiodic pure point spectrum.



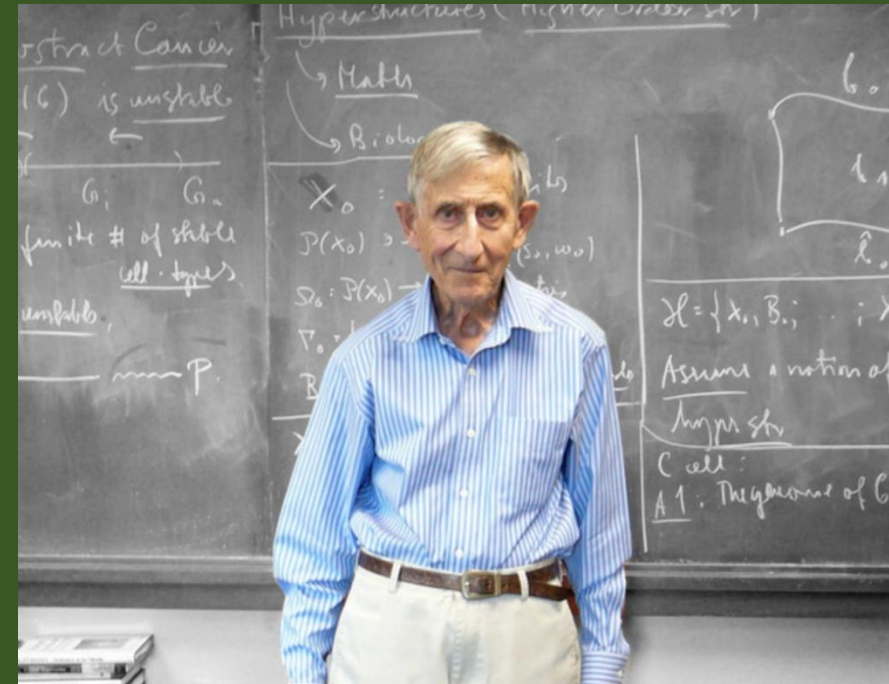
- Information Causality Loops Non-determinism Consciousness Pixelation E8 Crystal Golden Ratio



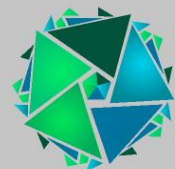
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Information

Every such quasicrystal corresponds to an irrational cut and projection through a higher dimensional crystal.



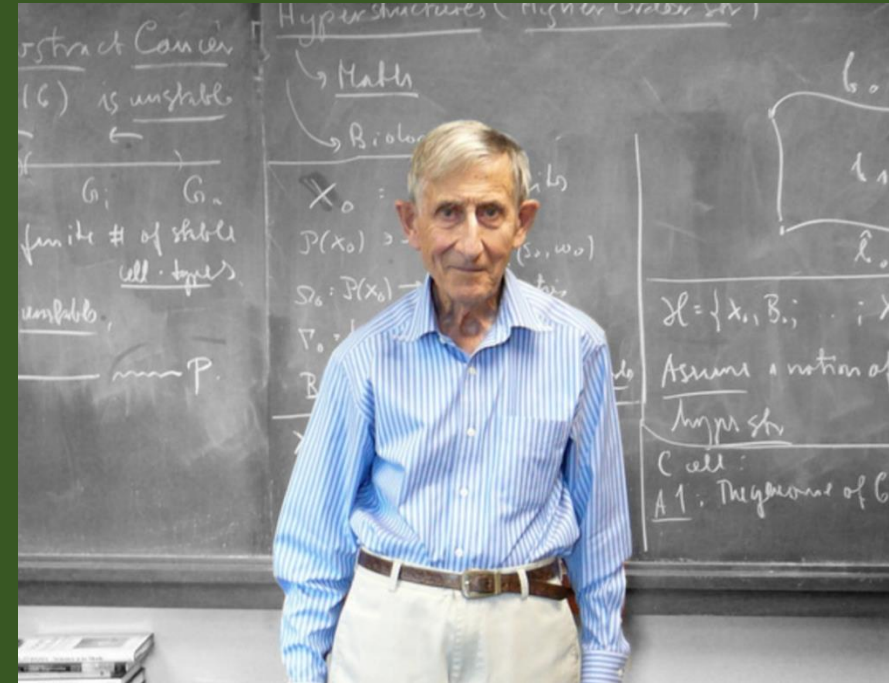
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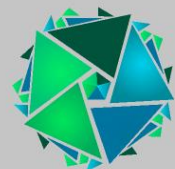
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Information

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.



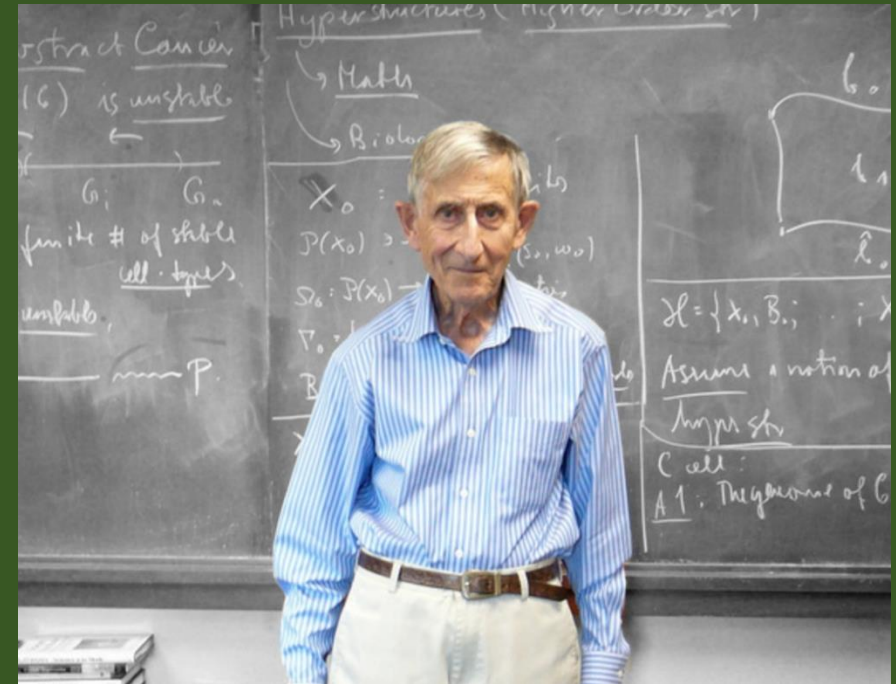
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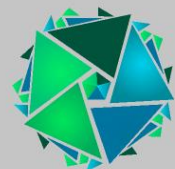
QUANTUM
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Information

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.



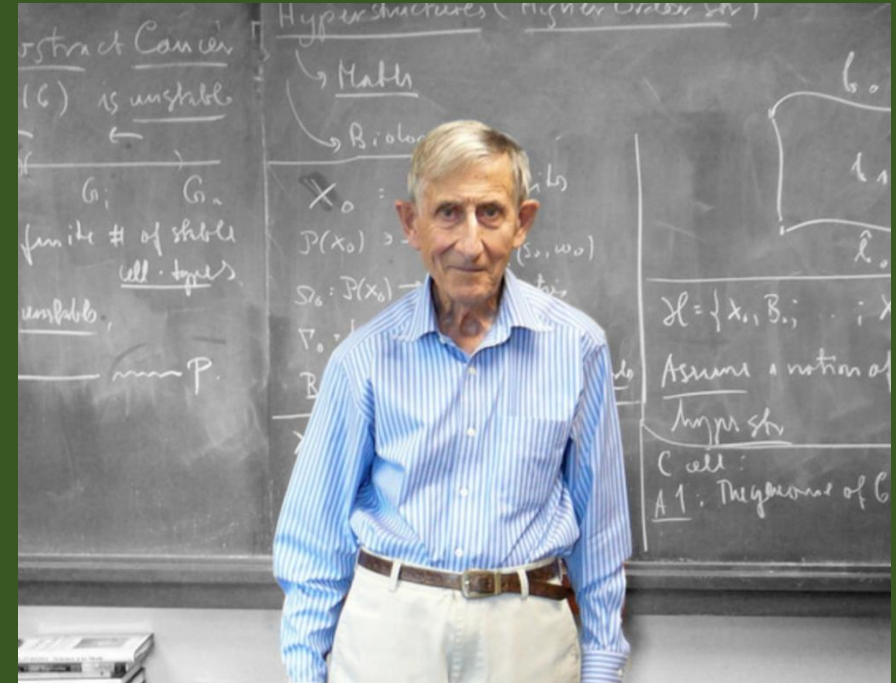
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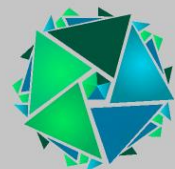
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Information

Of course, Wigner's universality pattern is evident in the distribution of non-trivial zeta zeros. And indeed, it is a 1D quasicrystal.

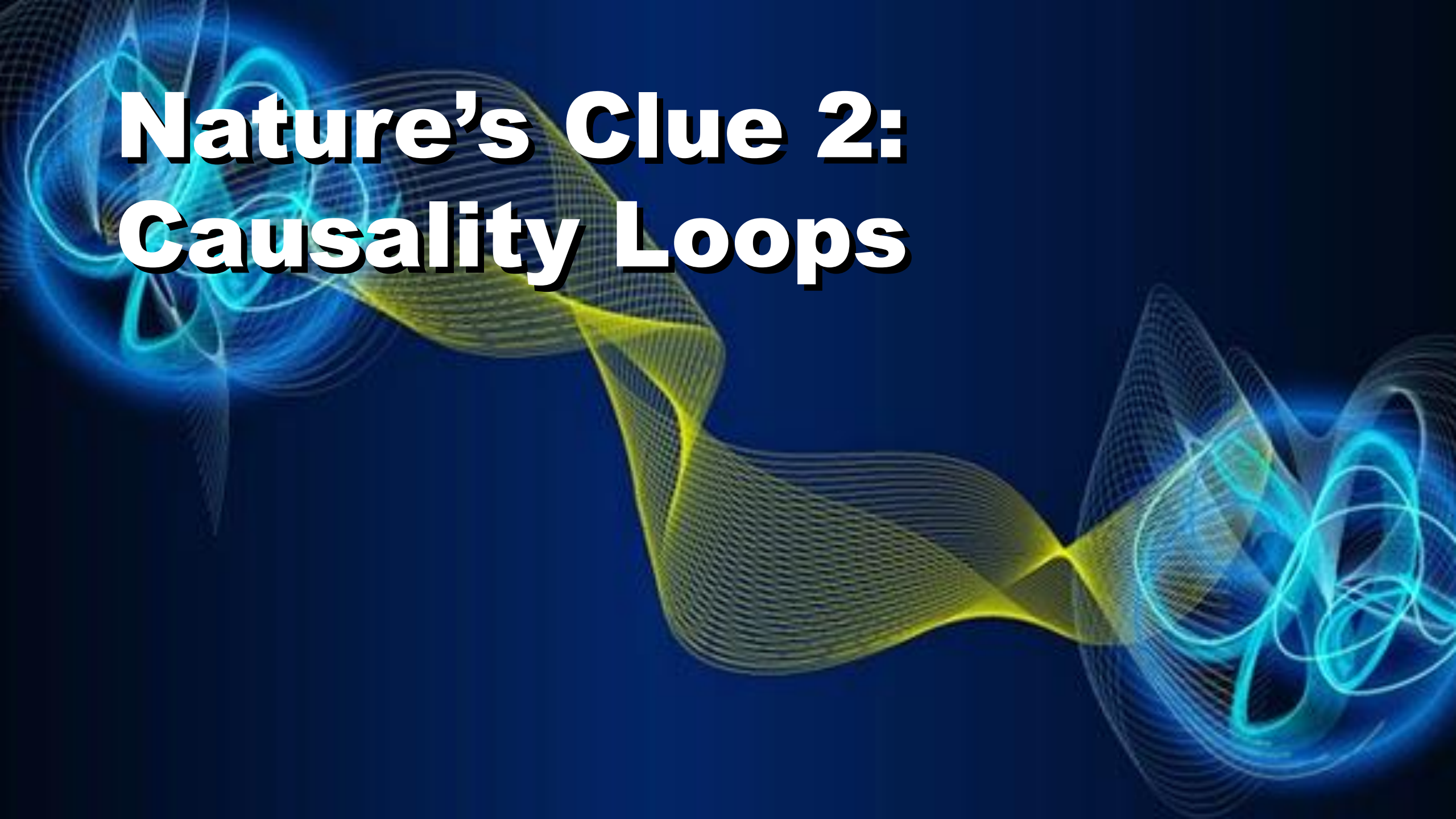


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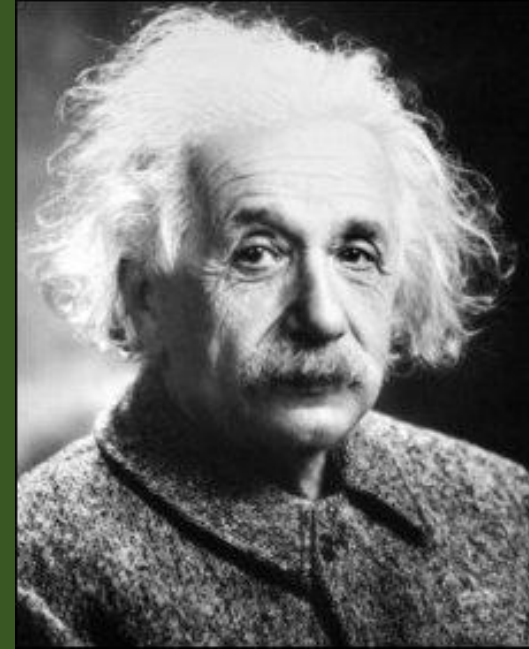
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Nature's Clue 2: Causality Loops

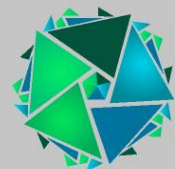
The background features a dark blue field with intricate, glowing patterns. On the left and right sides, there are complex, swirling structures made of thin, bright blue lines that resemble tangled paths or loops. A prominent, wavy band of yellow-green lines runs diagonally across the center, connecting the two blue structures. The overall effect is one of dynamic, interconnected energy.

Causality Loops

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



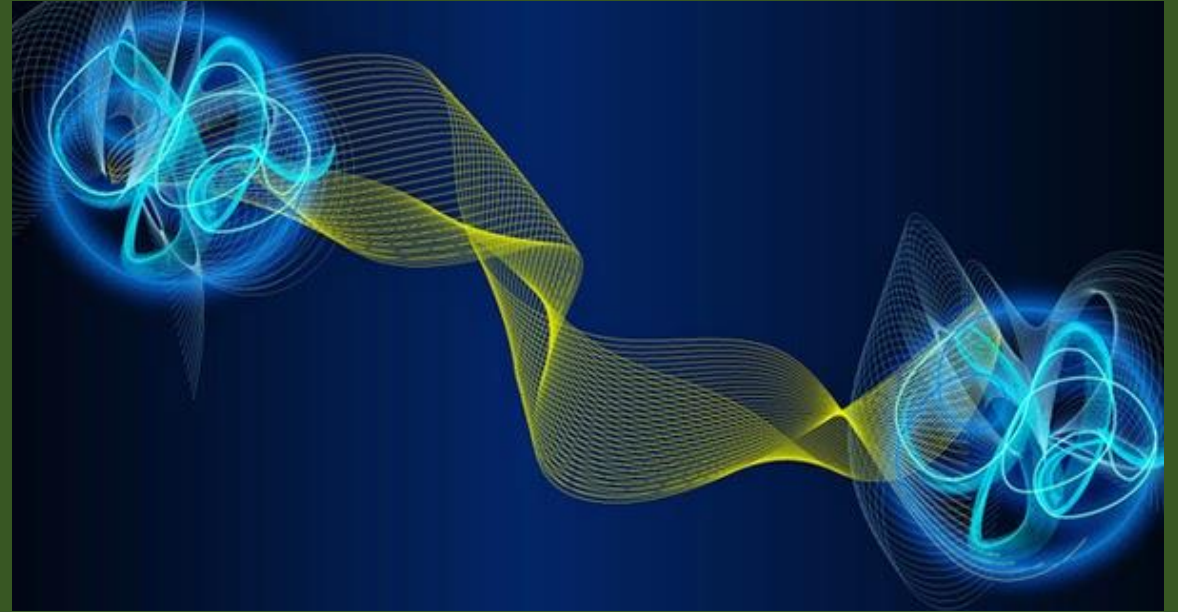
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Causality Loops

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



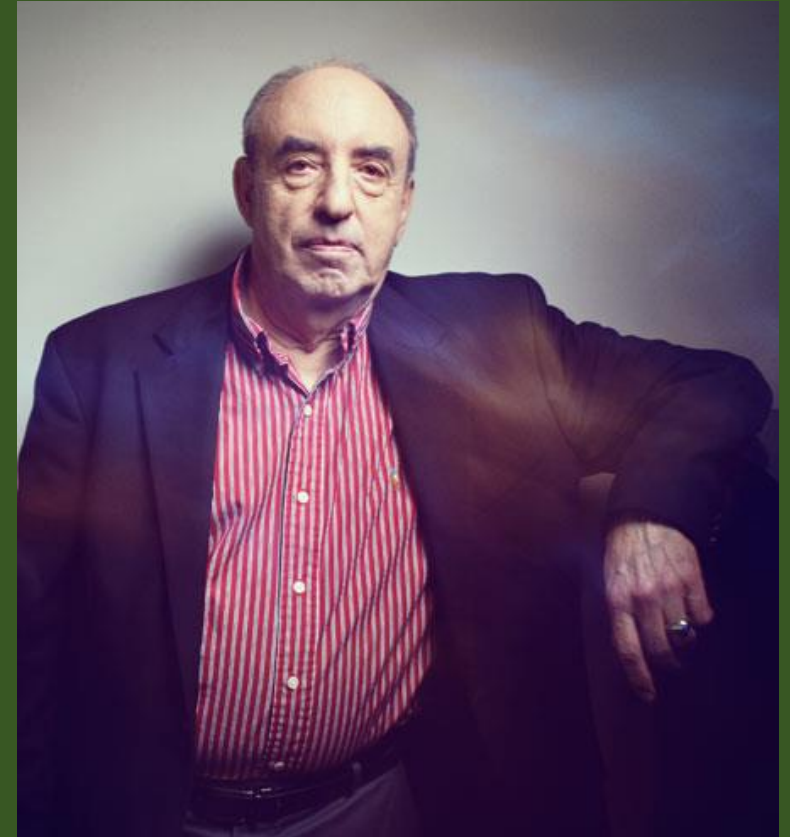
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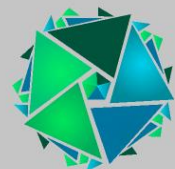
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Causality Loops

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



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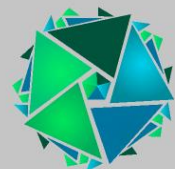
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Causality Loops

Obviously, the past co-creates the future.



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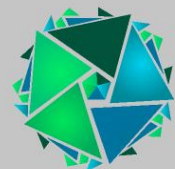
Causality Loops

Obviously, the past co-creates the future.

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



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



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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.



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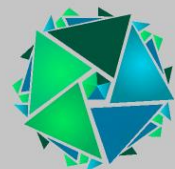
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Causality Loops

Like the feedback between two mirrors.



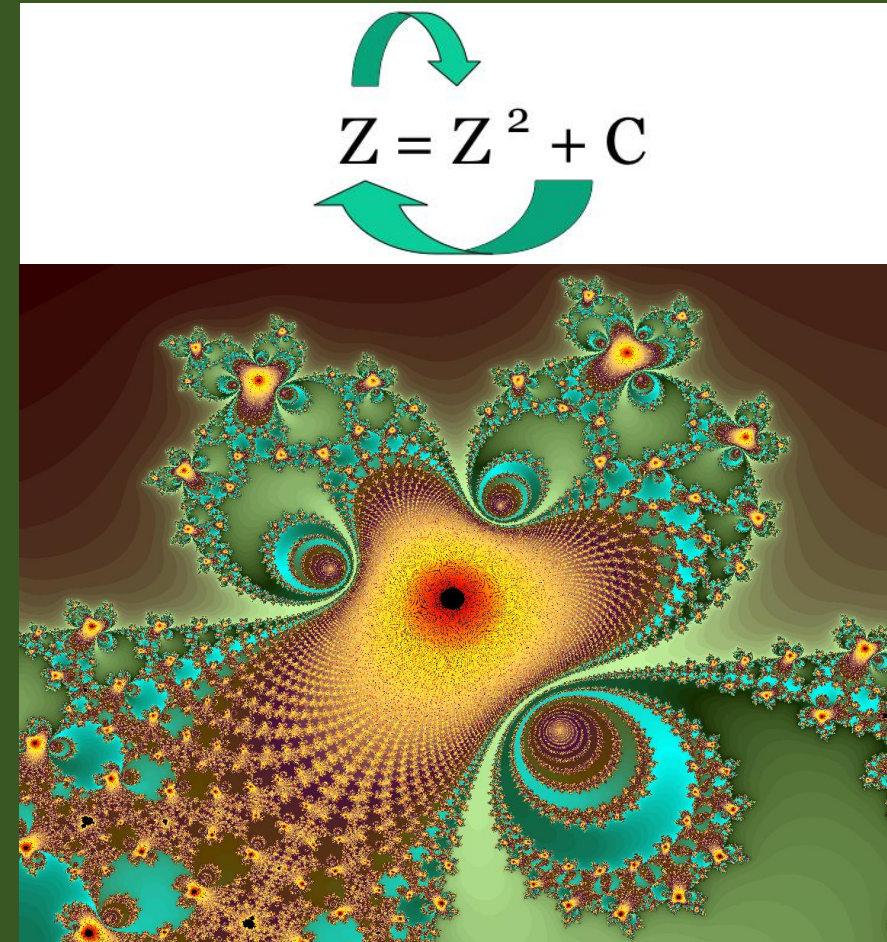
- Information Causality Loops Non-determinism Consciousness Pixelation E8 Crystal Golden Ratio



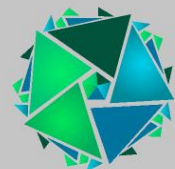
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Causality Loops

Or the mathematical feedback loop of a fractal.



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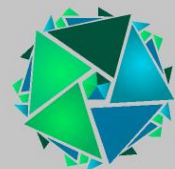
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Causality Loops

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



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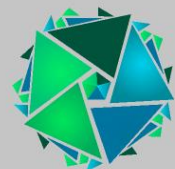
Causality Loops

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.



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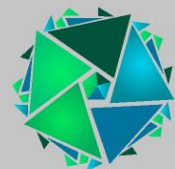
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Causality Loops

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



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



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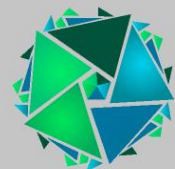
Causality Loops

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

...it would be self-actualized – its own creator.



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



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Nature's Clue 3: Non-determinism

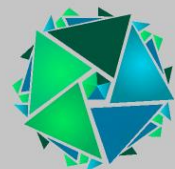


Non-determinism

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



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



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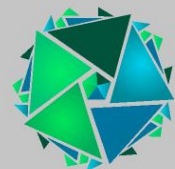
Non-determinism

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.



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



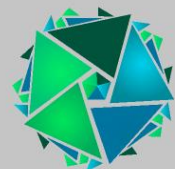
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Non-determinism

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



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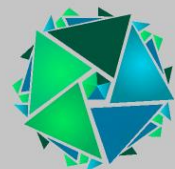
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Non-determinism

But even without the double slit experiment, the existence of freewill rules out the clock-work universe hypothesis.

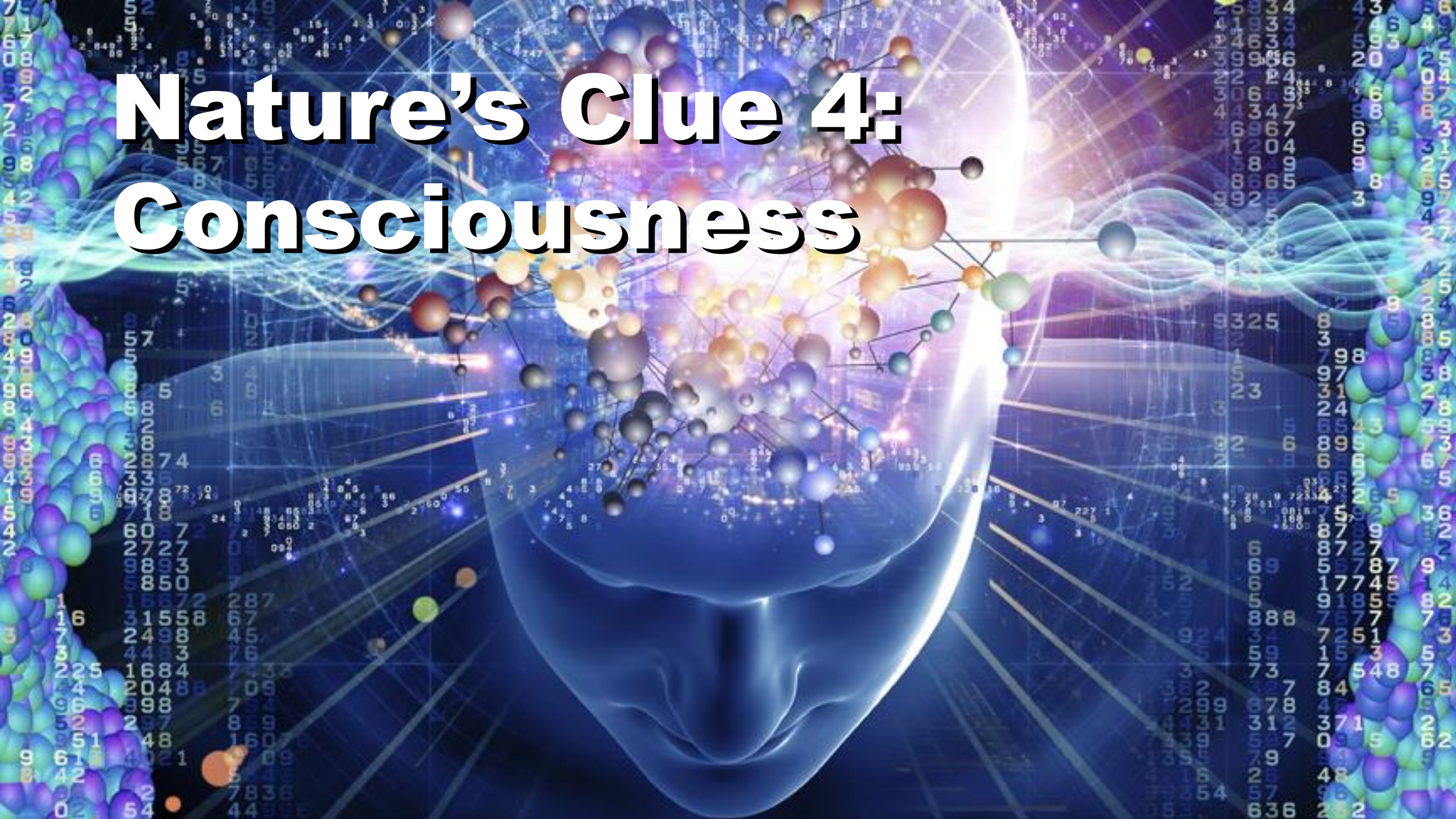


Information Causality Loops Non-determinism Consciousness Pixelation E8 Crystal Golden Ratio



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Nature's Clue 4: Consciousness



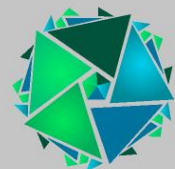
Consciousness

Bell's theorem essentially states:

All that exists is that which is measured.



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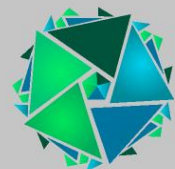
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Consciousness

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



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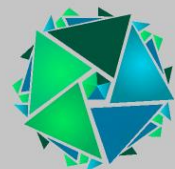
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Consciousness

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



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



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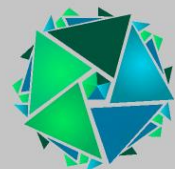
Consciousness

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

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



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



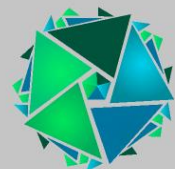
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Consciousness

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



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



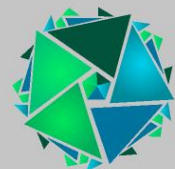
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Consciousness

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



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



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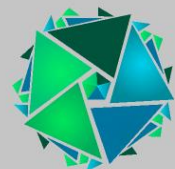
Consciousness

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.



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



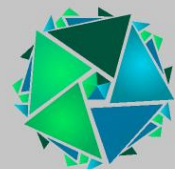
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Consciousness

Did consciousness and information emerge in a causality feedback loop?

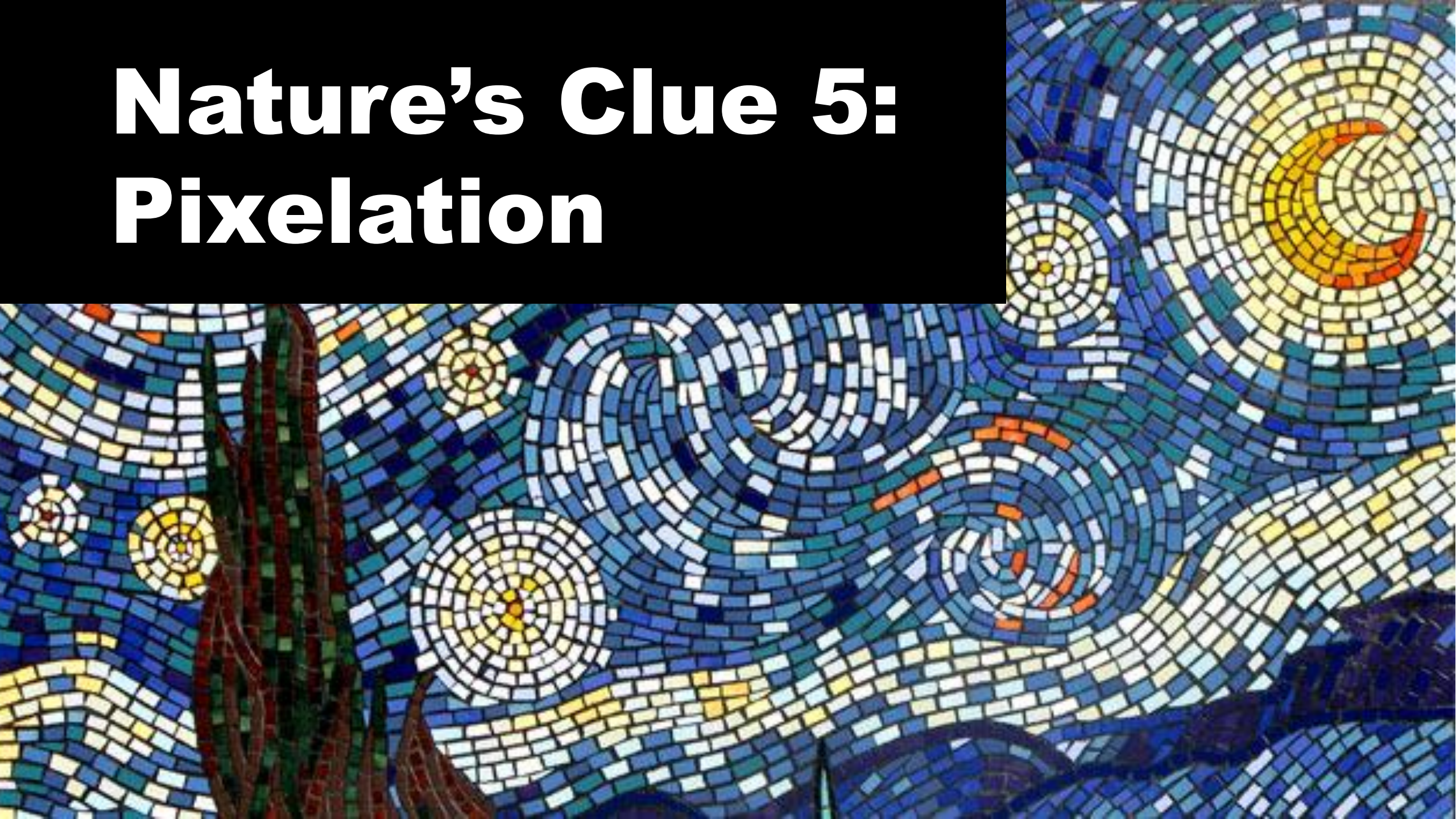


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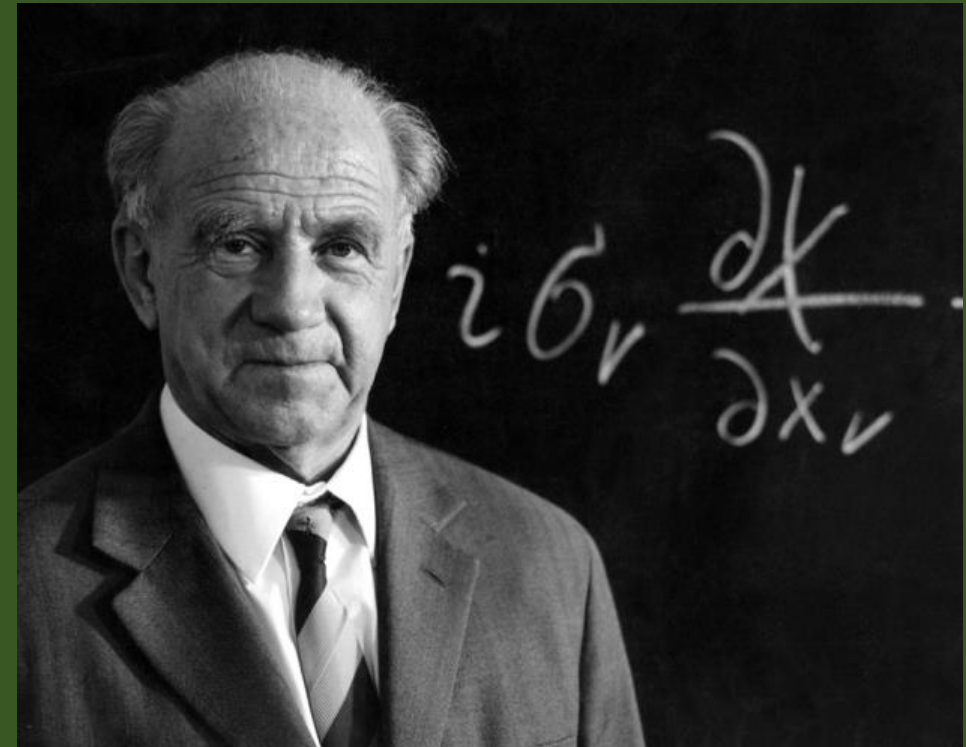
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Nature's Clue 5: Pixelation

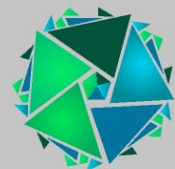


Pixelation

Werner Heisenberg deduced space and time are pixelated into indivisible Planck units, like a mosaic.



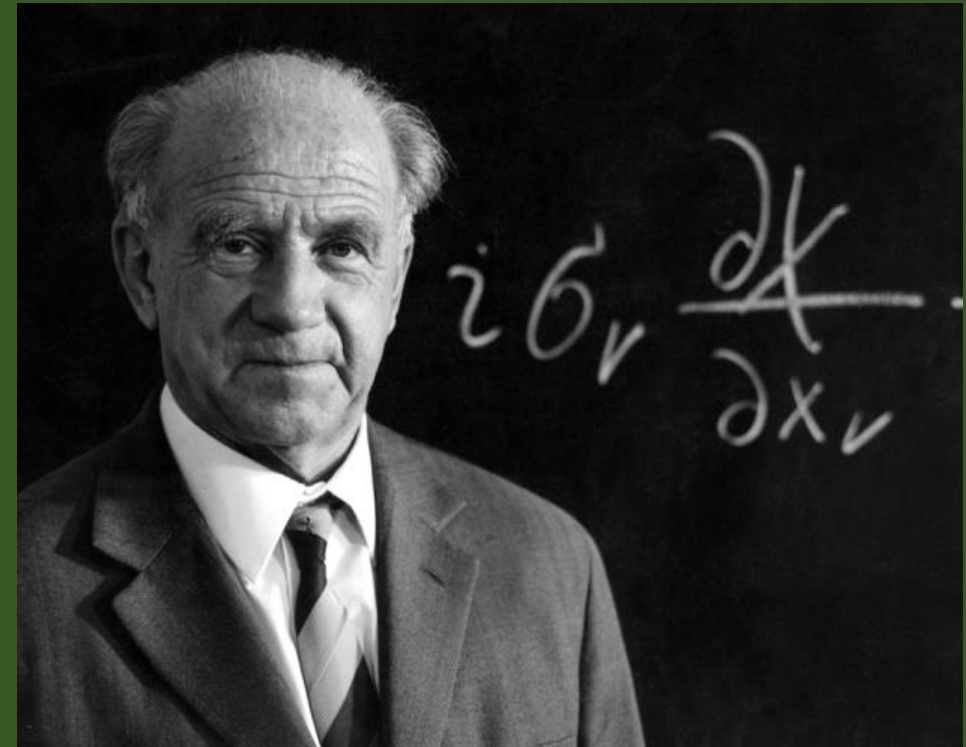
Information Causality Loops Non-determinism Consciousness Pixelation E8 Crystal Golden Ratio



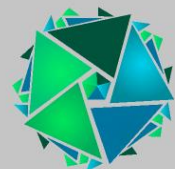
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Pixelation

The mathematics indicated this ...



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

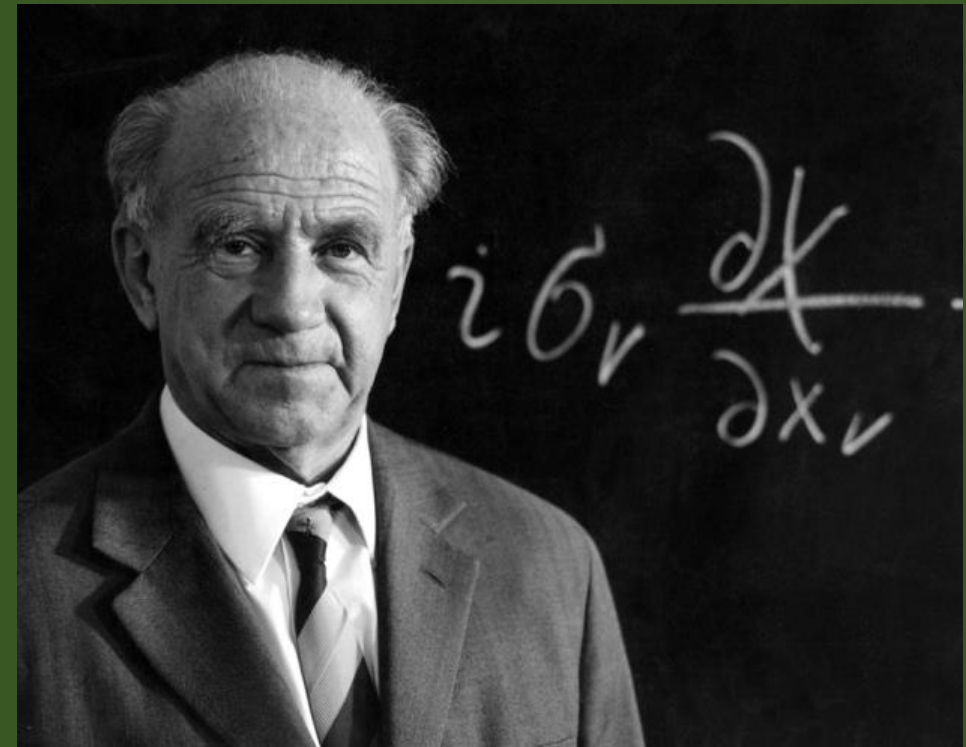


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Pixelation

The mathematics indicated this ...

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



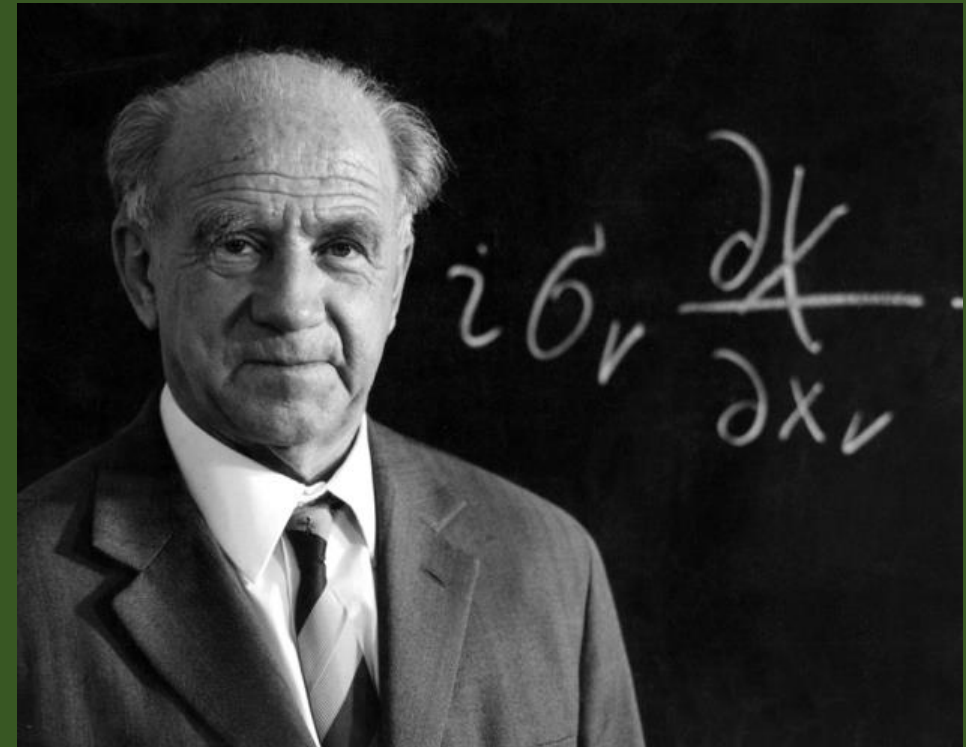
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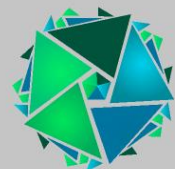
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Pixelation

However, this new idea was too radical for most scientists of the day except for Niels Bohr, who agreed with Heisenberg.



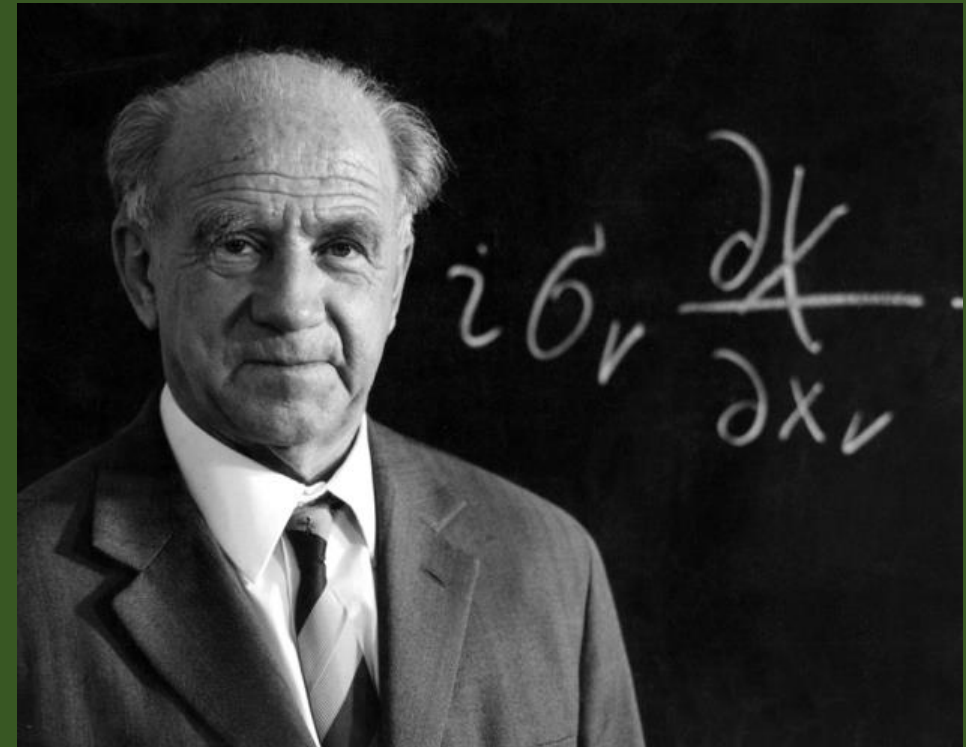
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Pixelation

Today, most scientists agree that a length can be no shorter than the Planck length – which suggest reality is pixelated.



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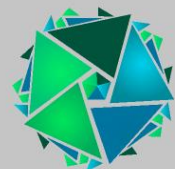
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Pixelation

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



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



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Nature's Clue 6: E8 Crystal

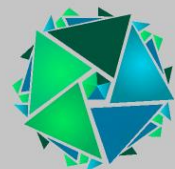


E8 Crystal

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



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



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E8 Crystal

What is it?



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E8 Crystal

What is it?

A microscope.



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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.



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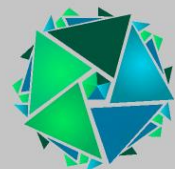
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E8 Crystal

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



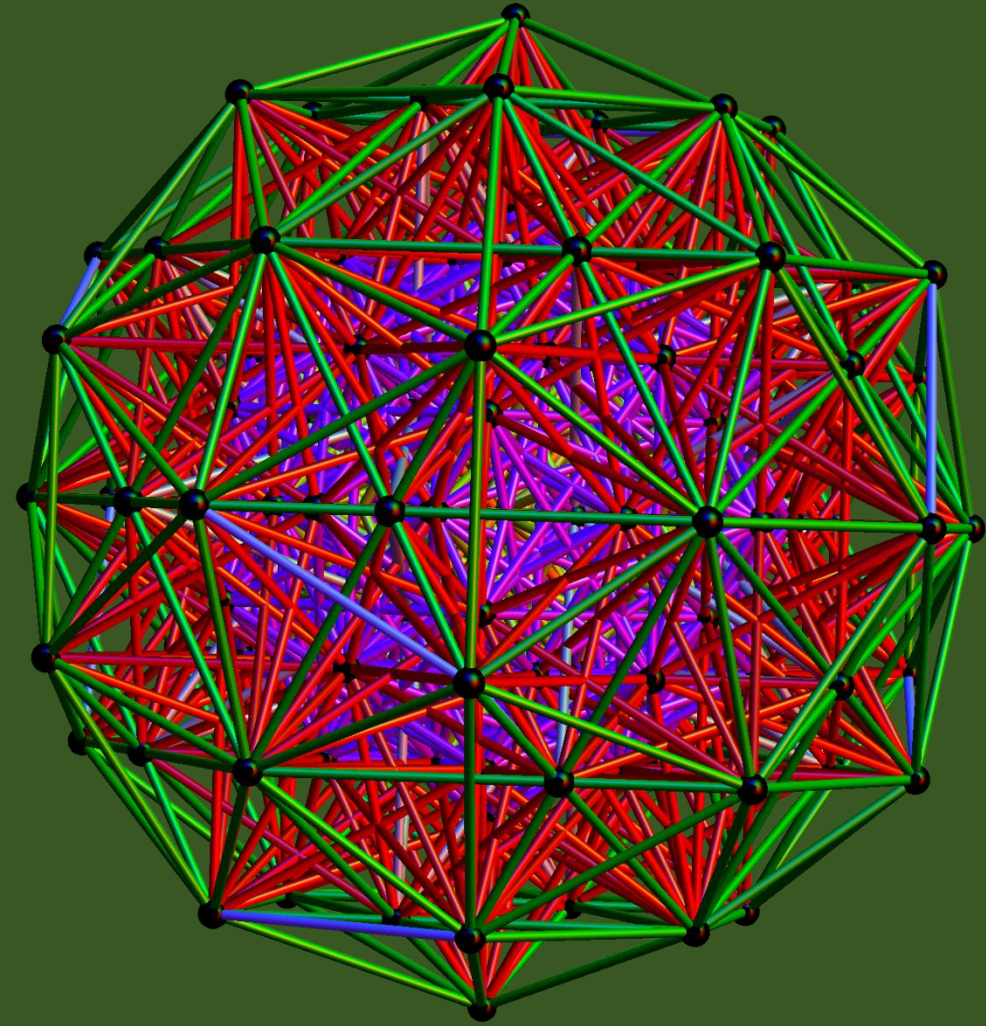
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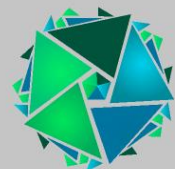
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E8 Crystal

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



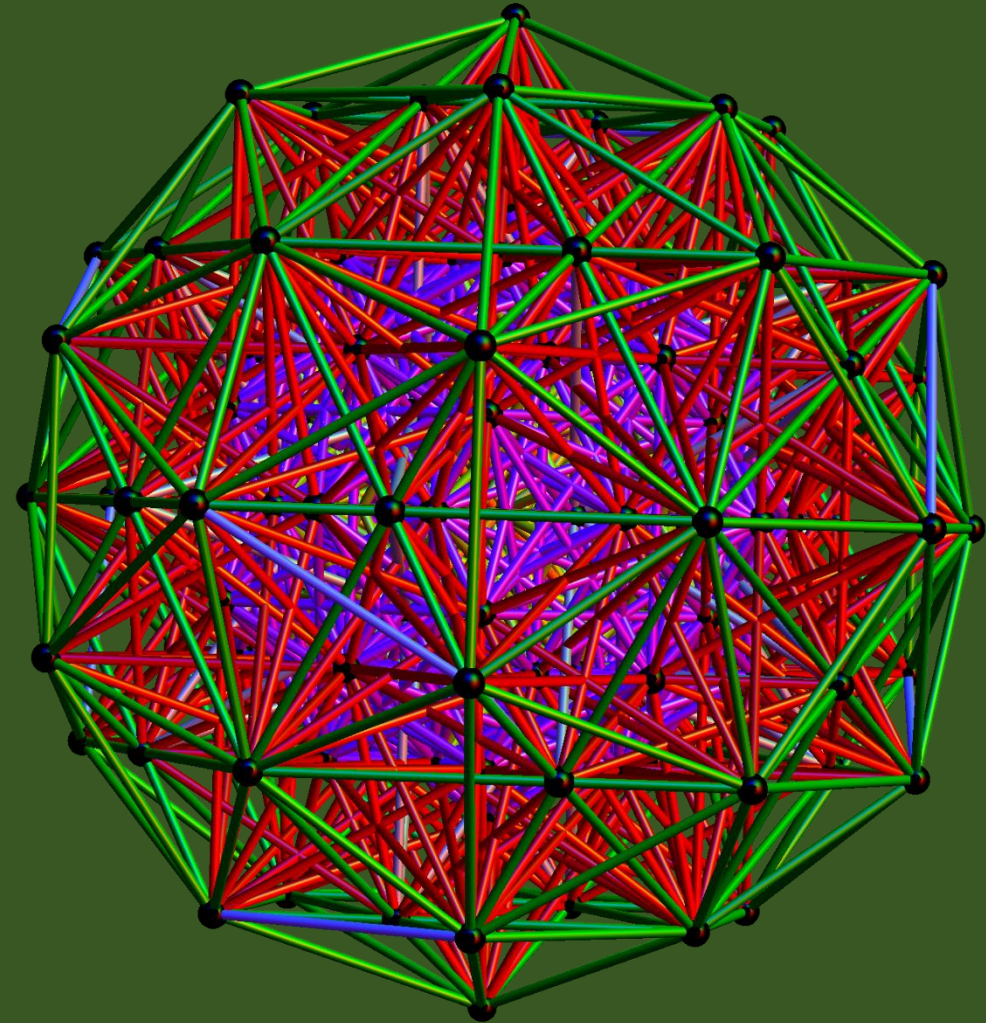
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- Pixelation
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- Golden Ratio



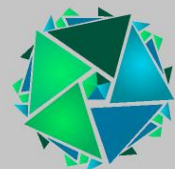
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E8 Crystal

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



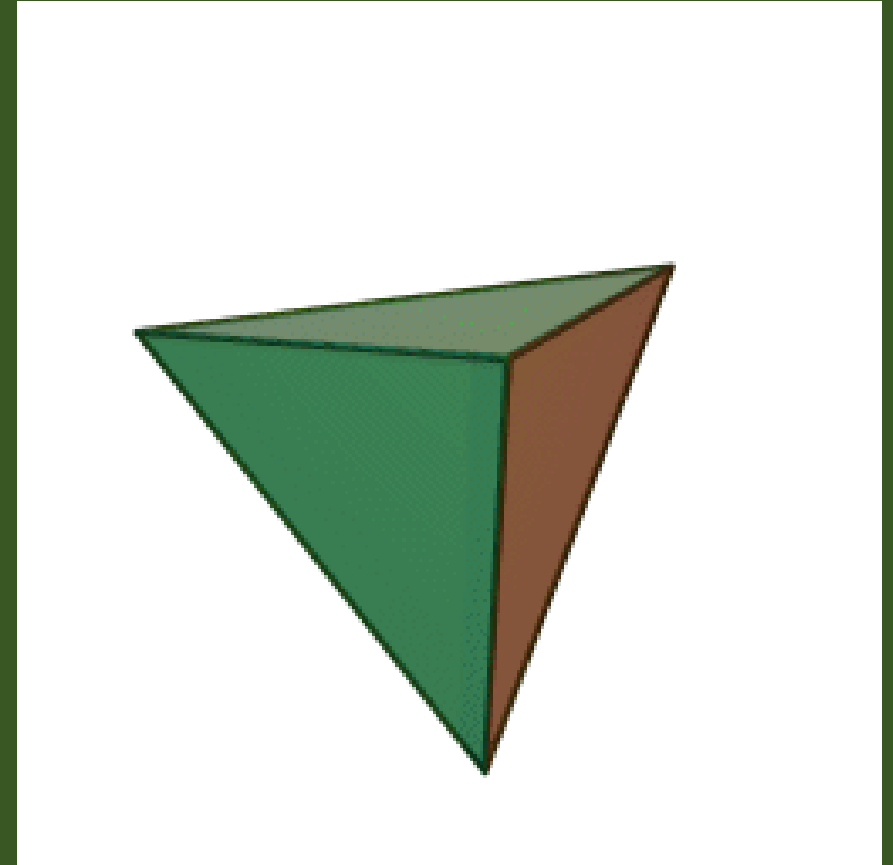
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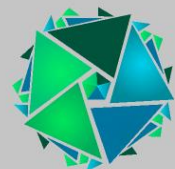
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E8 Crystal

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



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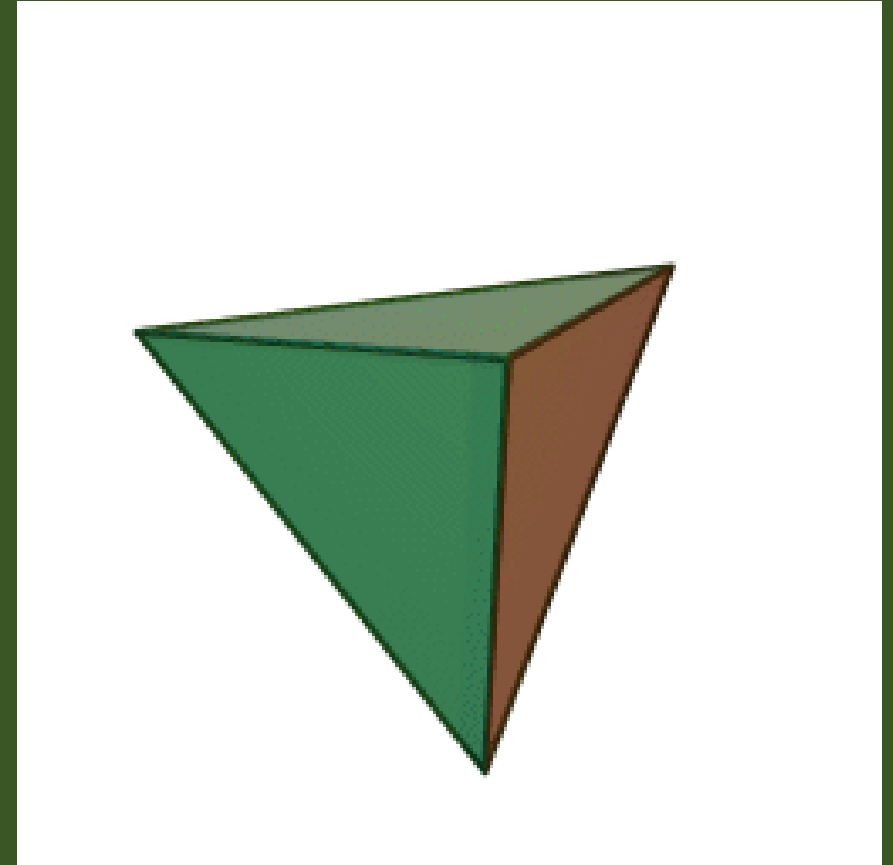


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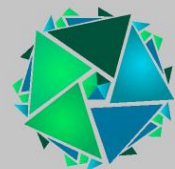
E8 Crystal

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

...rotated from one another into
different 3D subspaces of R^8 by a
golden ratio based angle.



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



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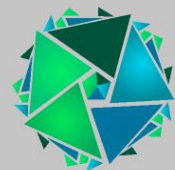
Nature's Clue 7: Golden Ratio



Golden Ratio

The golden ratio may be the fundamental constant of nature.

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



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Golden Ratio

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

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



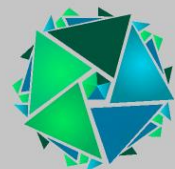
QUANTUM
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Golden Ratio

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.

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



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Golden Ratio

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.

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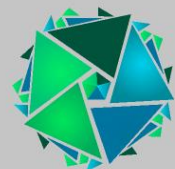


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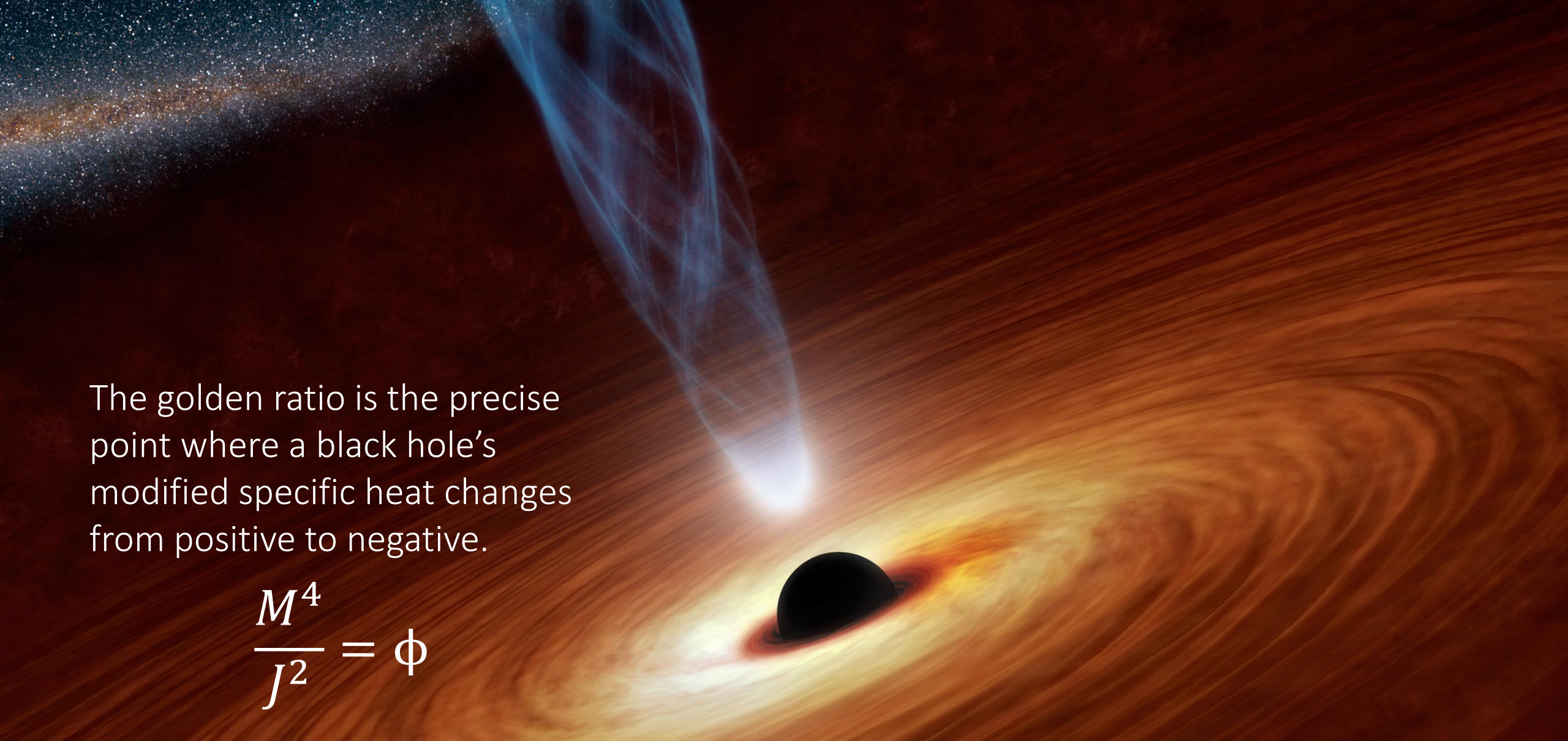
Golden Ratio

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.

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



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A black hole is depicted with a glowing accretion disk and a blue jet of light. The background is a dark, starry space with a galaxy visible in the upper left.

The golden ratio is the precise point where a black hole's modified specific heat changes from positive to negative.

$$\frac{M^4}{J^2} = \phi$$



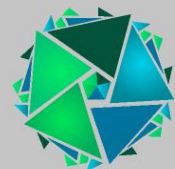
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And it is part of the equation for the lower bound on black hole entropy.

$$e^{\frac{8\pi S l_p^2}{kA}} \geq \phi$$

The golden ratio is the precise point where a black hole's modified specific heat changes from positive to negative.

$$\frac{M^4}{J^2} = \phi$$



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

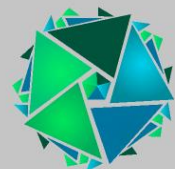
$$e^{\frac{8\pi S l_p^2}{kA}} \geq \phi$$

The golden ratio is the precise point where a black hole's modified specific heat changes from positive to negative.

$$\frac{M^4}{J^2} = \phi$$

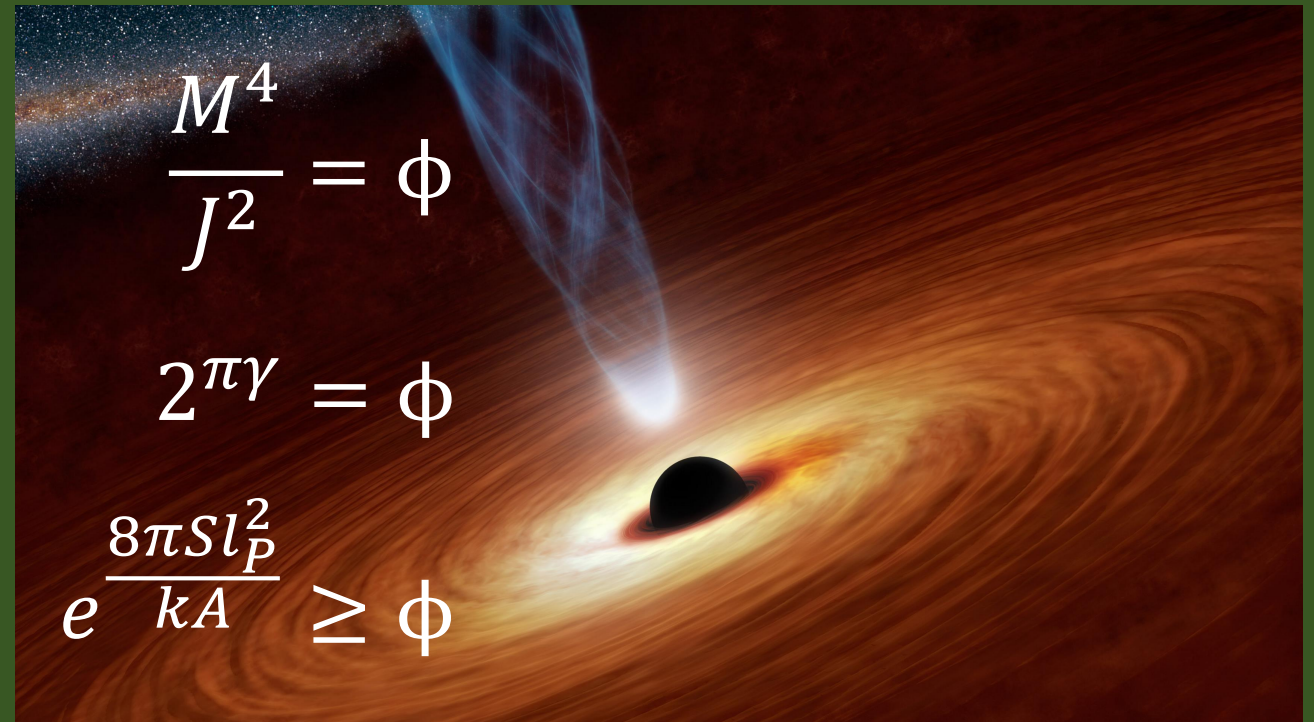
The golden ratio even relates the loop quantum gravity parameter to black hole entropy.

$$2^{\pi\gamma} = \phi$$

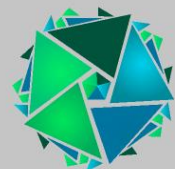


Golden Ratio

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



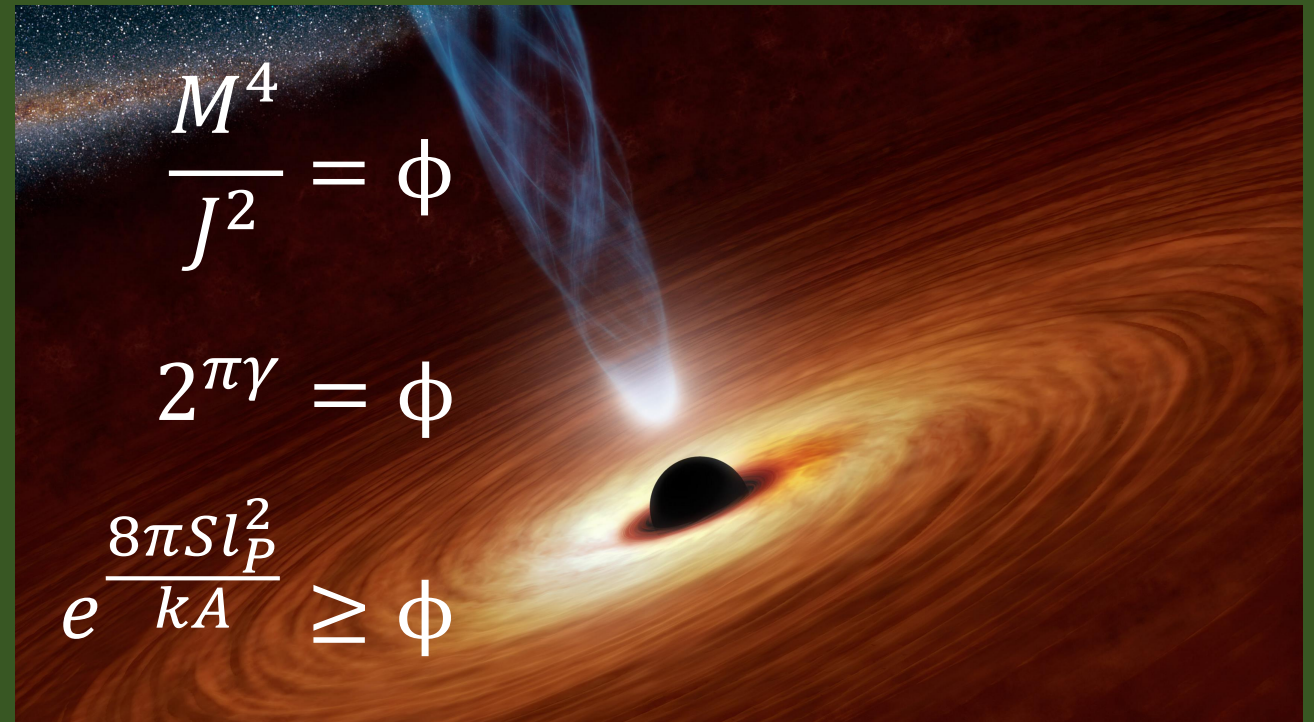
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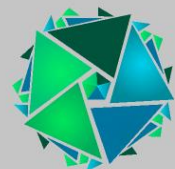
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Golden Ratio

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



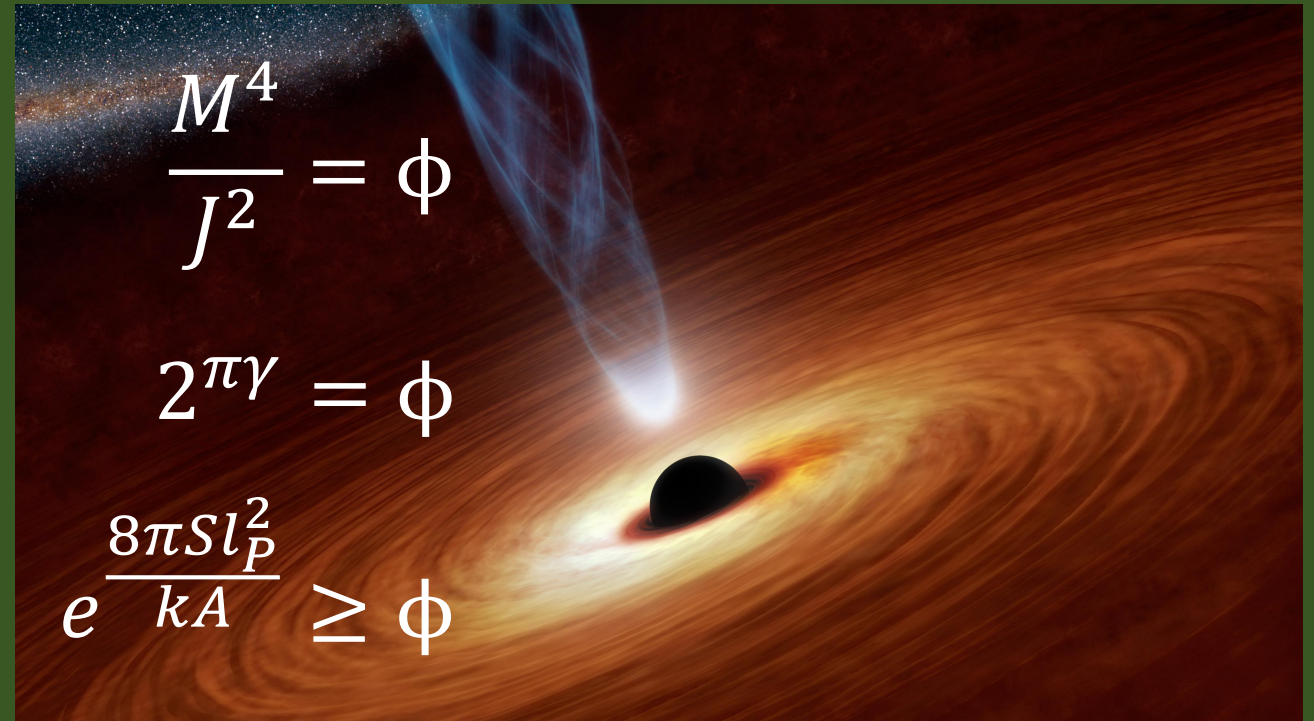
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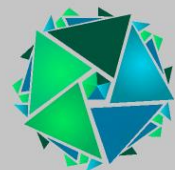
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Golden Ratio

And a black hole is where these two theories converge.



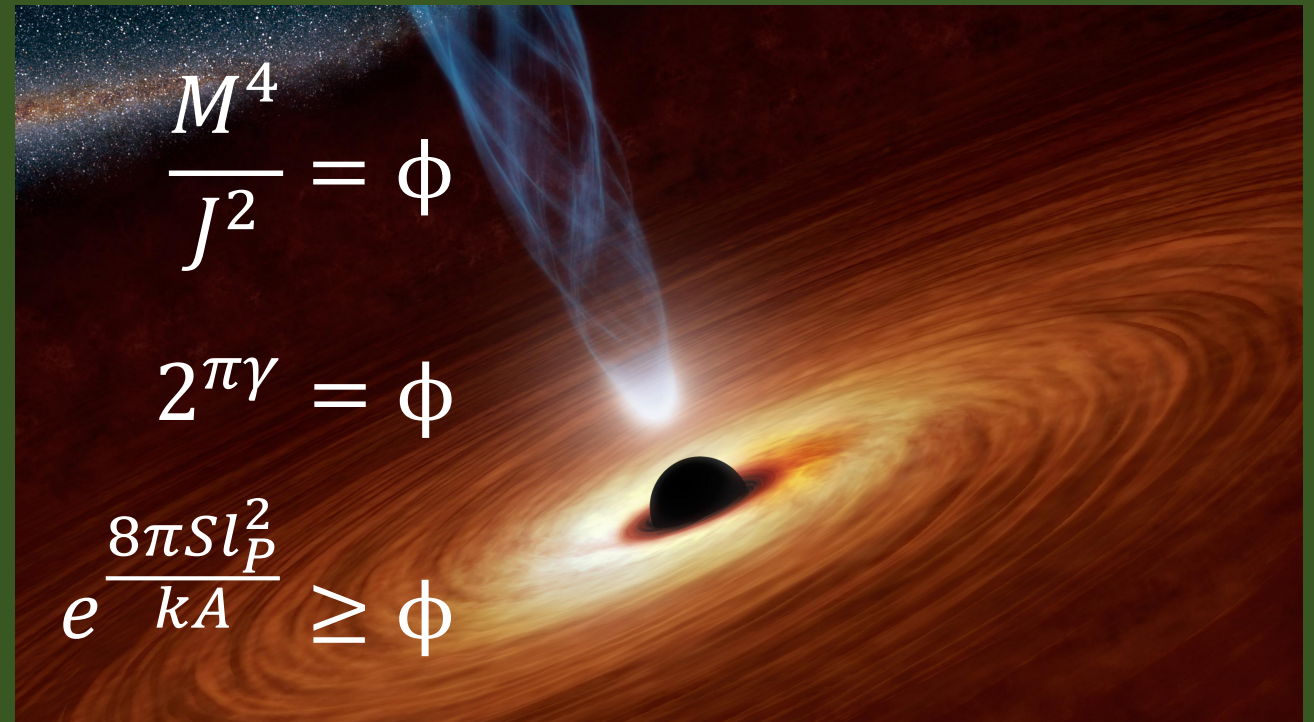
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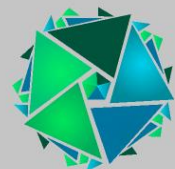
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Golden Ratio

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



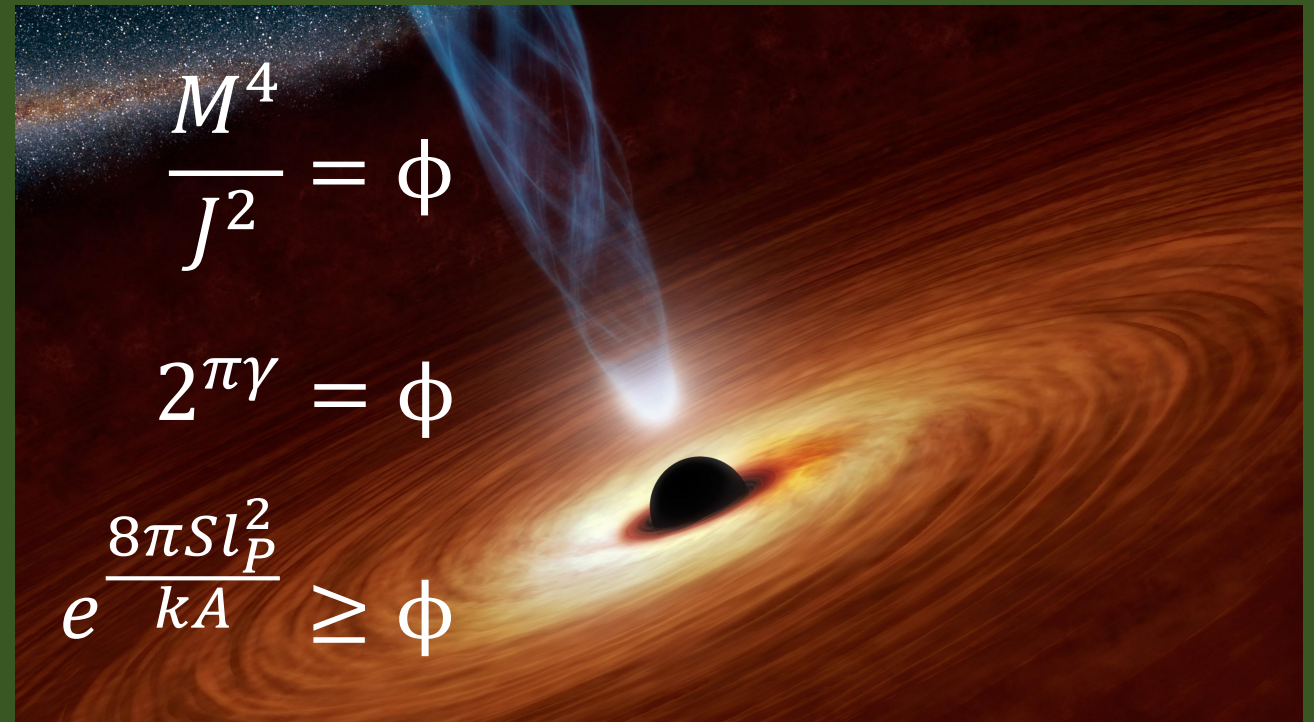
Information Causality Loops Non-determinism Consciousness Pixelation E8 Crystal Golden Ratio



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Golden Ratio

The idea is known as the *holographic principle*...



- Information
- Causality Loops
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- Pixelation
- E8 Crystal
- Golden Ratio

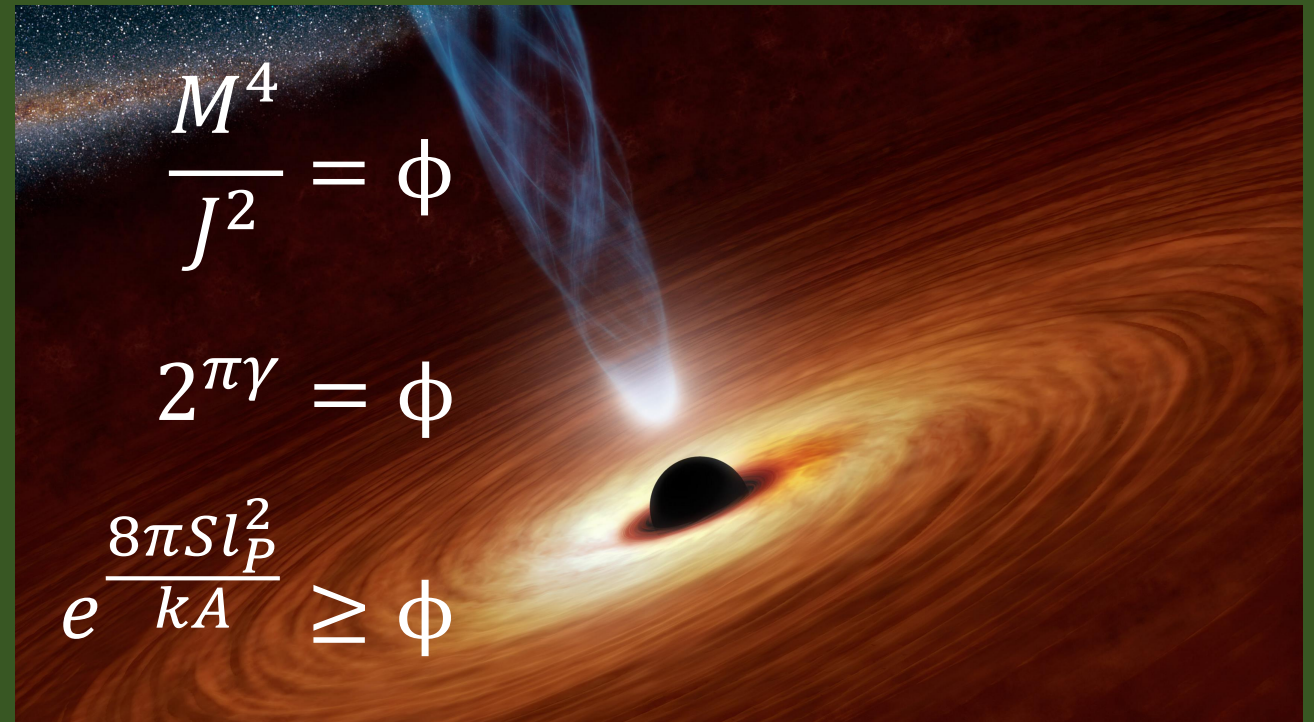


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GRAVITY RESEARCH

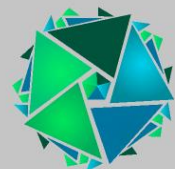
Golden Ratio

The idea is known as the *holographic principle*...

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



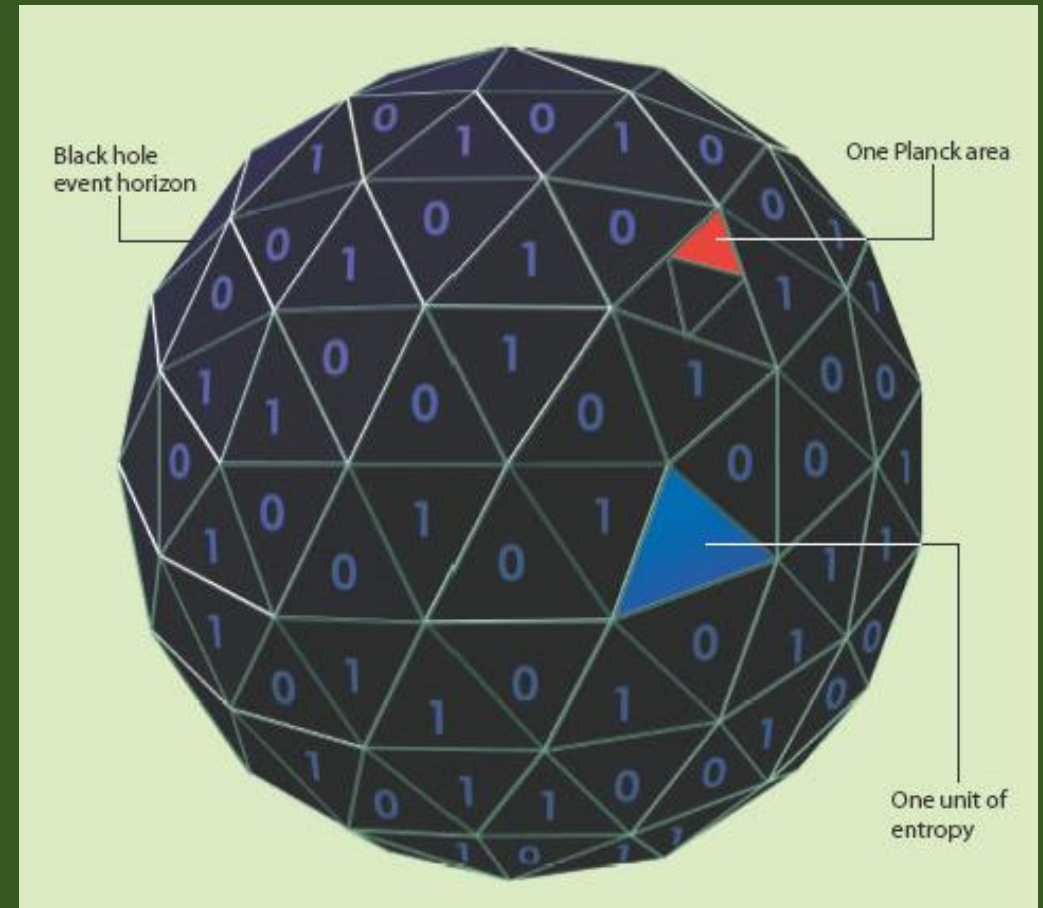
- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio



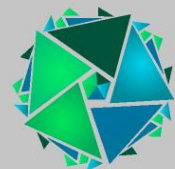
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Golden Ratio

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...



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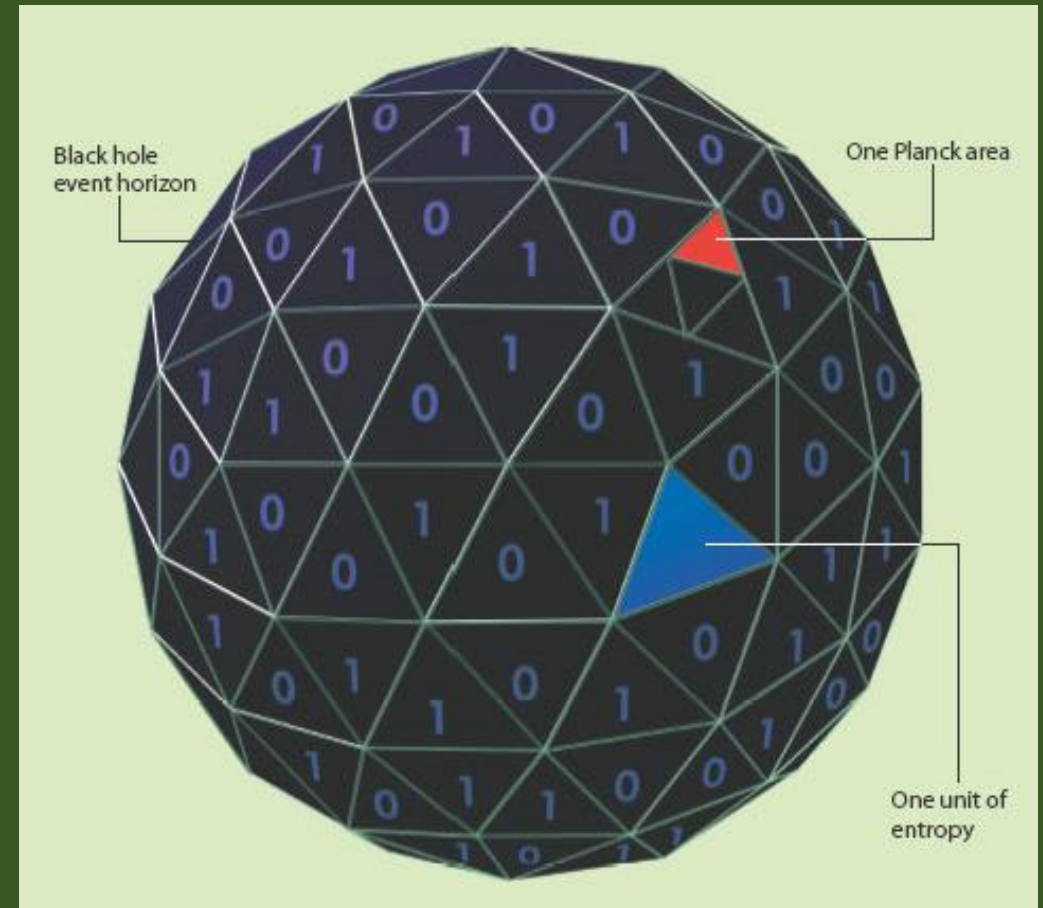


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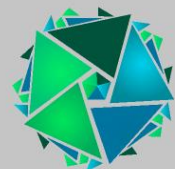
Golden Ratio

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



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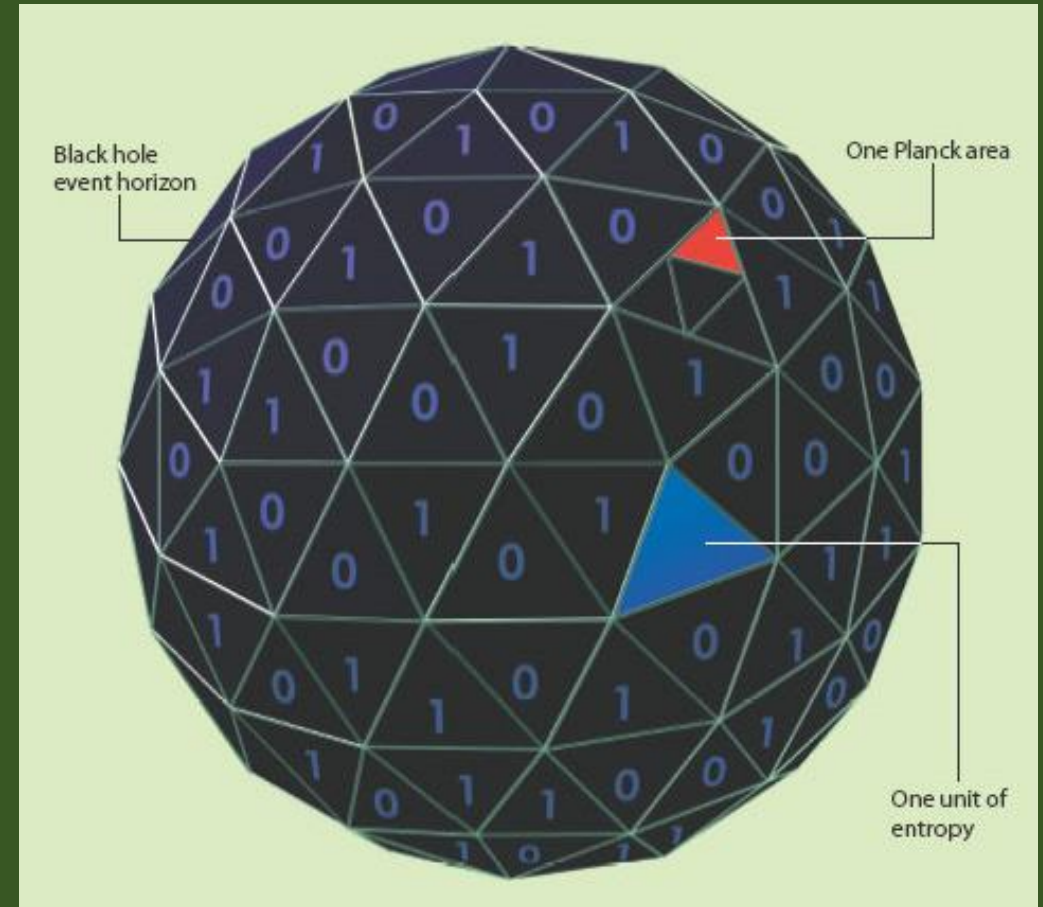


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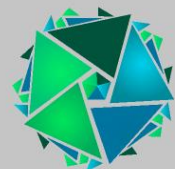
Golden Ratio

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

$$\begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$$



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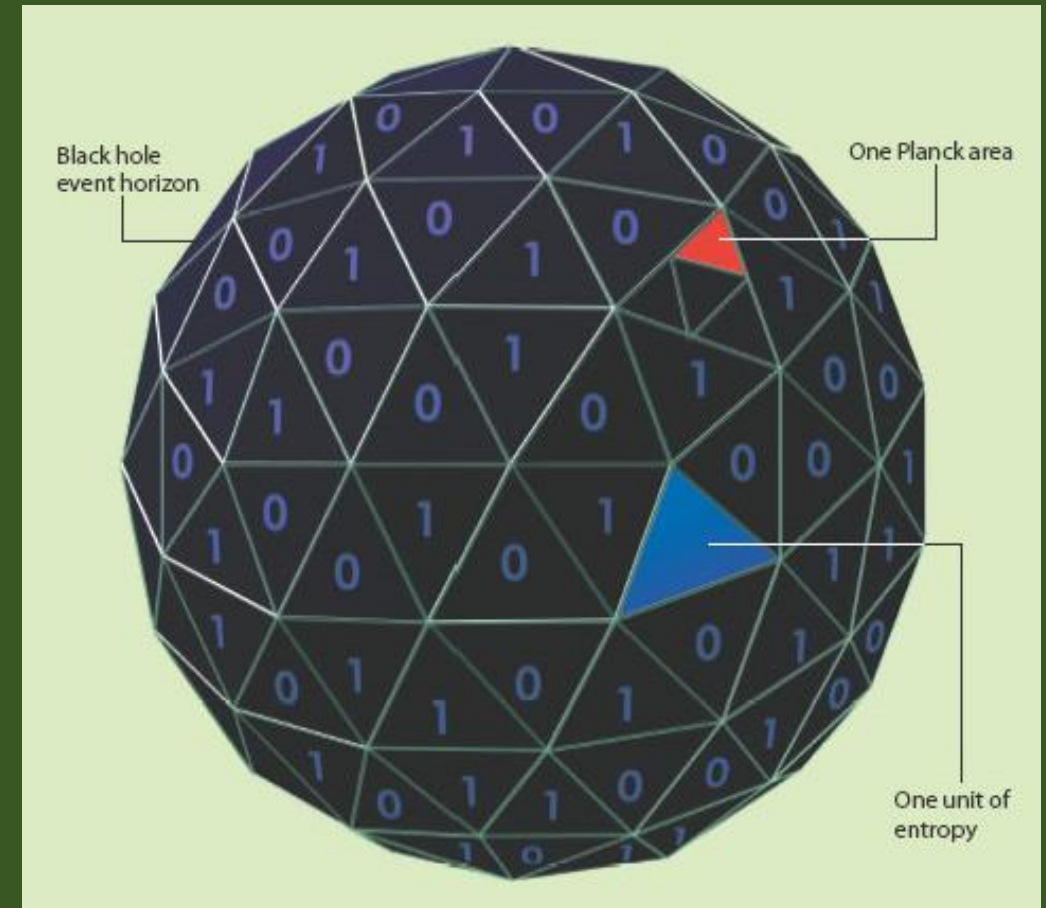


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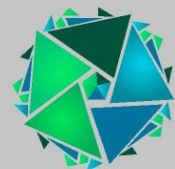
Golden Ratio

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

$$\begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$$



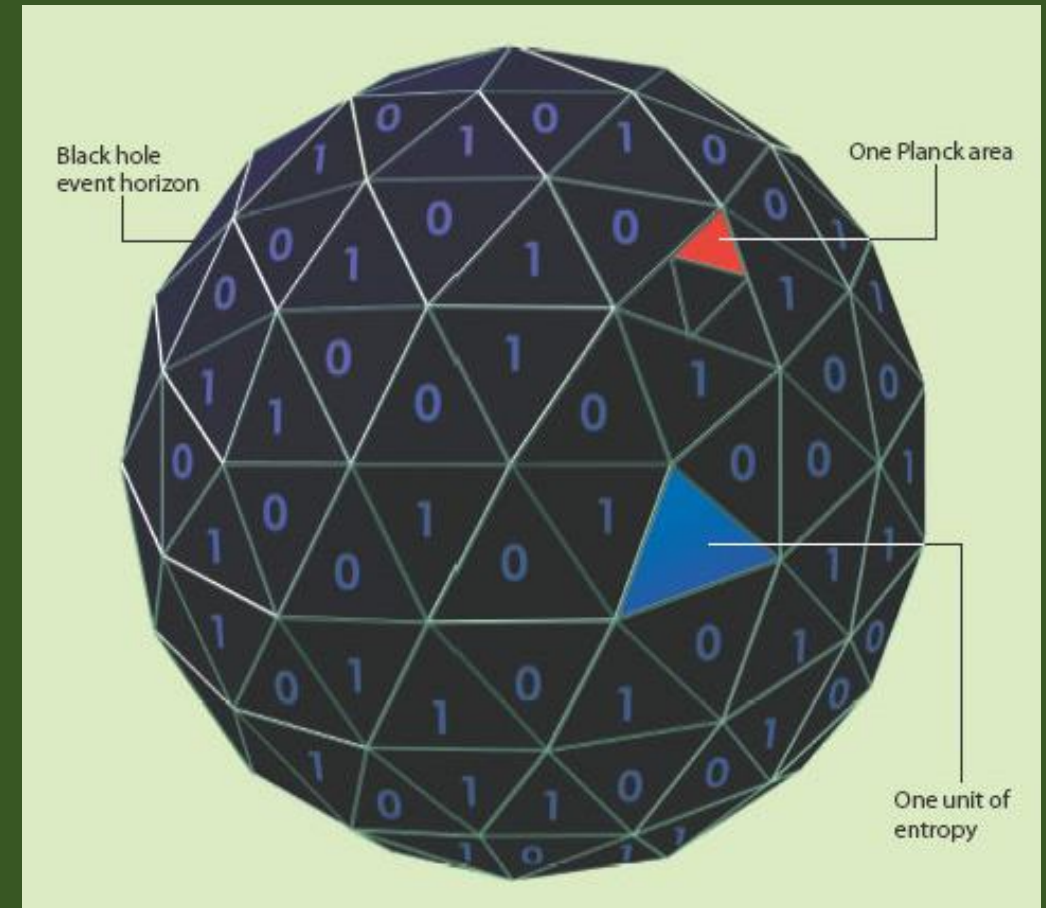
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Golden Ratio

1/8th are non-trivial golden ratio values as:



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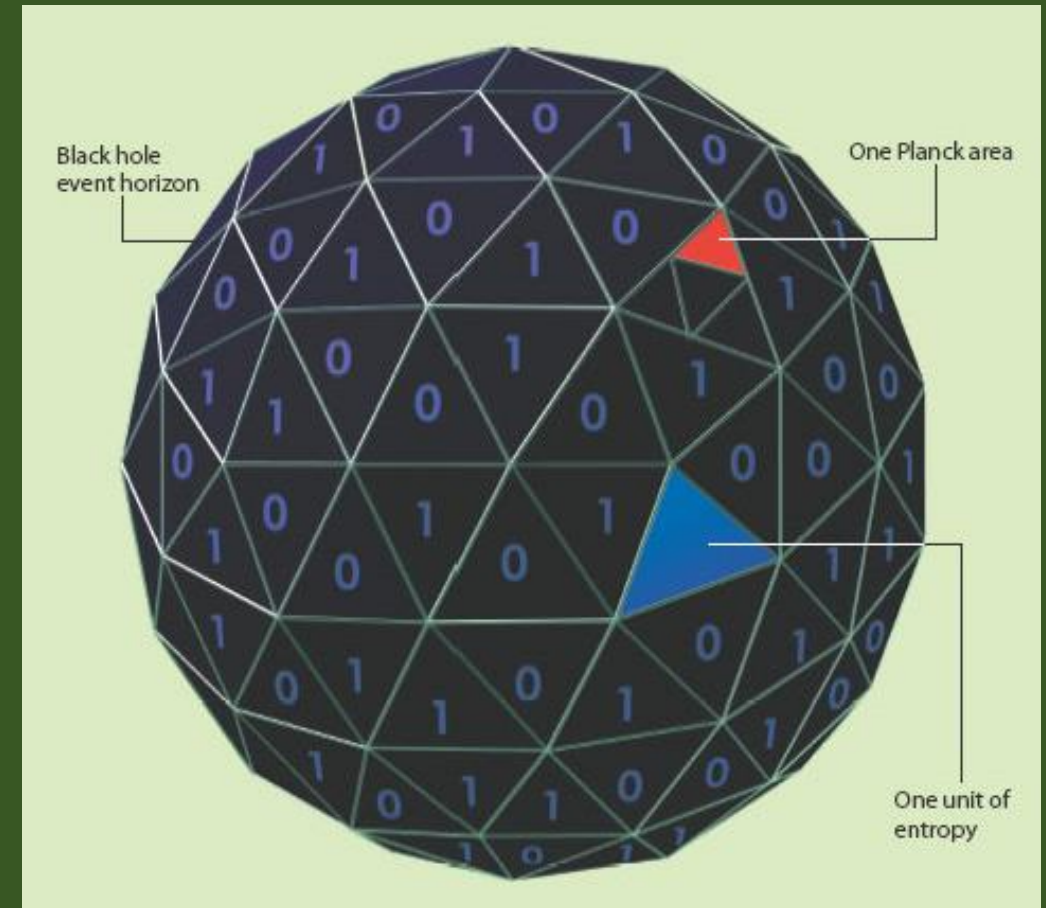


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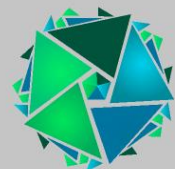
Golden Ratio

1/8th are non-trivial golden ratio values as:

$$\phi \text{ and } \frac{1}{\phi}$$



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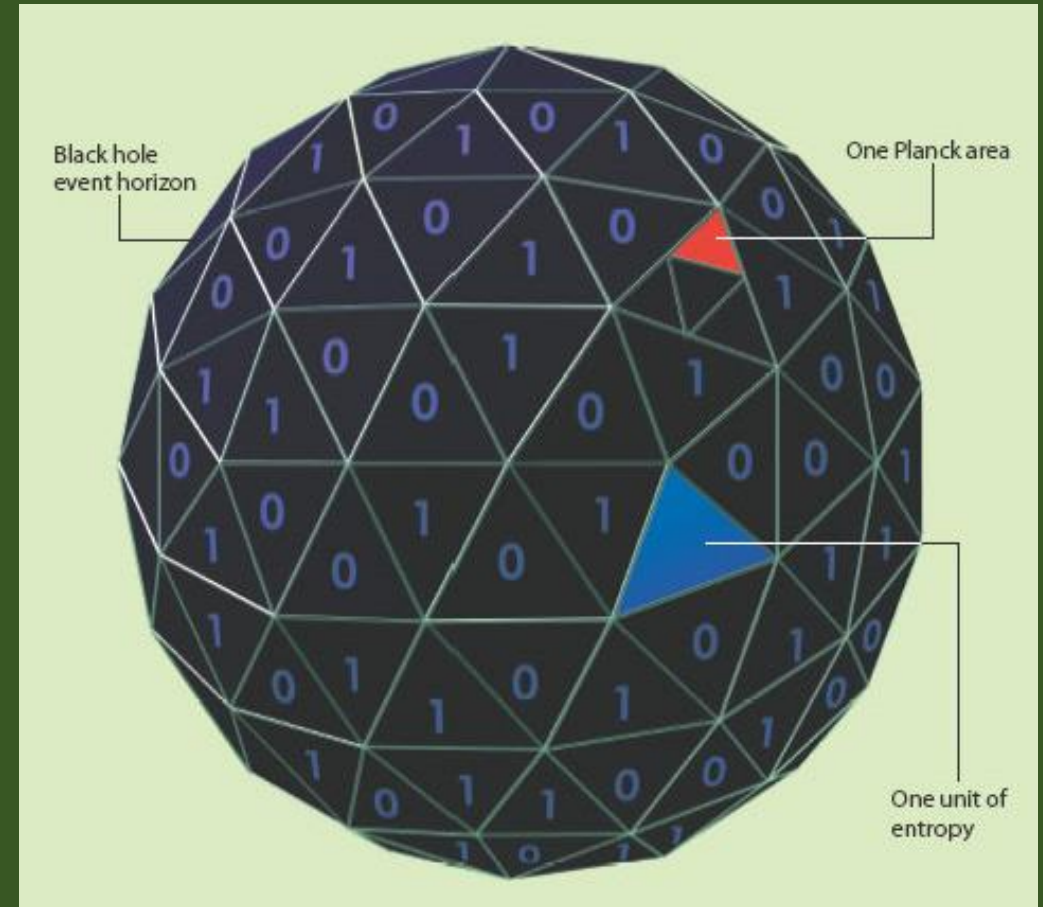


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Golden Ratio

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

$$\phi \text{ and } \frac{1}{\phi}$$



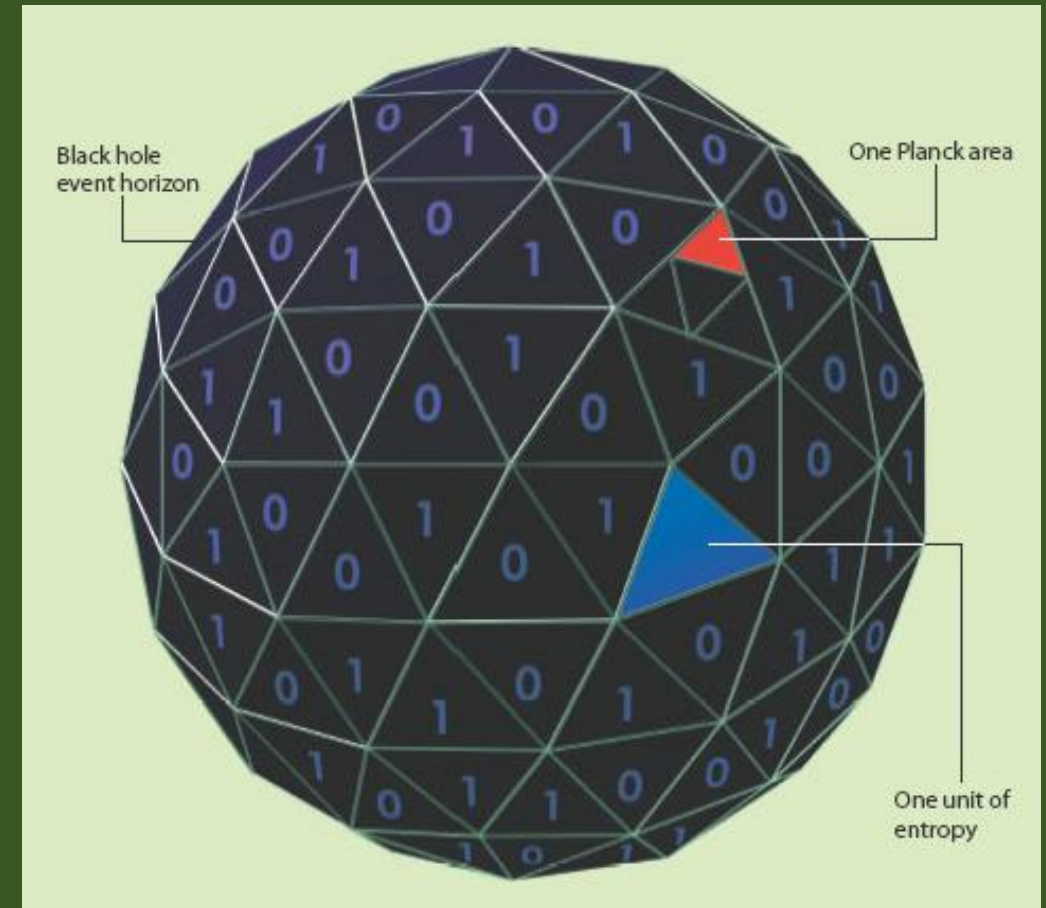
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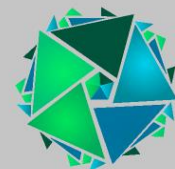
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Golden Ratio

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



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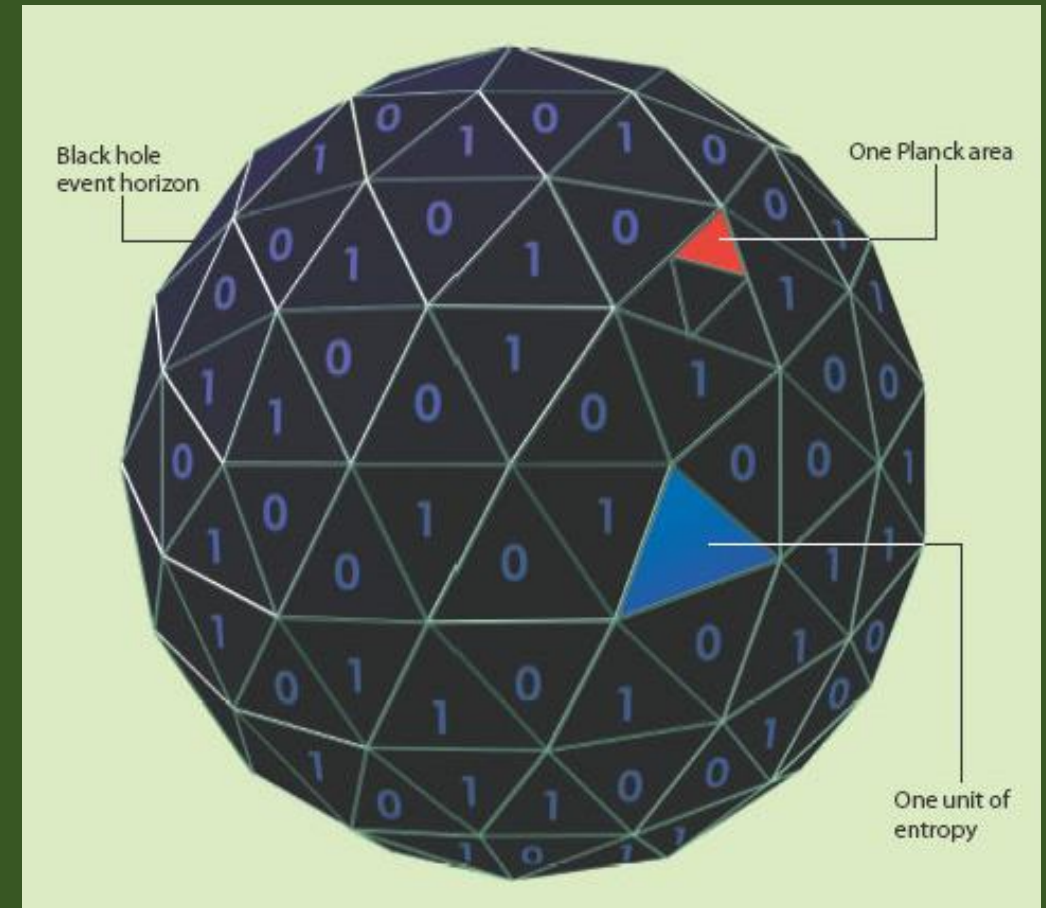


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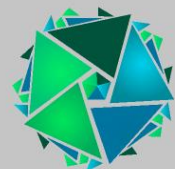
Golden Ratio

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.



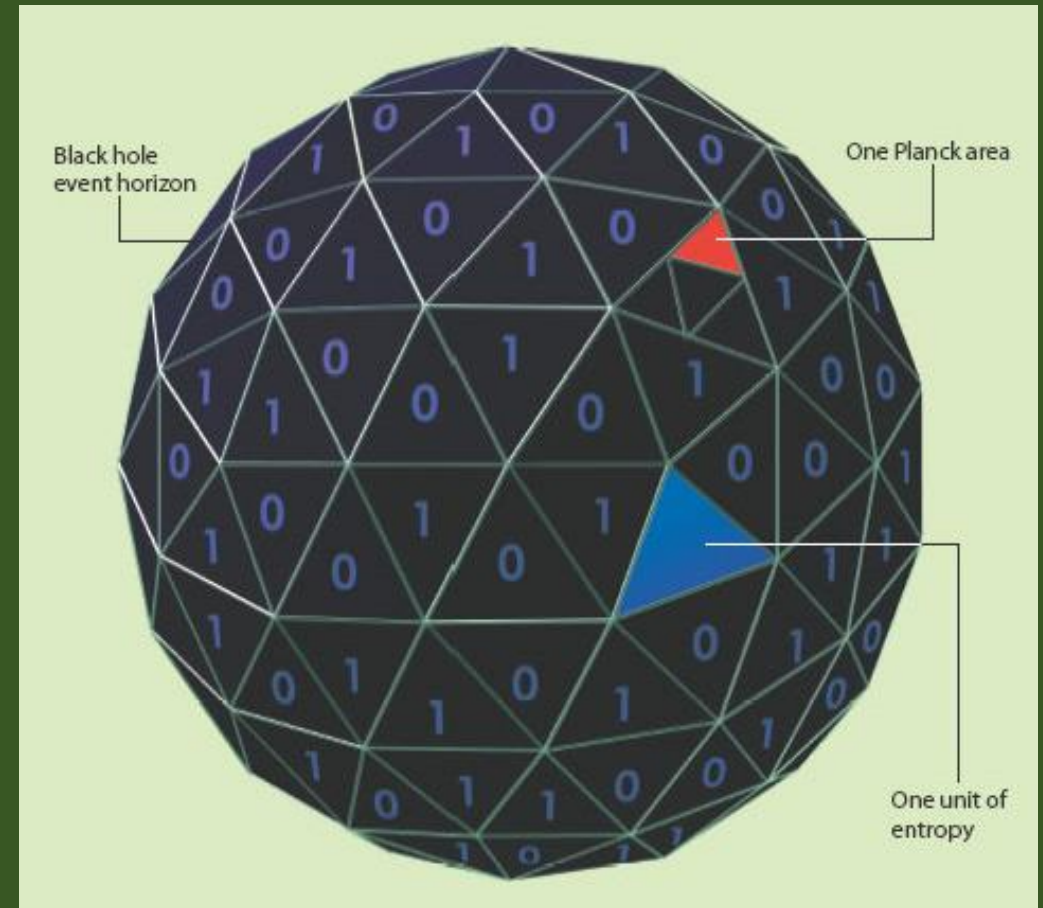
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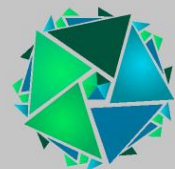
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Golden Ratio

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.



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Golden Ratio

The gravitational constant, G , ties time and length based values

together as: $G = \chi c^2 / 4\pi$



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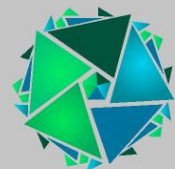
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$\phi = 99.9997\%$ of $= h\chi$ as:
 $0.6180382(10^{-53}) \text{ m}^3/\text{sec}.$



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



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



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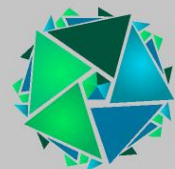
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But how can this be true if the meter and second are man-made metrics?



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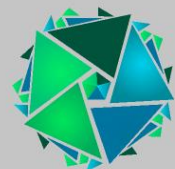


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Golden Ratio

Well, it turns out they're not so man-made...

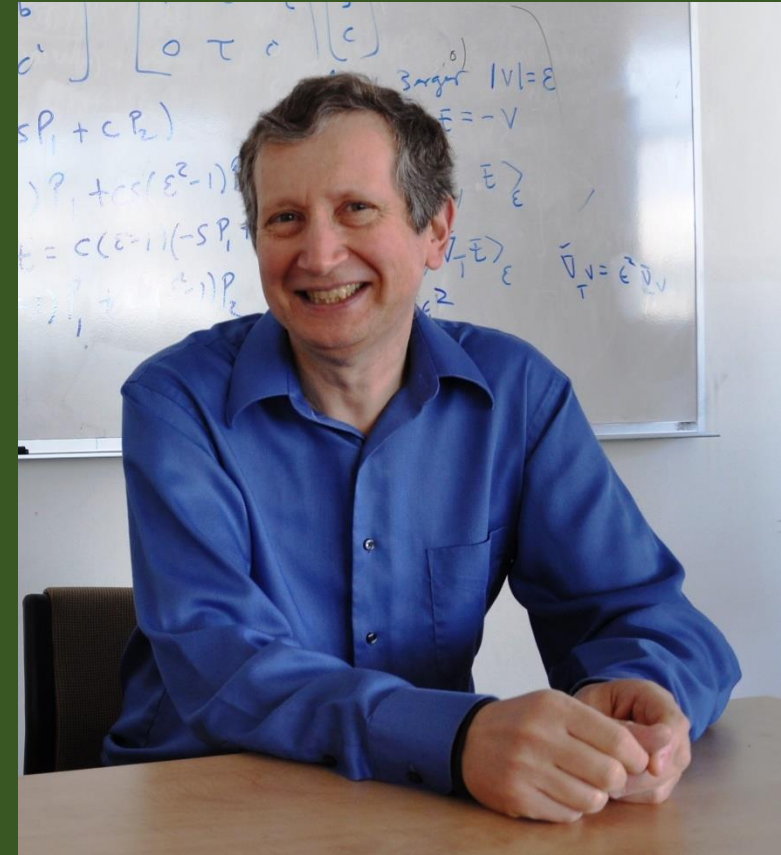
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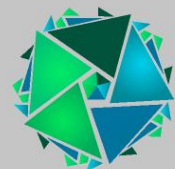
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Golden Ratio

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



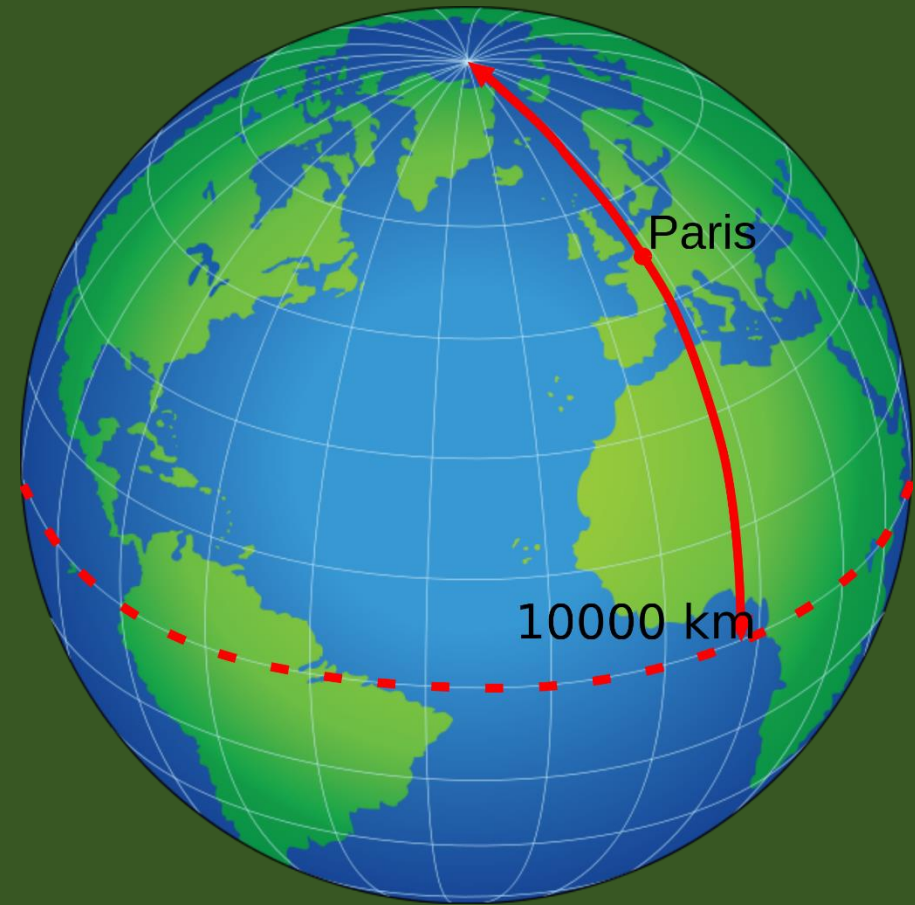
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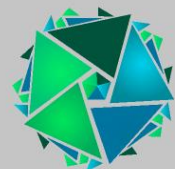
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Golden Ratio

The metric unit is simply the distance from the Equator to a pole, the minimally distorted $\frac{1}{4}$ circumference of Earth.



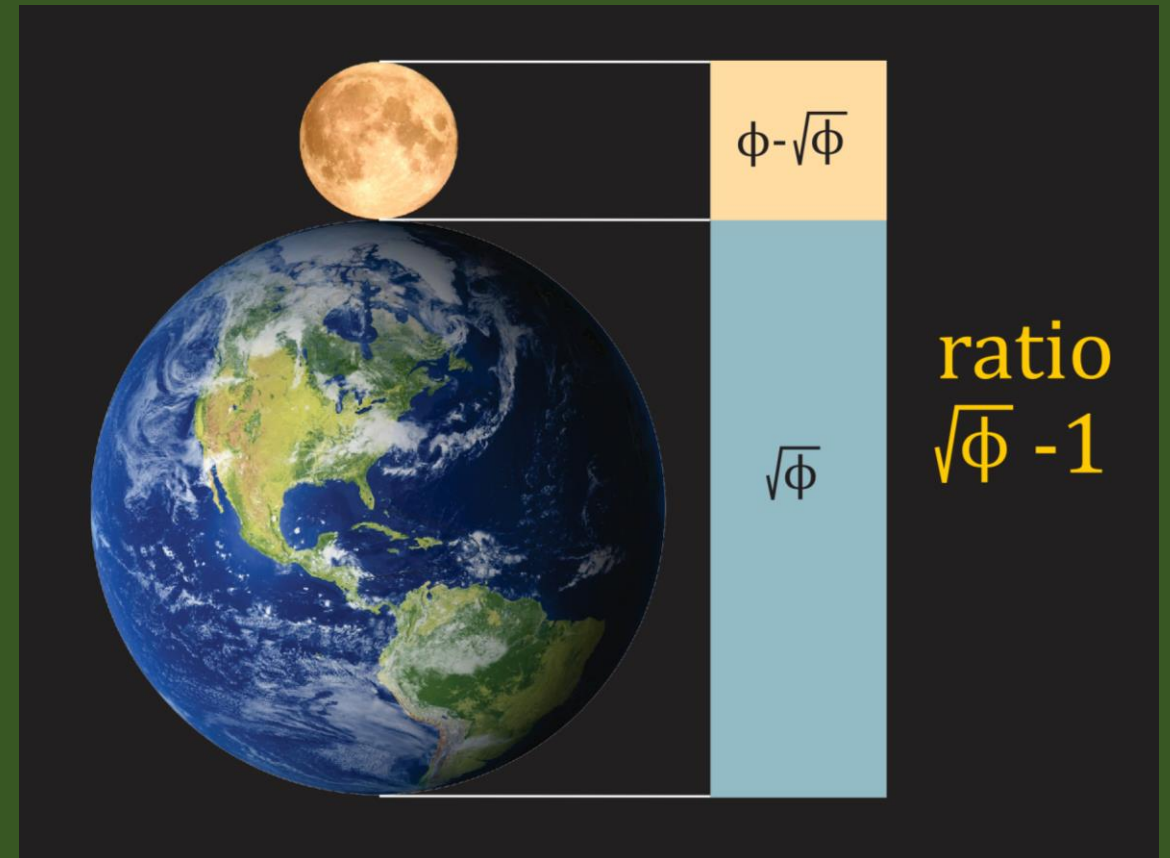
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Golden Ratio

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



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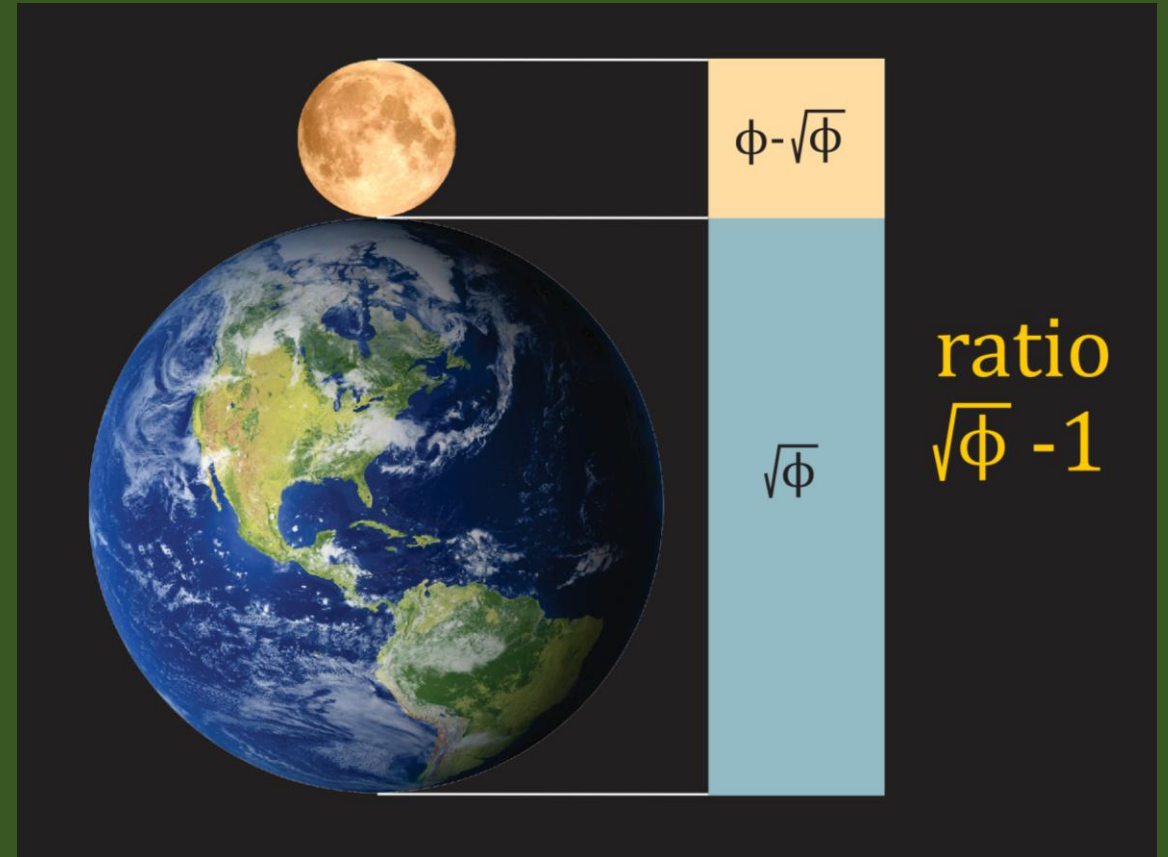


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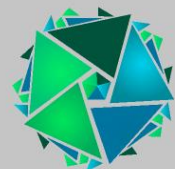
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And the dimensionless ratio of the Earth to Moon pole through pole diameters is $\sqrt{\phi} - 1$.

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



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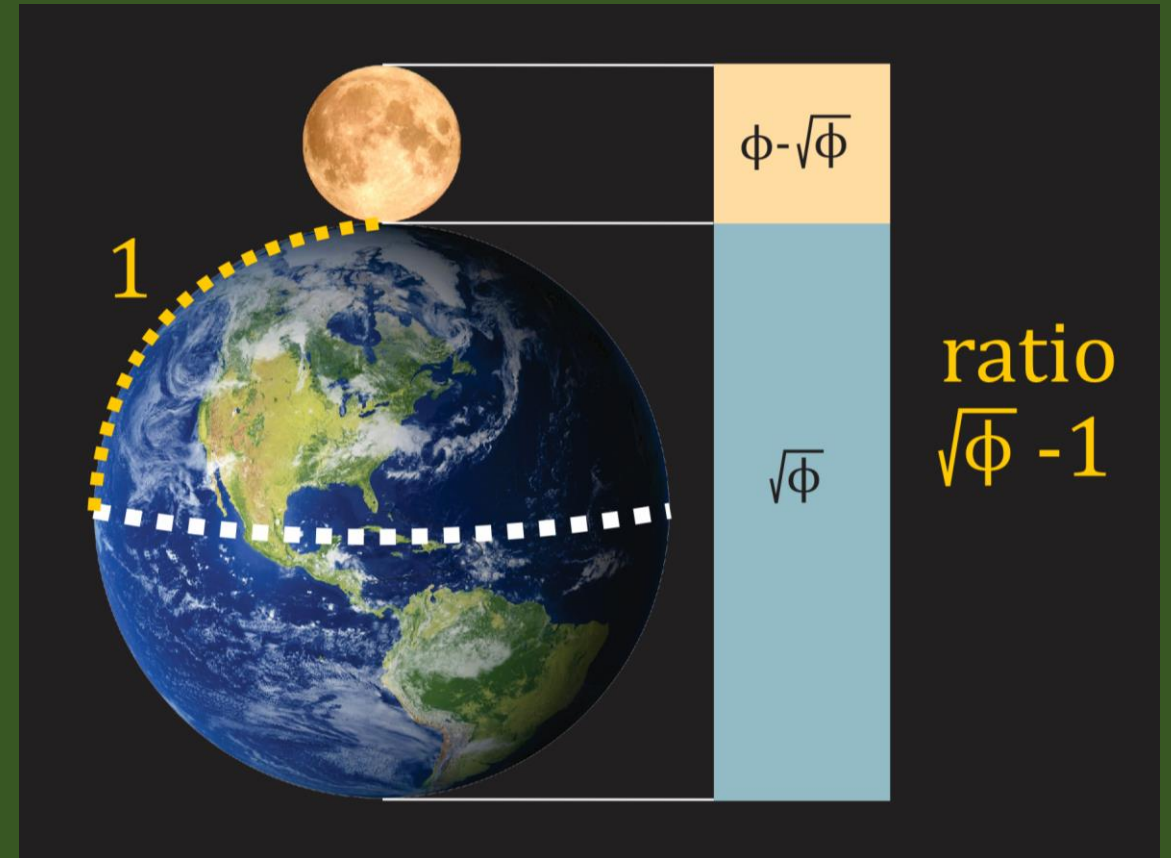
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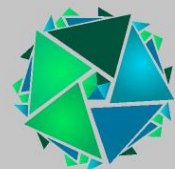
And the dimensionless ratio of the Earth to Moon pole through pole diameters is $\sqrt{\phi} - 1$.

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.



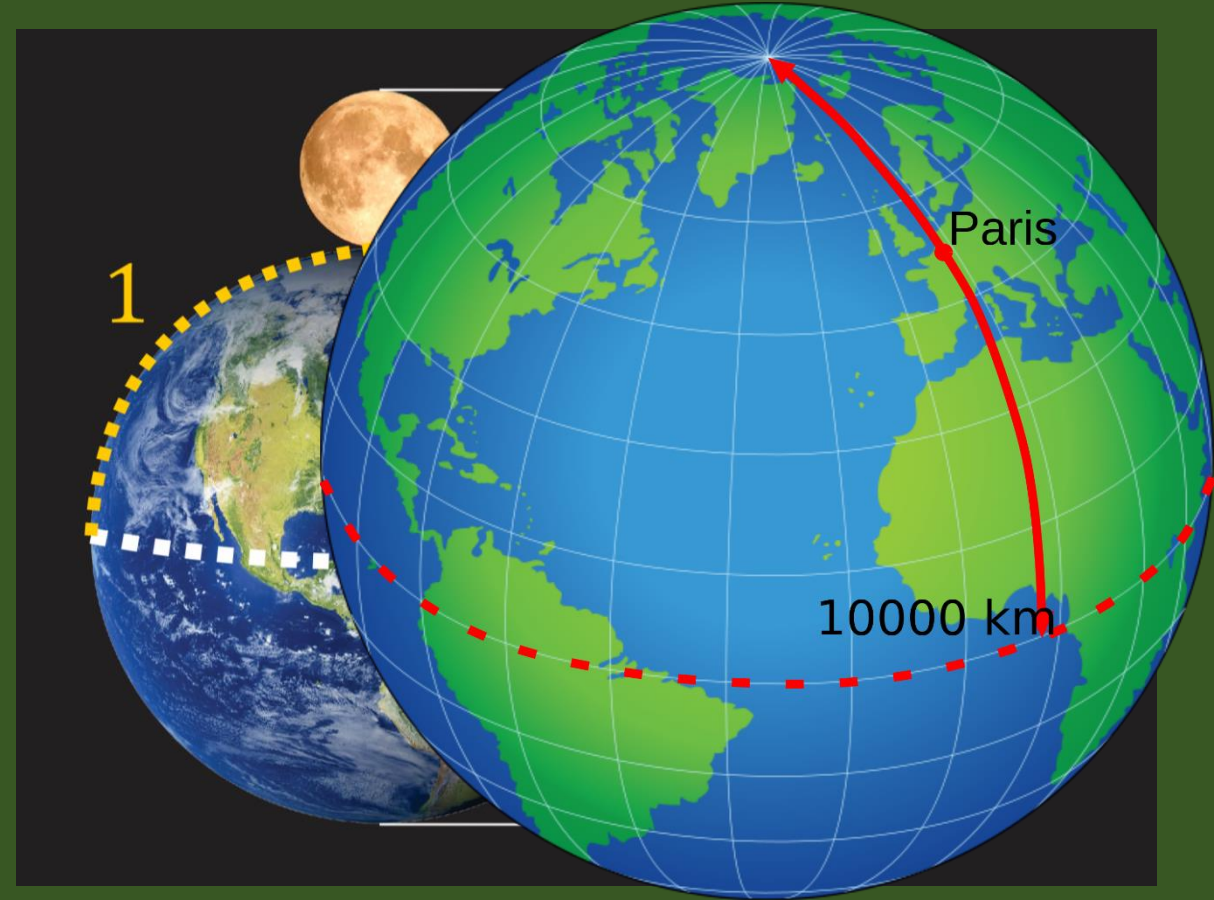
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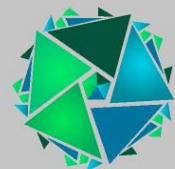
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Golden Ratio

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



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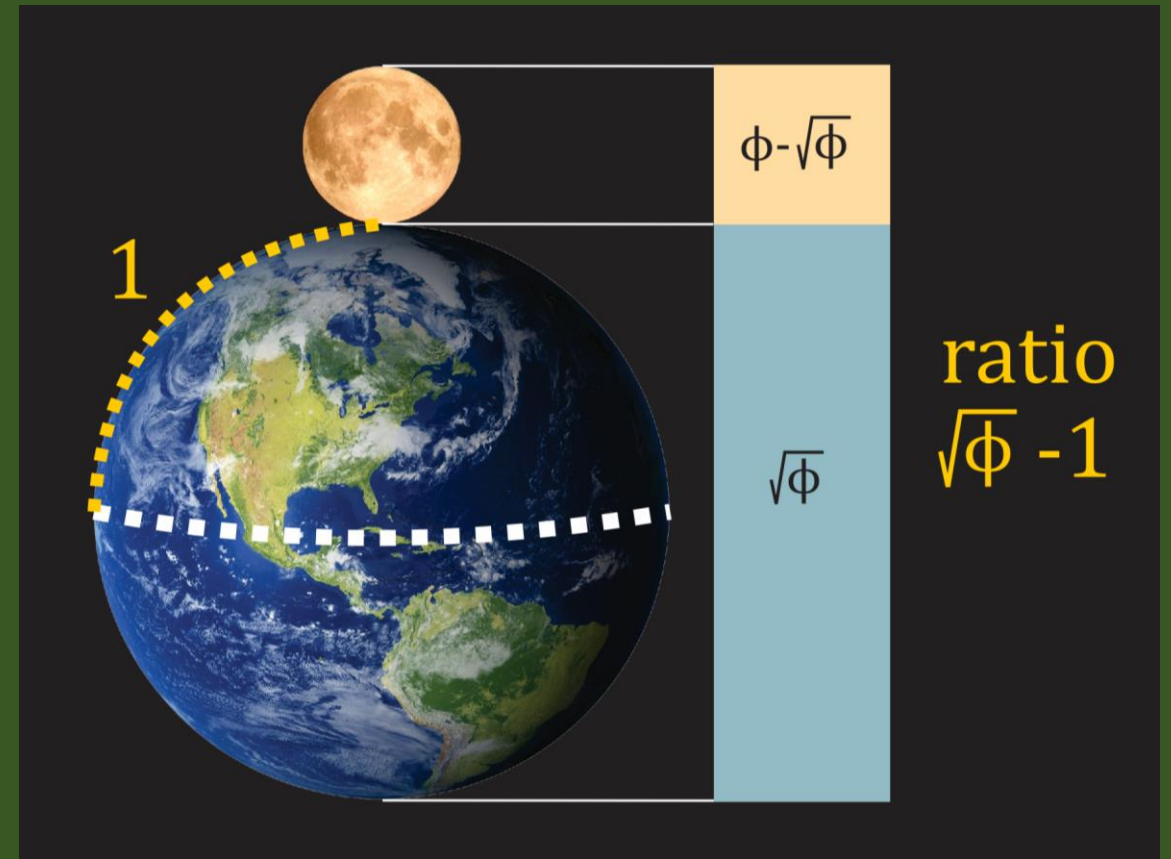


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Golden Ratio

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

1 and $1/\phi$.



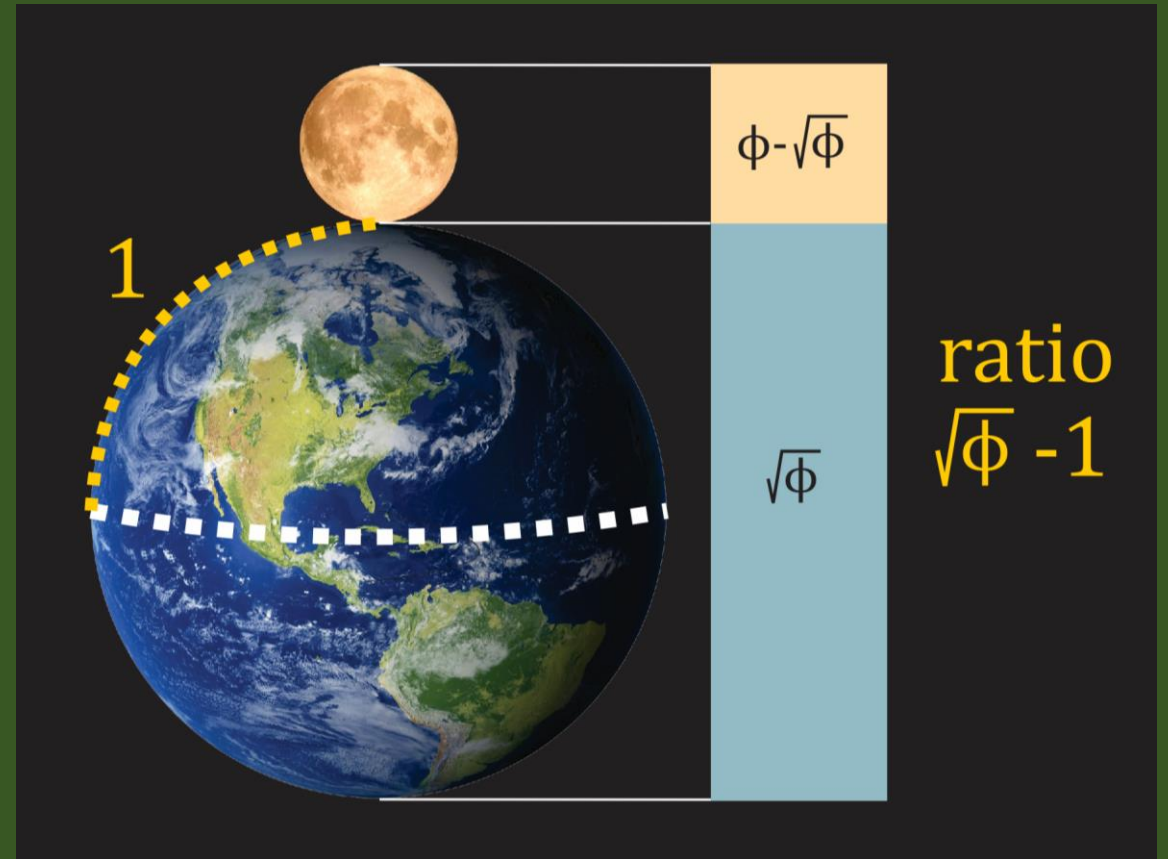
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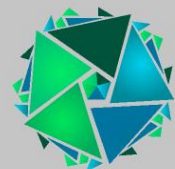
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Golden Ratio

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



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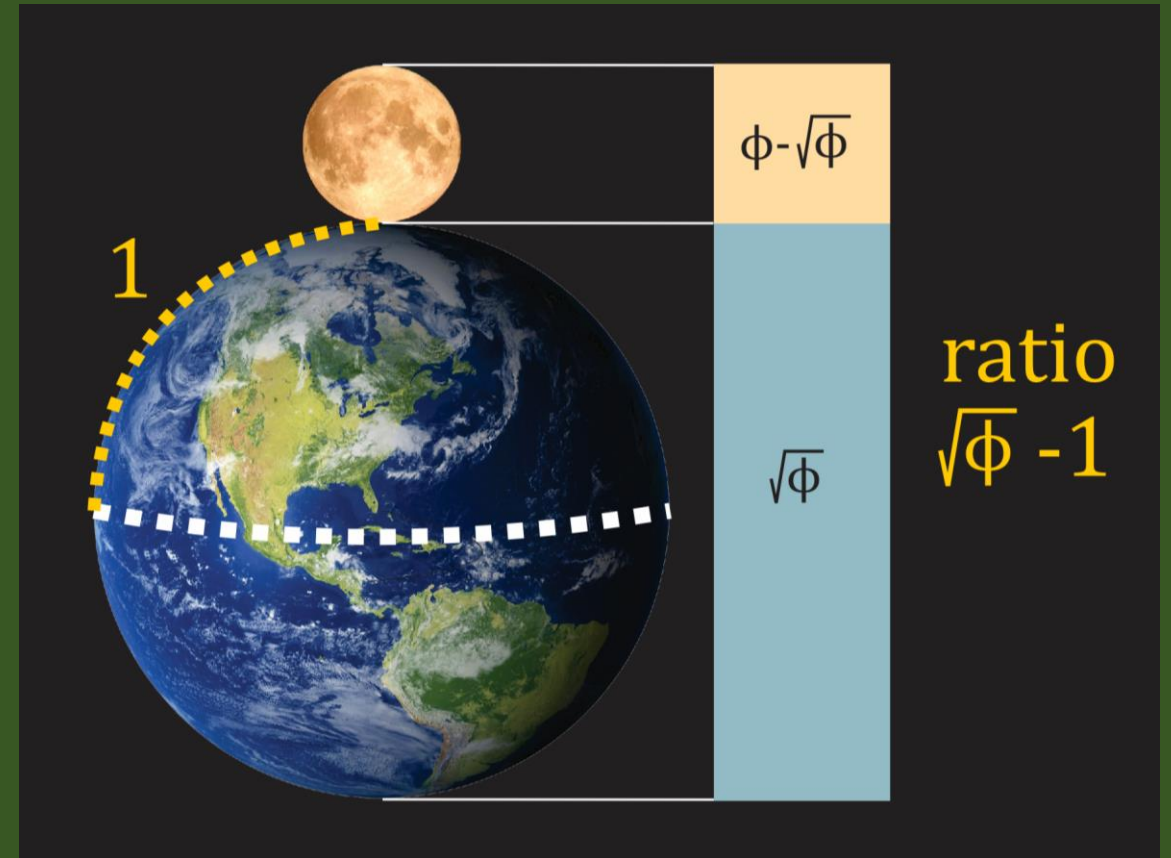


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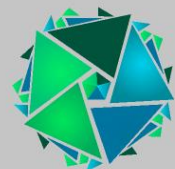
Golden Ratio

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.



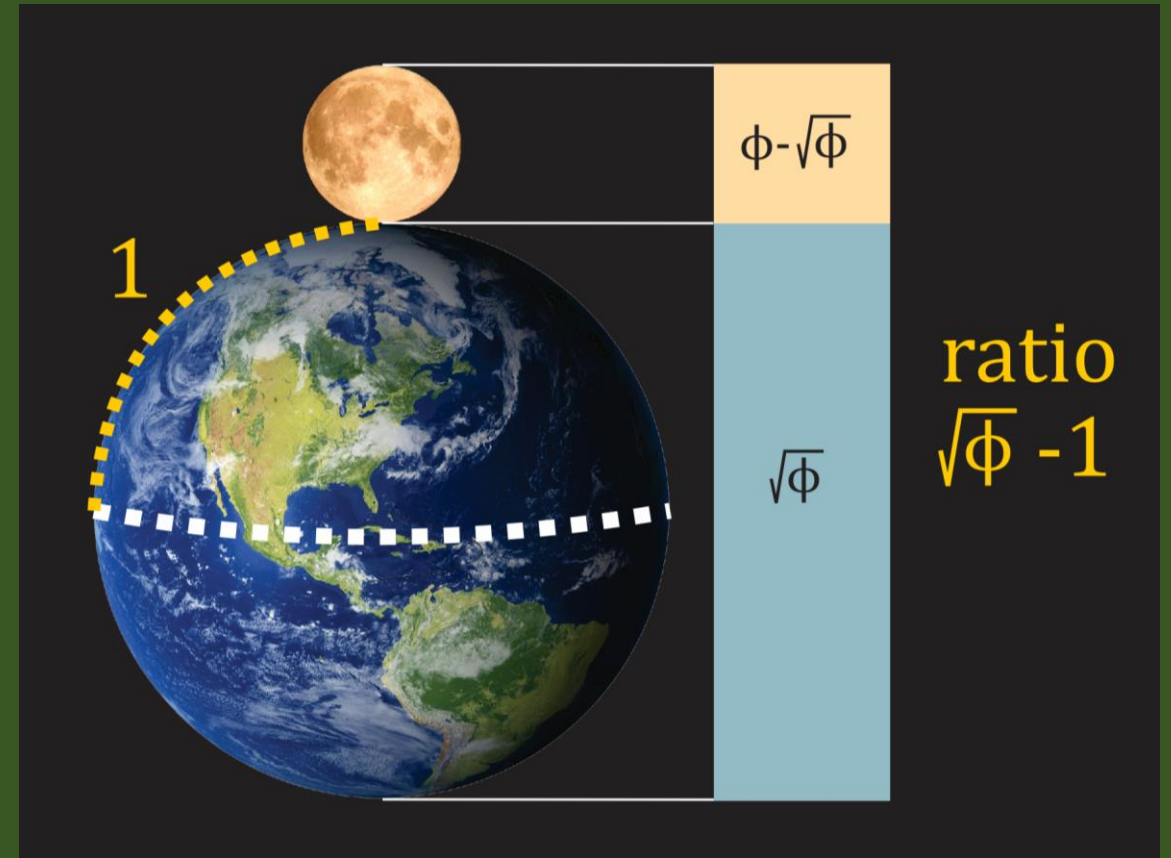
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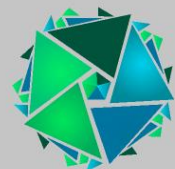
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Golden Ratio

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.



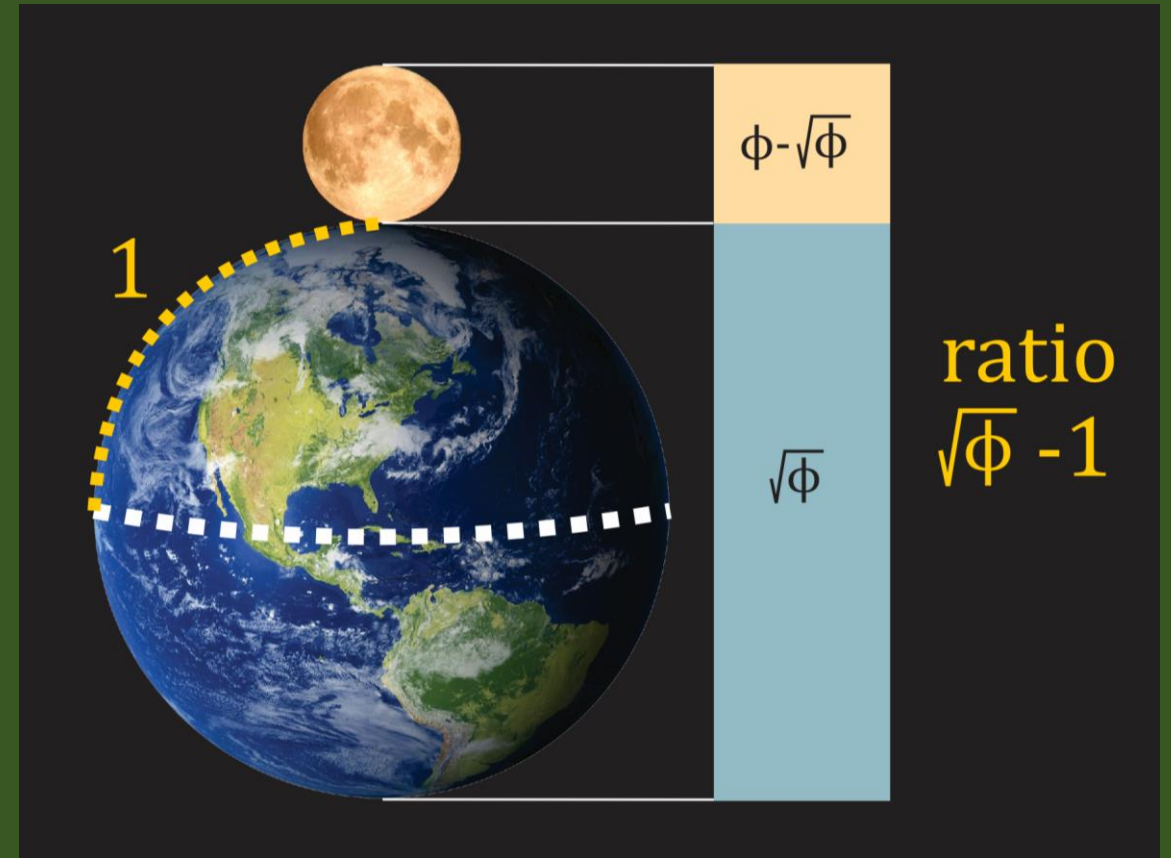
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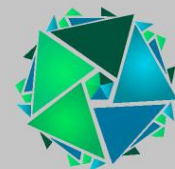
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2, 3 and 5 are sequential Fibonacci numbers.



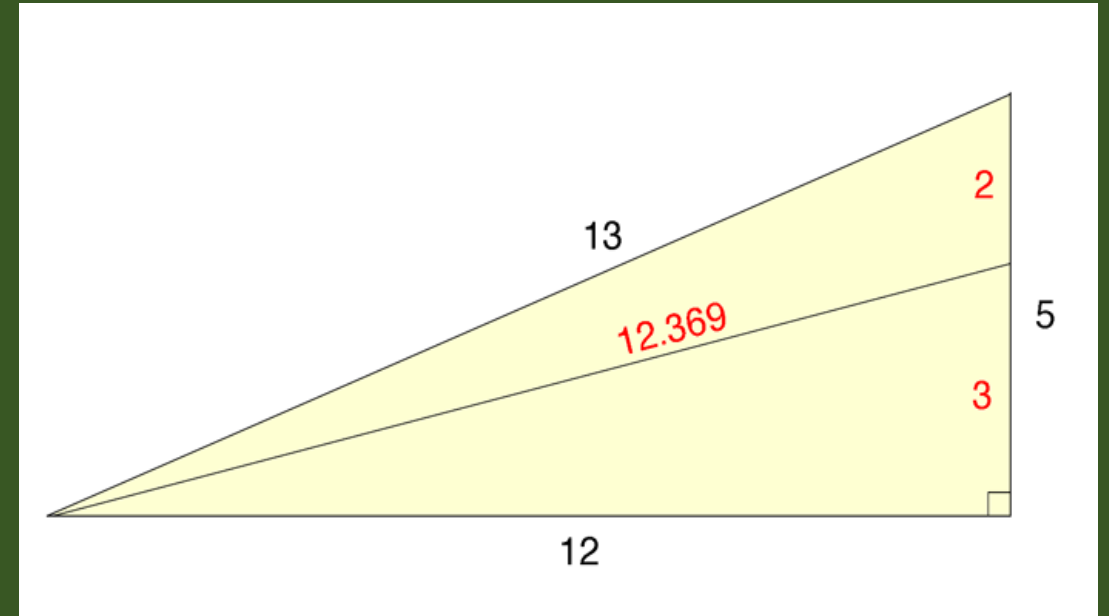
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Golden Ratio

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.



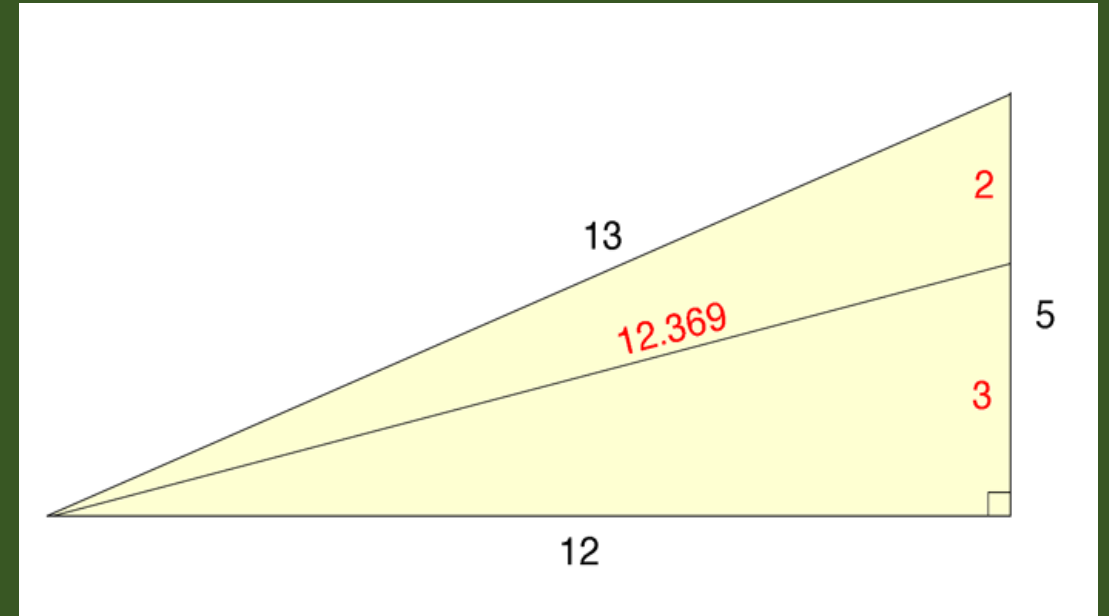
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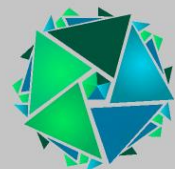
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Golden Ratio

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



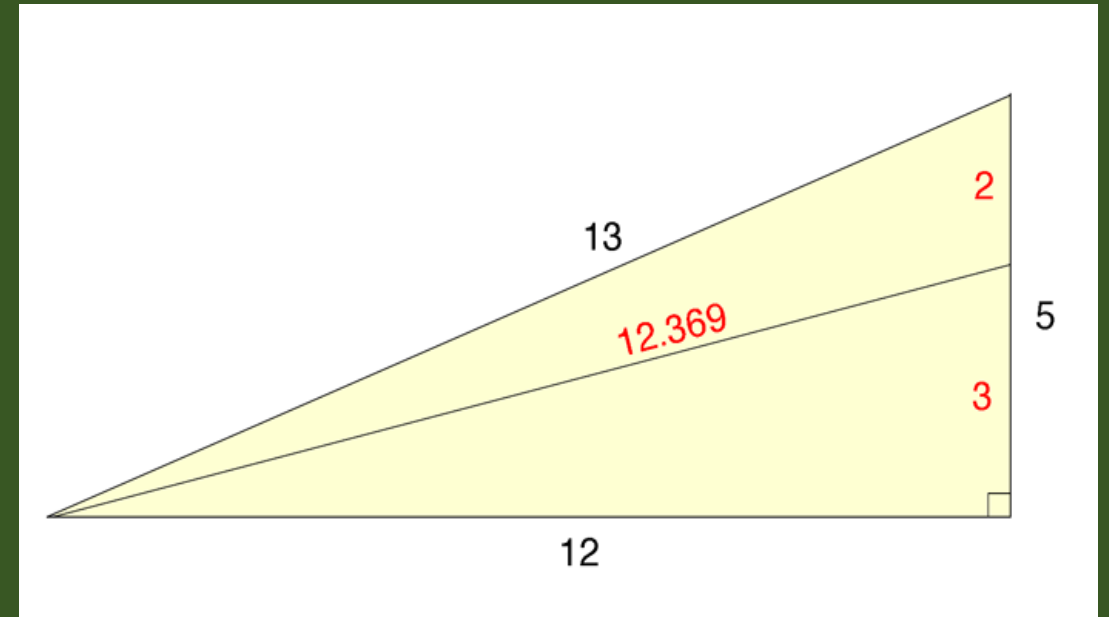
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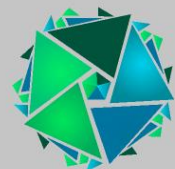
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Golden Ratio

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



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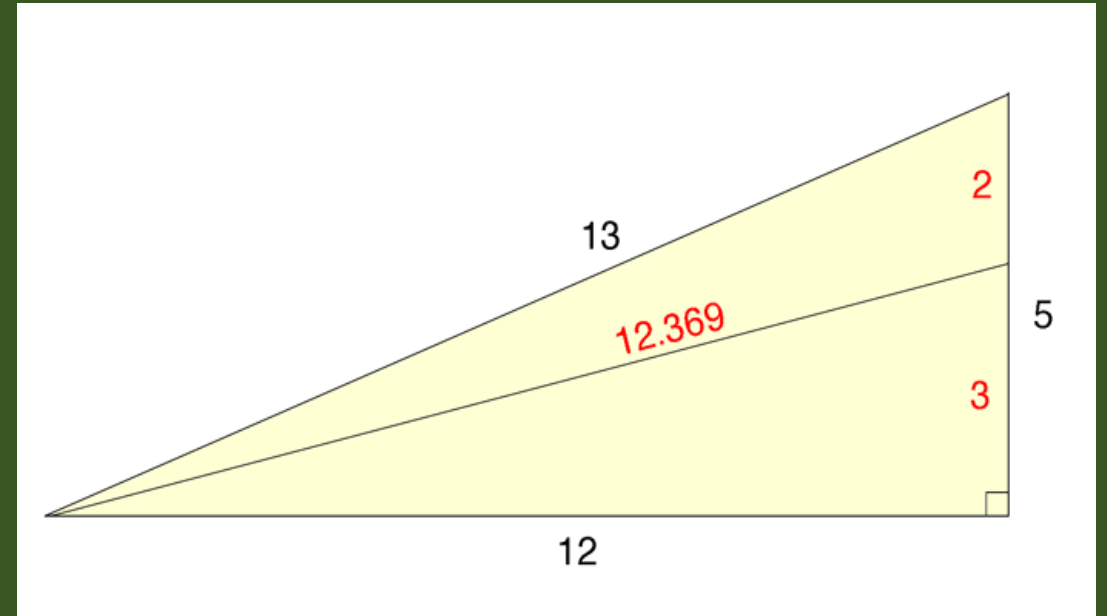


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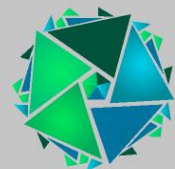
Golden Ratio

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%.



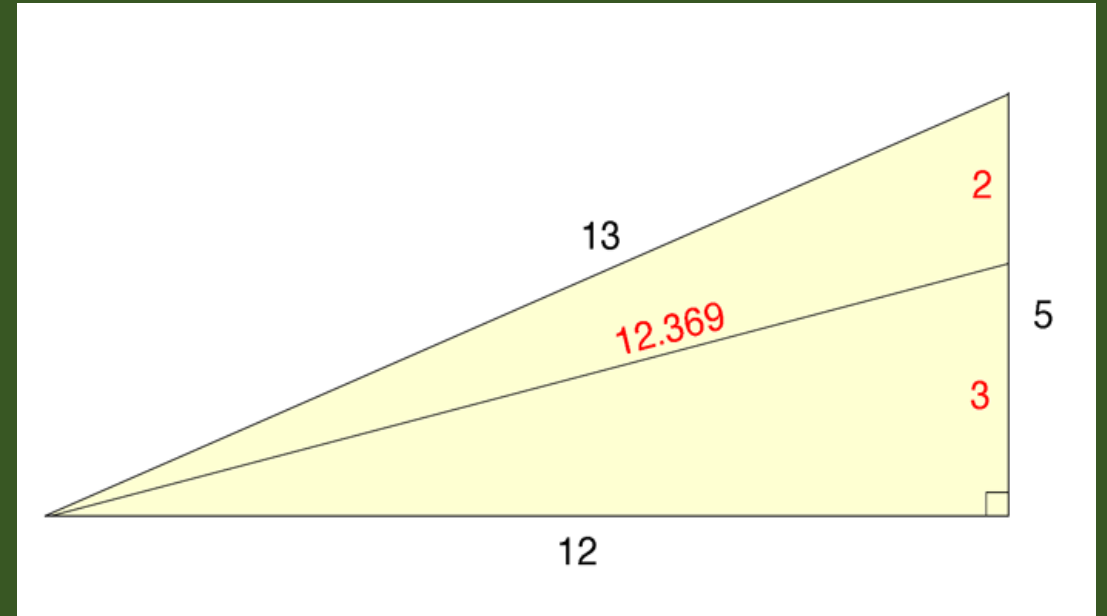
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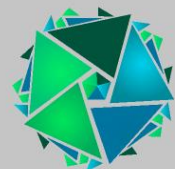
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Golden Ratio

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



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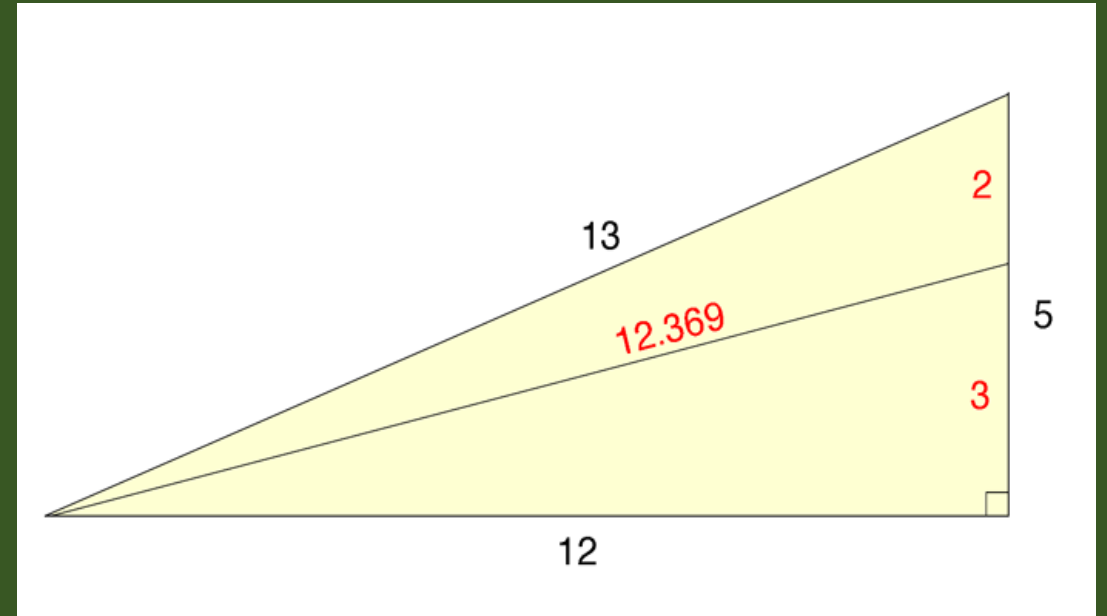


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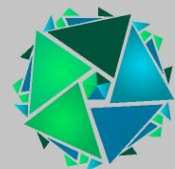
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There are many other Fibonacci based time and space values in astrophysics.

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



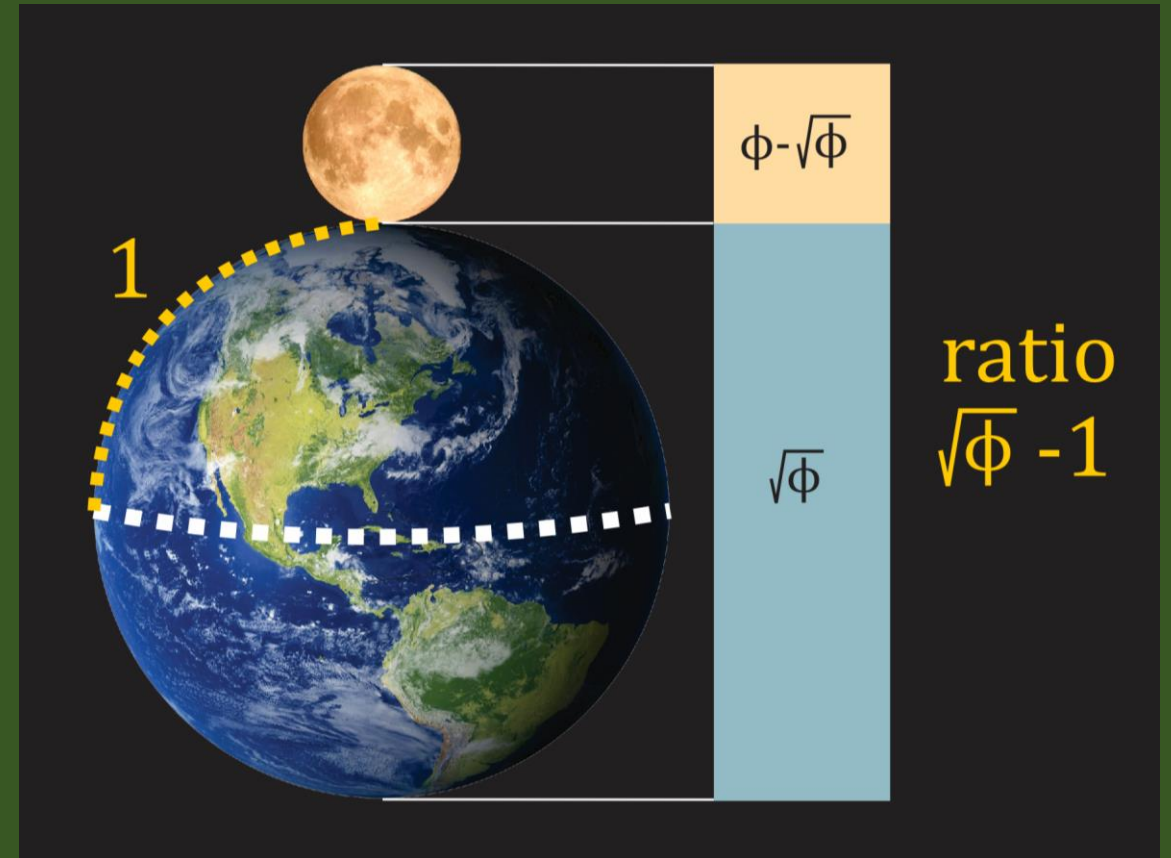
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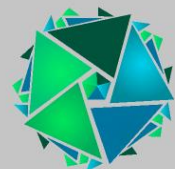
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GRAVITY RESEARCH

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.



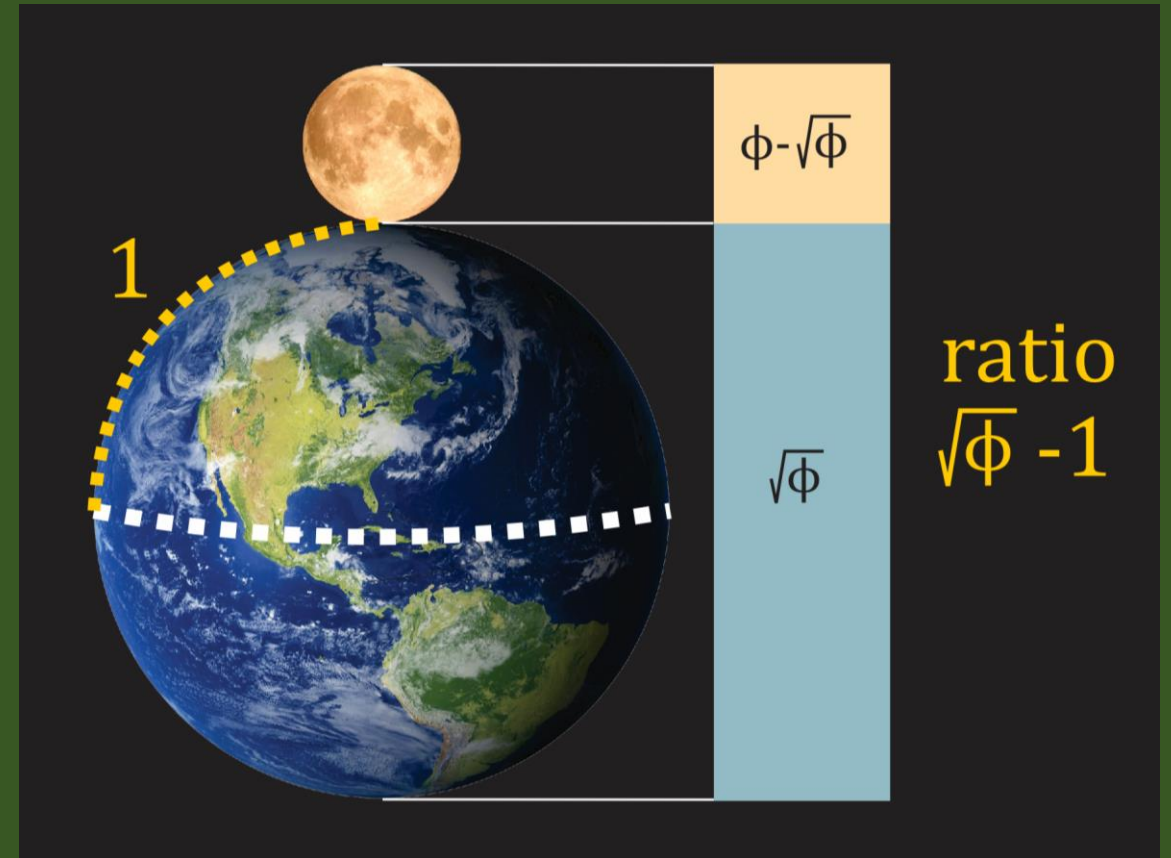
- Information
- Causality Loops
- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio



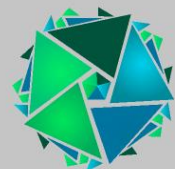
QUANTUM
GRAVITY RESEARCH

Golden Ratio

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



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

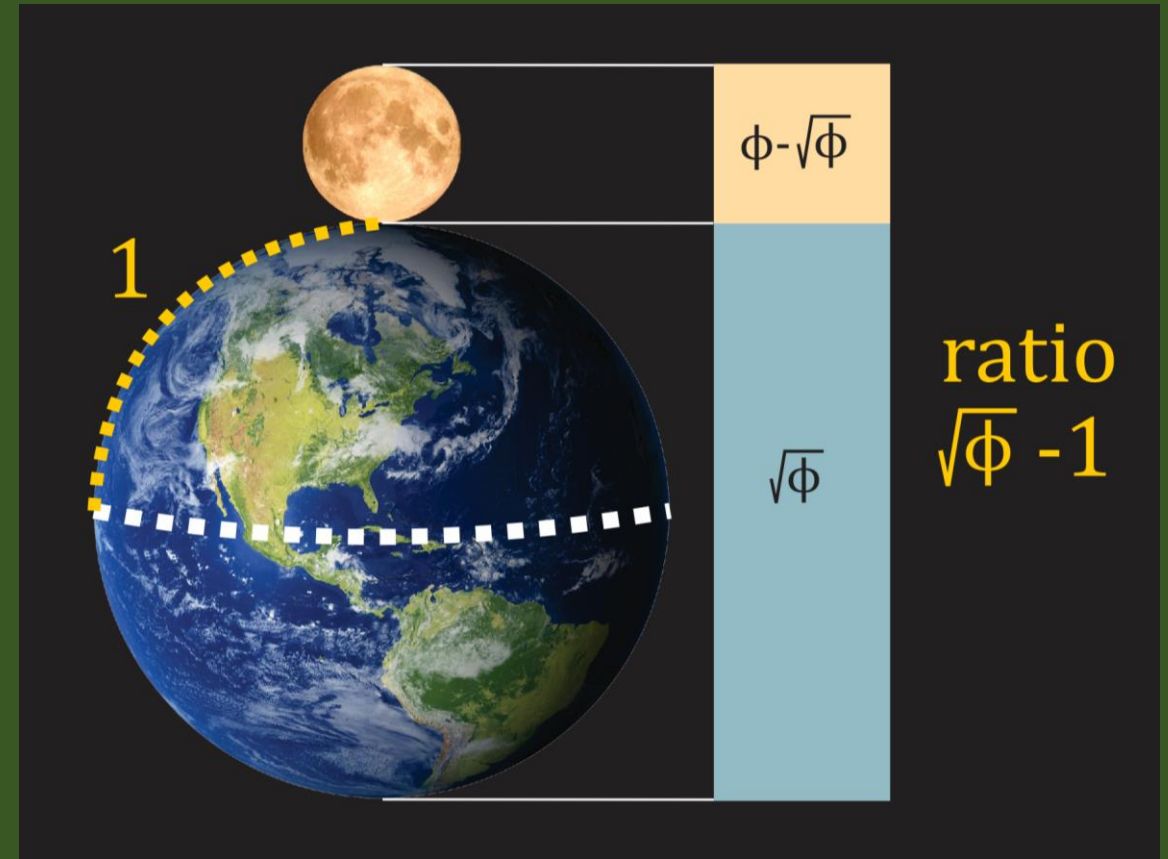


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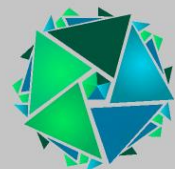
Golden Ratio

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.



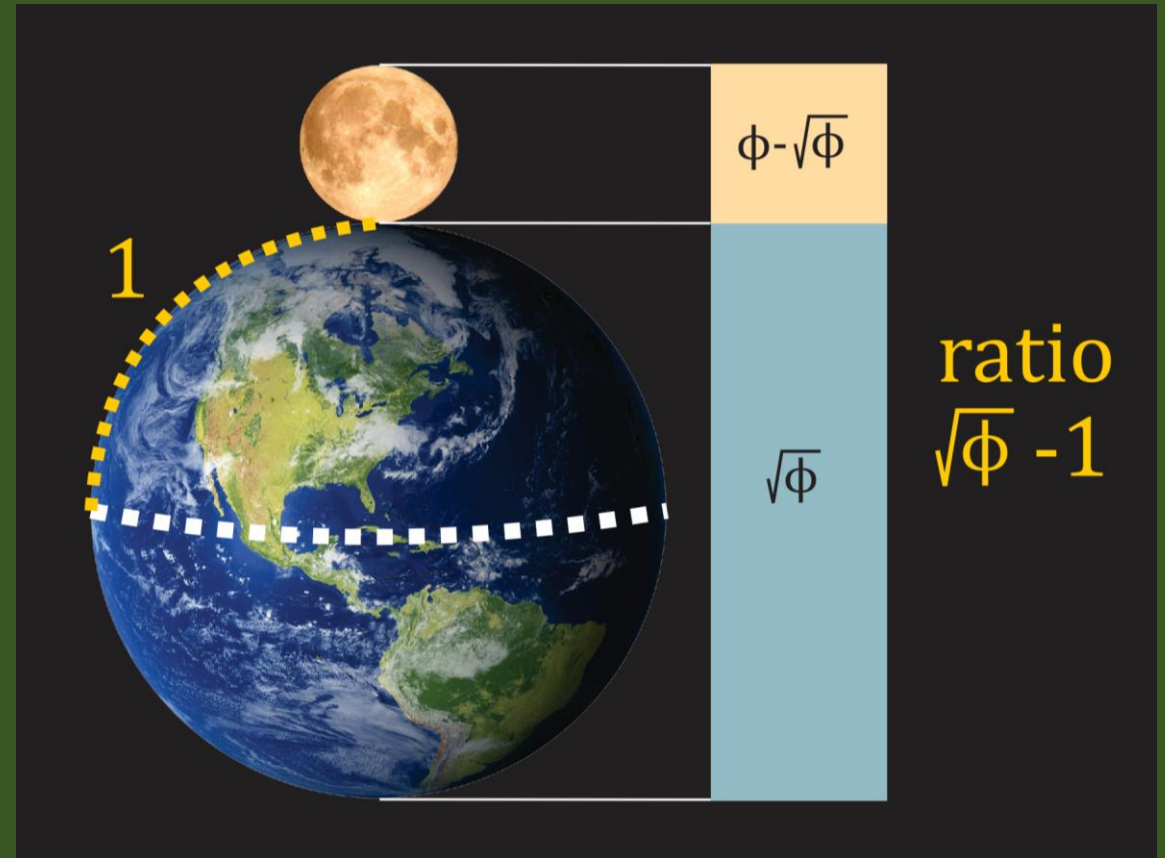
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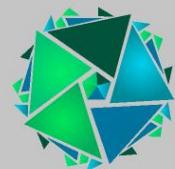
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Golden Ratio

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 $(F_3^5)(F_4^3)$.



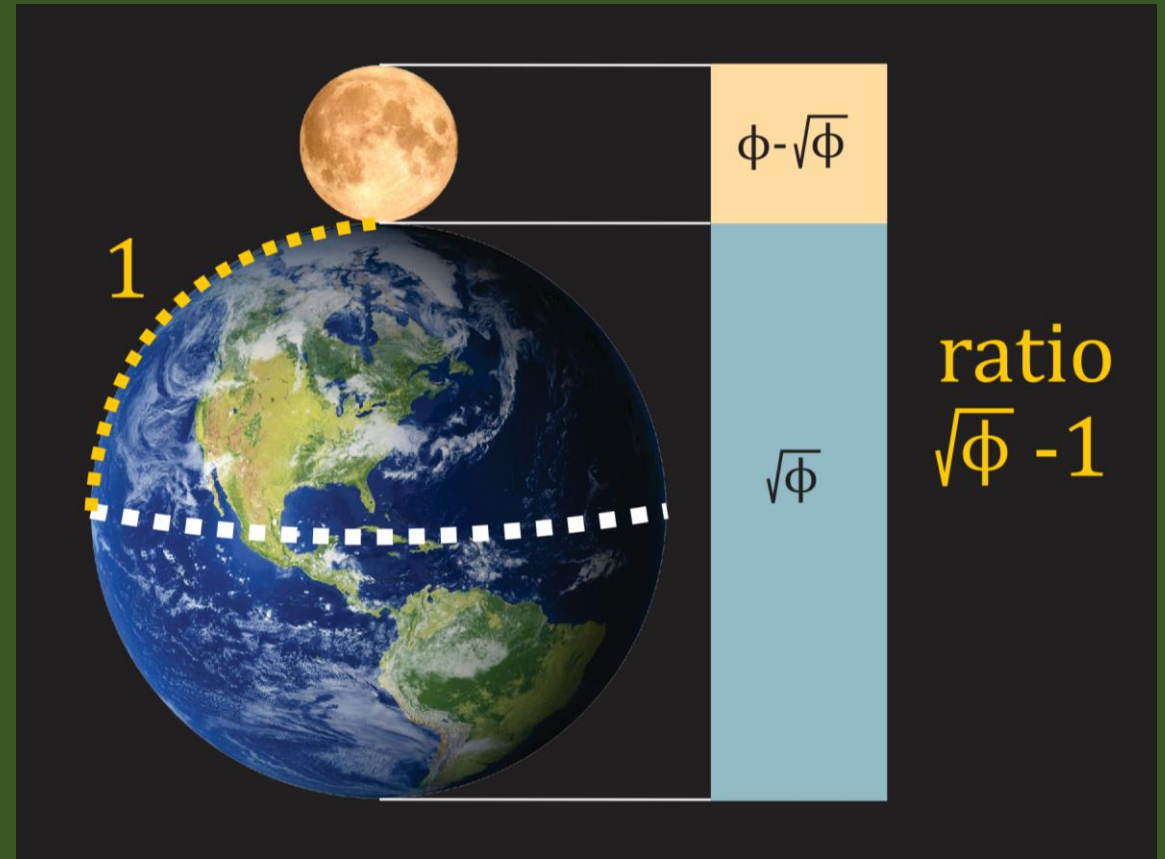
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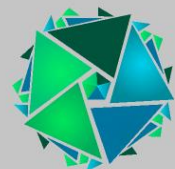
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Golden Ratio

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 .



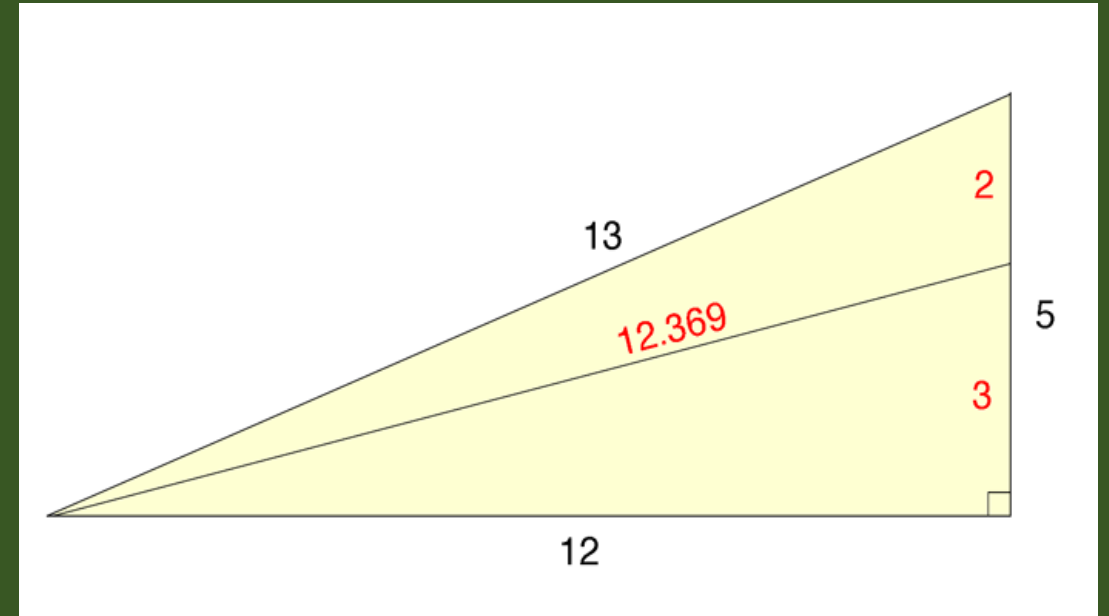
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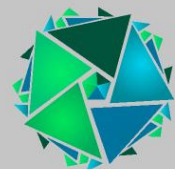
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Golden Ratio

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.



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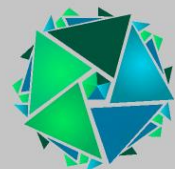


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Golden Ratio

$\phi = 99.9997\%$ of $= h\chi$ is interesting in light of our geometric first principles approach to fundamental physics on the *quasicrystalline spin network*.

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



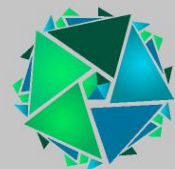
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GRAVITY RESEARCH

Golden Ratio

$\phi = 99.9997\%$ of $= h\chi$ 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.

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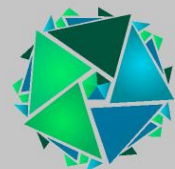


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Golden Ratio

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

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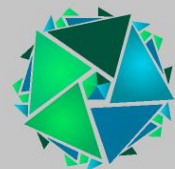
QUANTUM
GRAVITY RESEARCH

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 α .

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



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Golden Ratio

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



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 the most important dimensionless value is the fine structure constant α .

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



QUANTUM
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Golden Ratio

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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 the most important dimensionless value is the fine structure constant α .

And $l_p = 99.9\%$ of ϕ if the metric system is used.

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



QUANTUM
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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 α .



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

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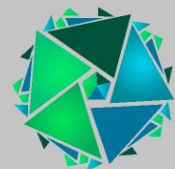
Golden Ratio

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 4th place after the decimal.

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.

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



QUANTUM
GRAVITY RESEARCH

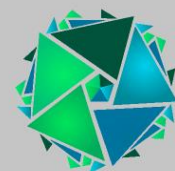
Golden Ratio

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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Watt balance	6.62606889(23)
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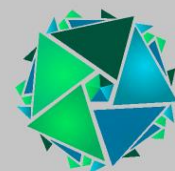
Golden Ratio

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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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 ϕ .

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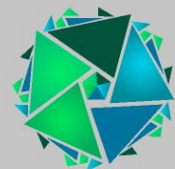
Golden Ratio

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.

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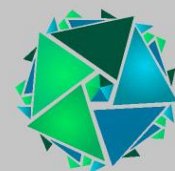
Golden Ratio

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} J·s)
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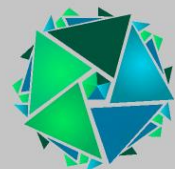
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Golden Ratio

75% of the universe is made of hydrogen.



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



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Golden Ratio

75% of the universe is made of hydrogen.

And the basis of all atomic theory can be derived from its values.



- Information
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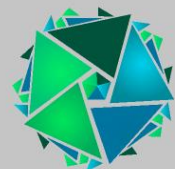
Golden Ratio

Based on work done by C. H. Suresh and N. Koga in 2001, Raji Heyrovska showed the atomic radius of Hydrogen in methane to be the Bohr radius over the golden ratio.

$$r_H = \frac{a_0}{\phi}$$



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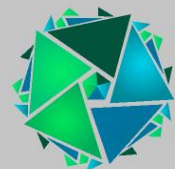
Golden Ratio

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

$$\phi^{-5}$$



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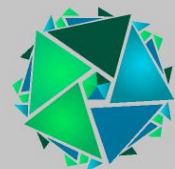
Golden Ratio

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

$$\phi^{-5}$$



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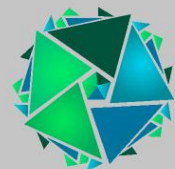
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Golden Ratio

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



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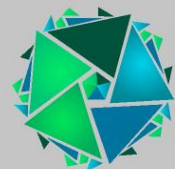
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Golden Ratio

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



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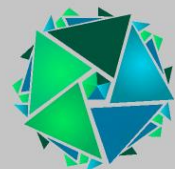
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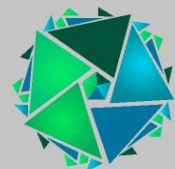
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Golden Ratio

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



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



QUANTUM
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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
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- Golden Ratio



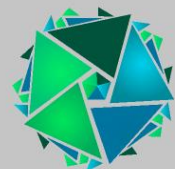
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Key to the Puzzle

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.



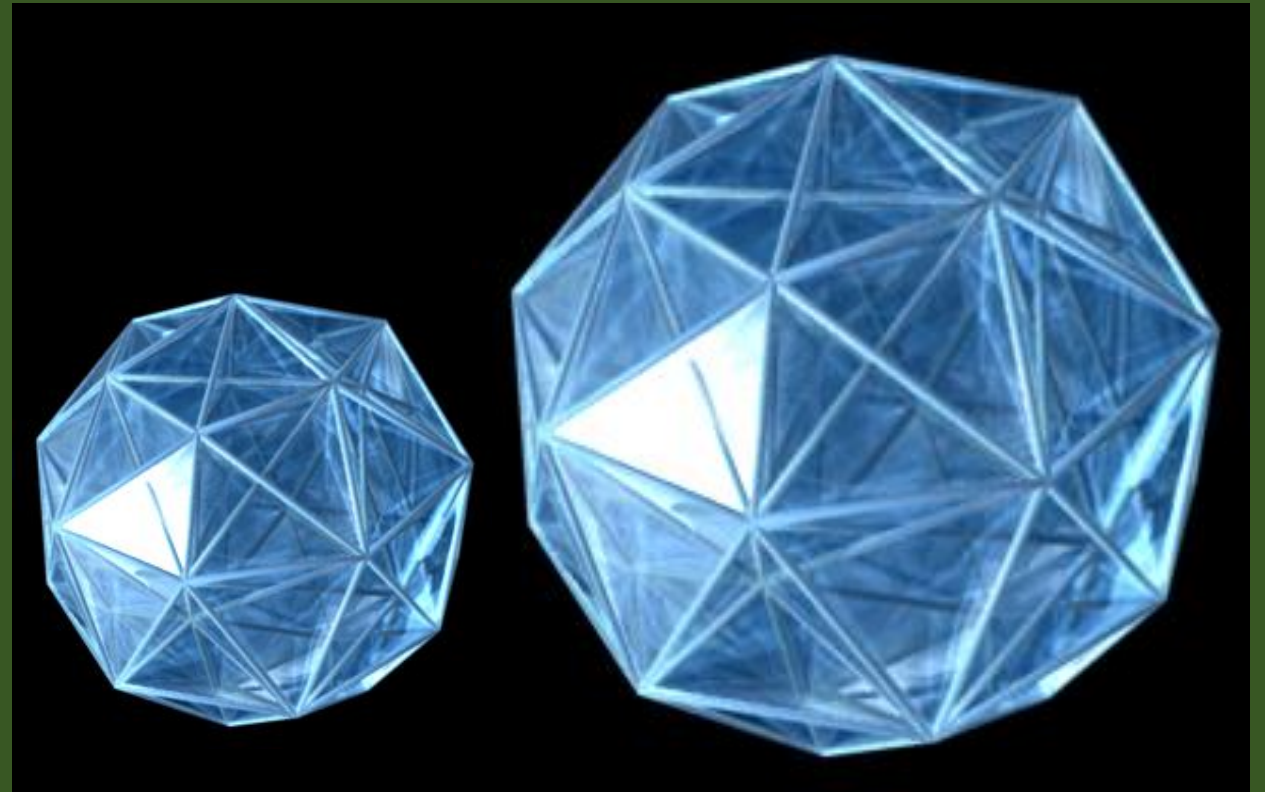
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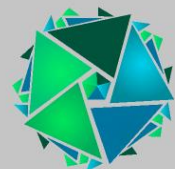
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Key to the Puzzle

The cell shape of E8 that best represents it is the Gosset polytope with 240 vertices.



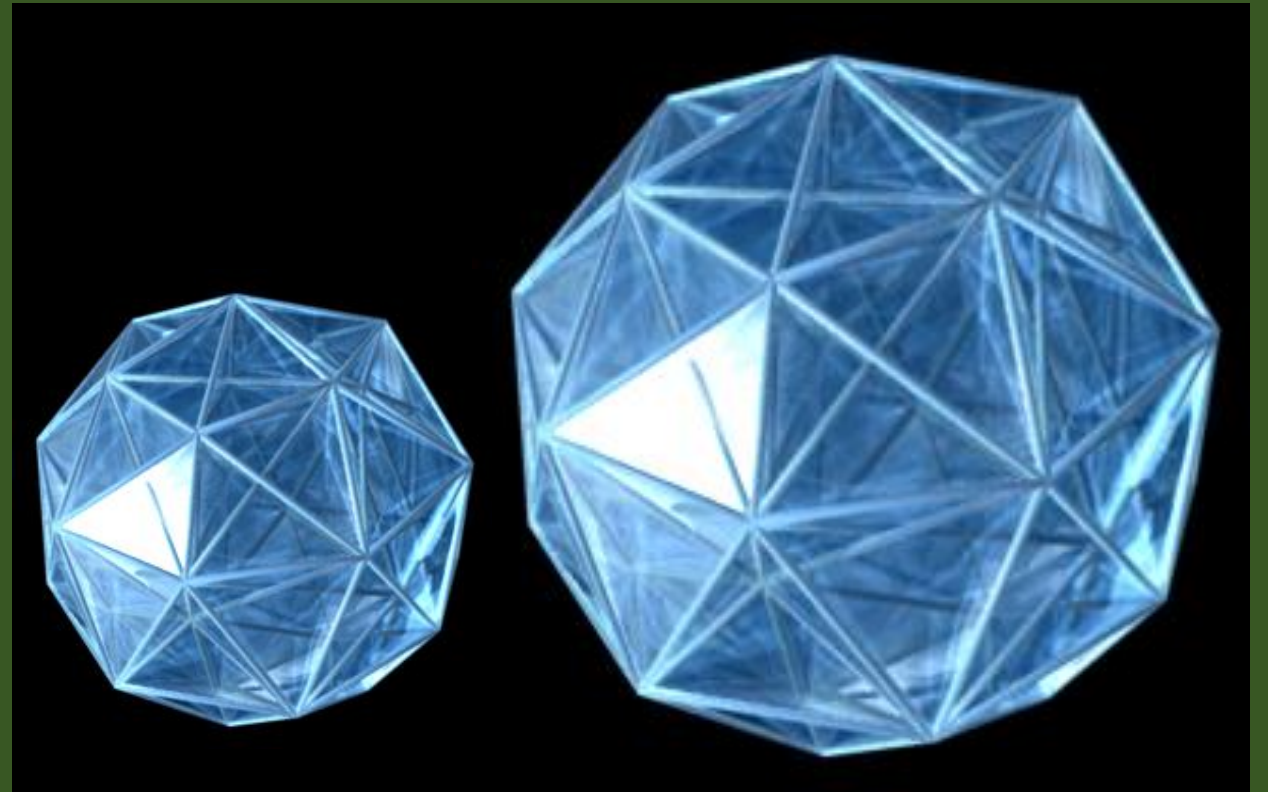
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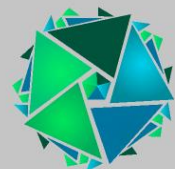
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Key to the Puzzle

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



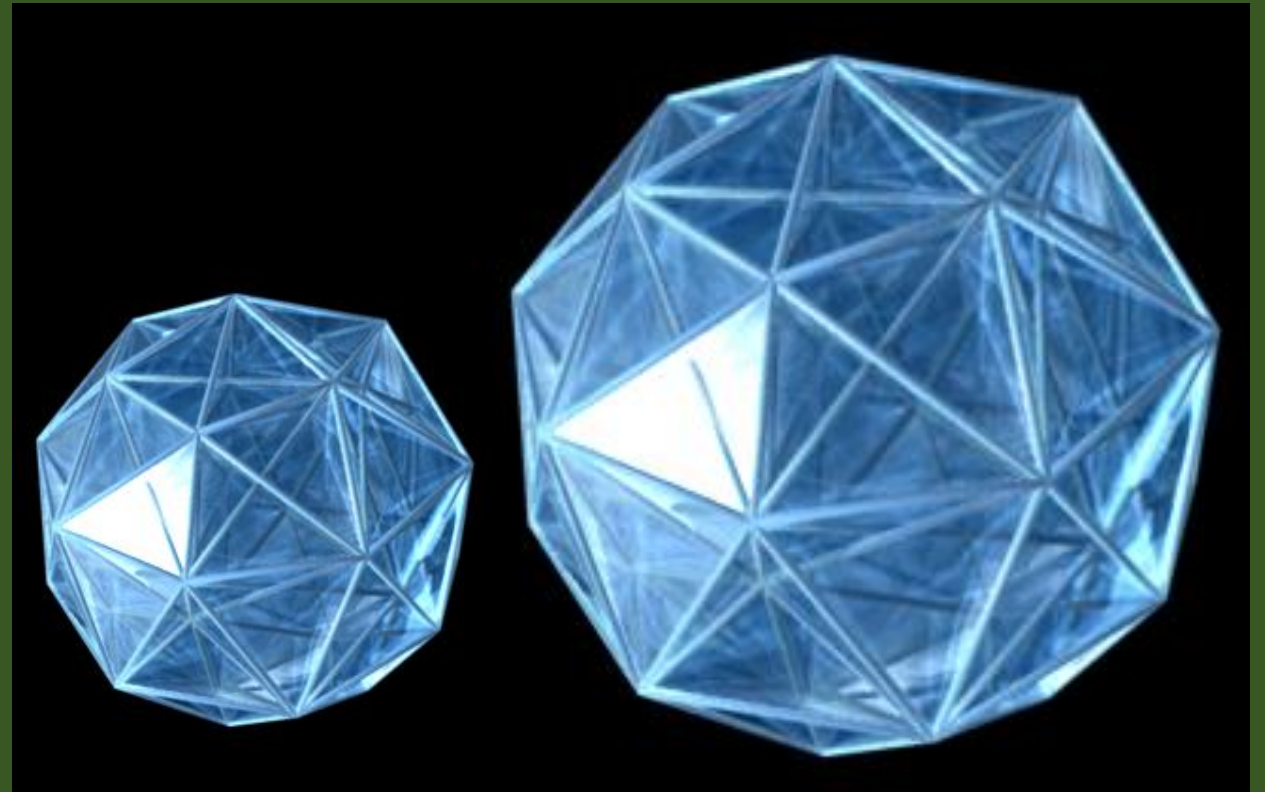
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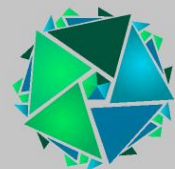
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Key to the Puzzle

The ratio of their sizes is:



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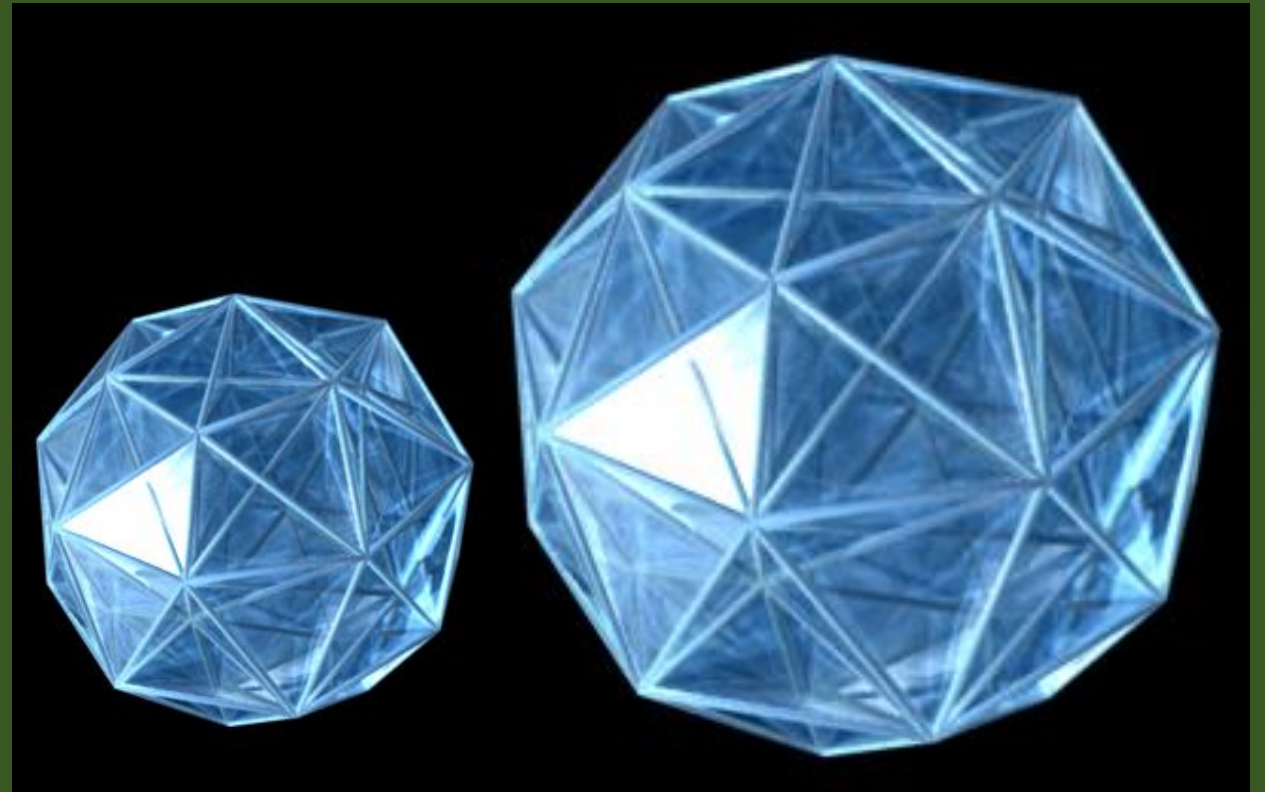


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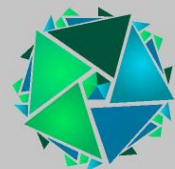
Key to the Puzzle

The ratio of their sizes is:

ϕ



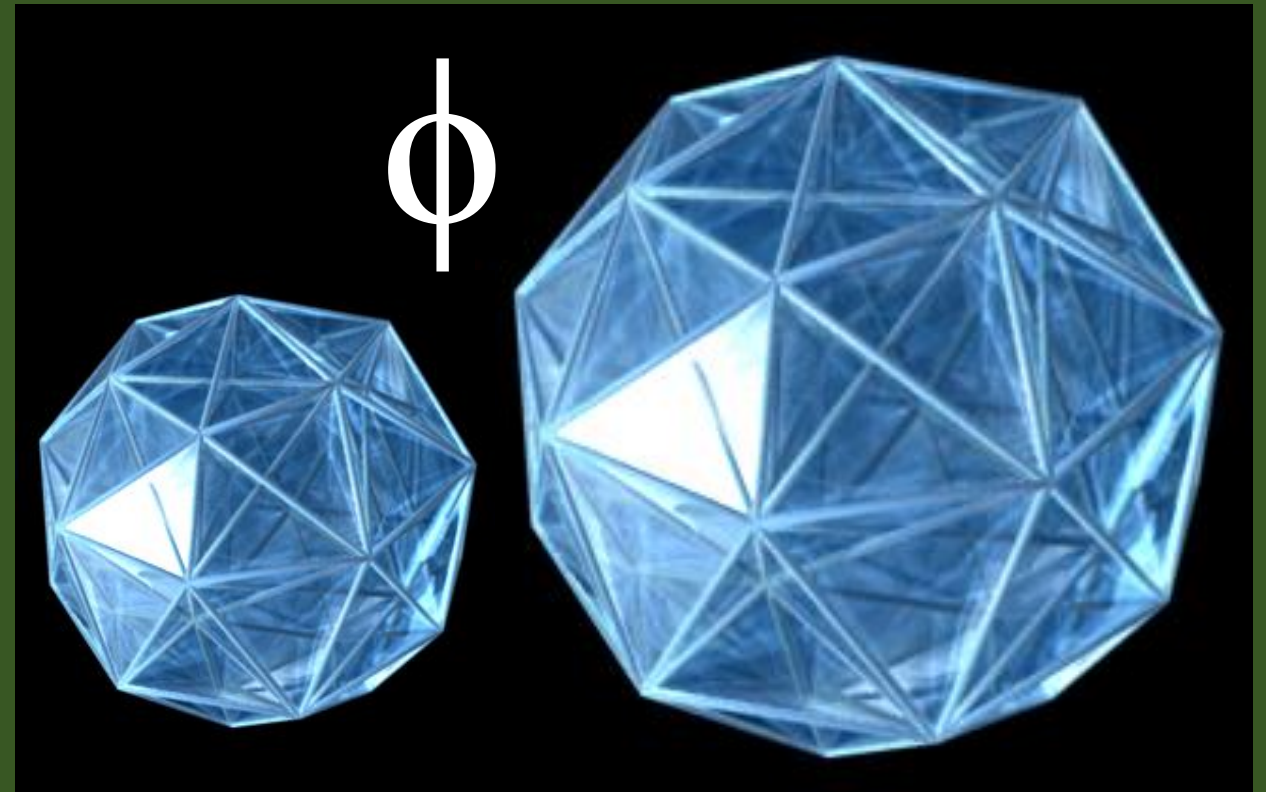
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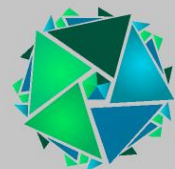
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Key to the Puzzle

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



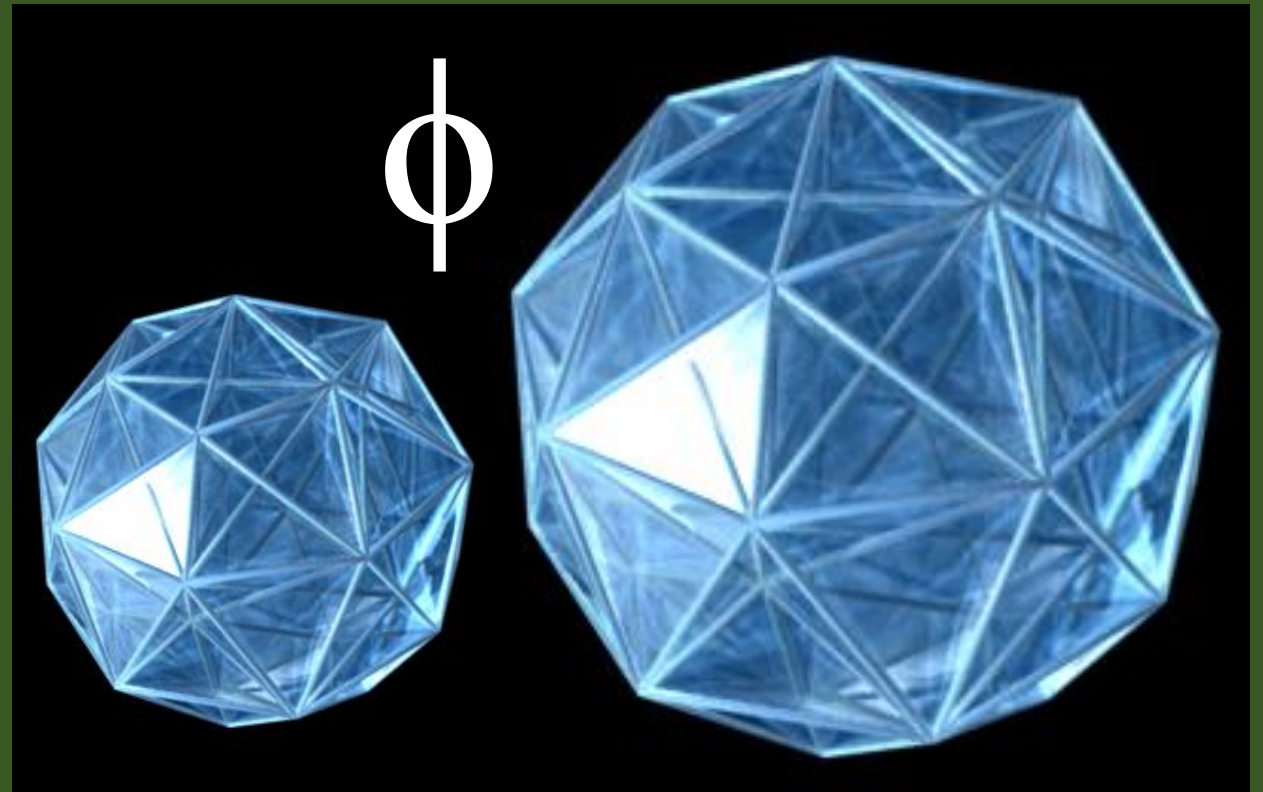
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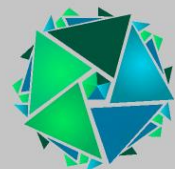
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Key to the Puzzle

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*.



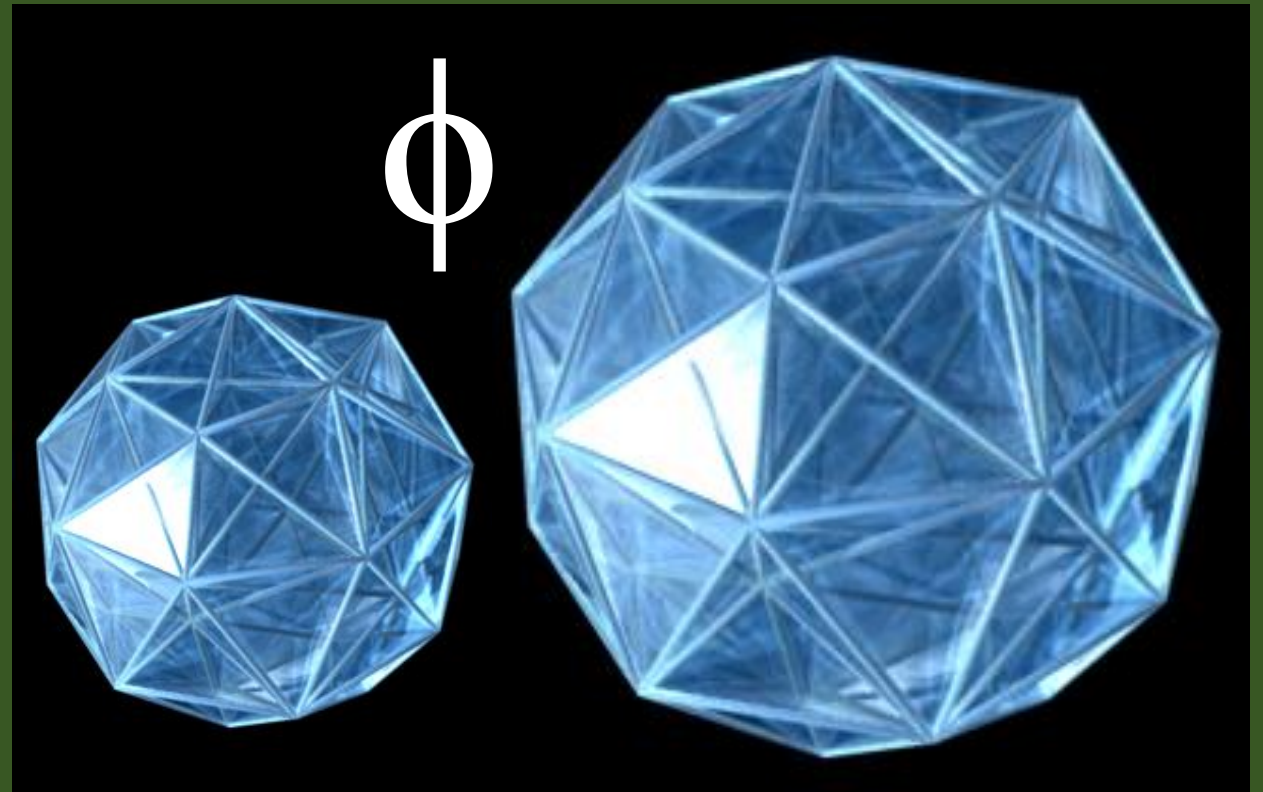
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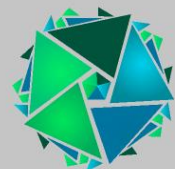
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Key to the Puzzle

A quasicrystal is a code or language.



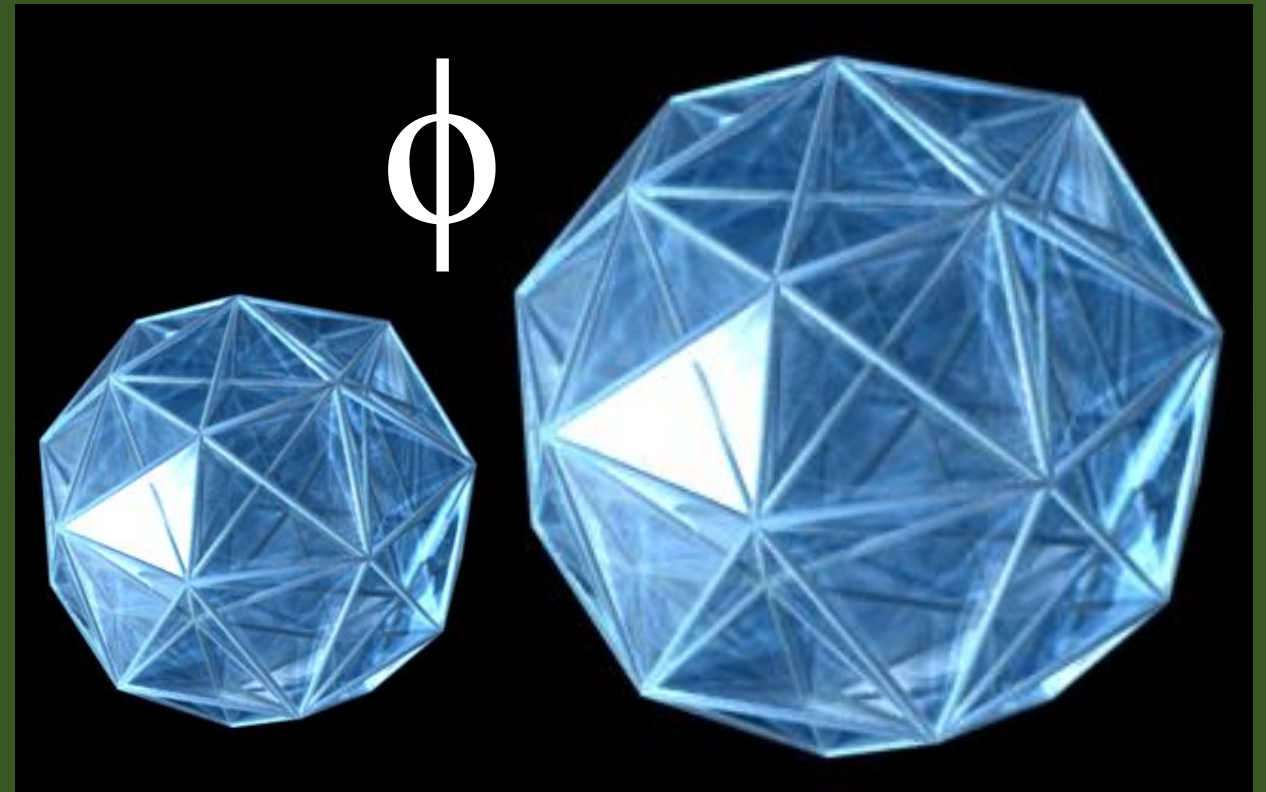
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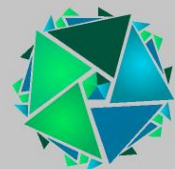
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Key to the Puzzle

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



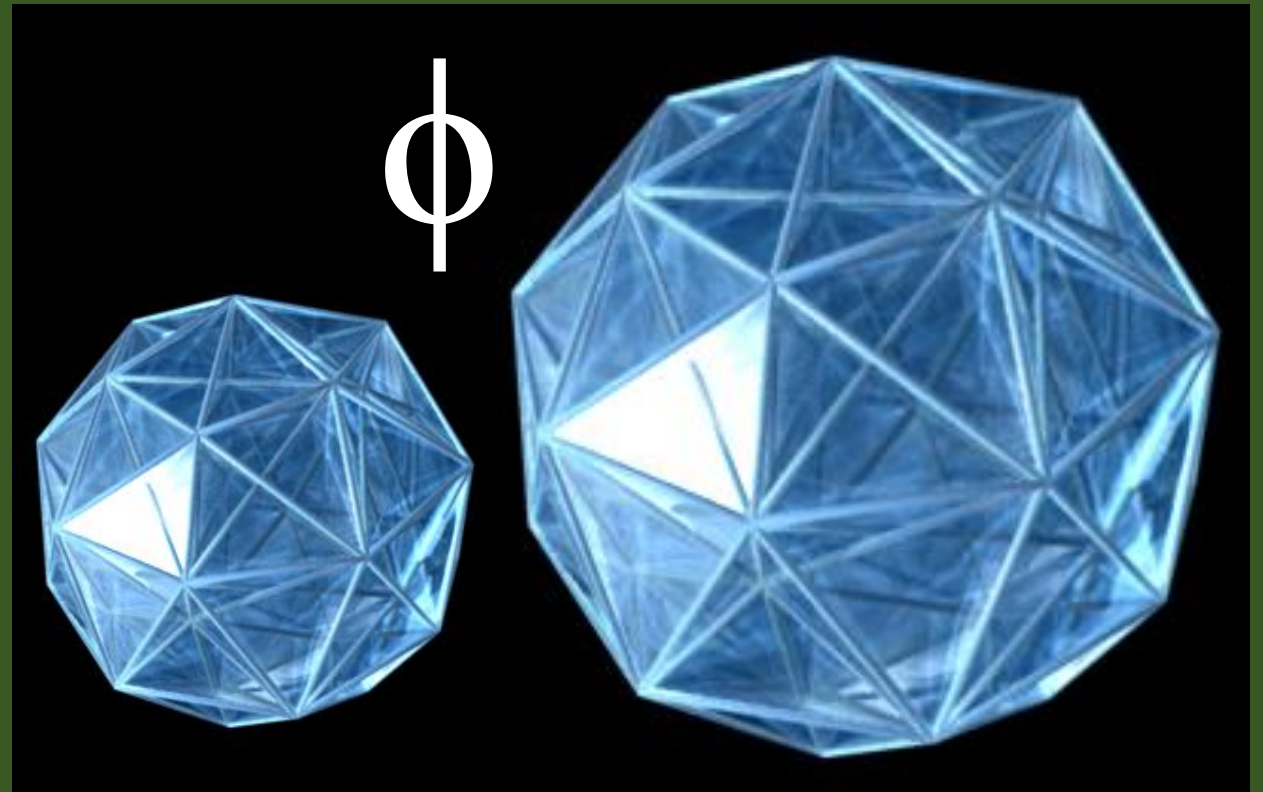
- Information
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- Non-determinism
- Consciousness
- Pixelation
- E8 Crystal
- Golden Ratio



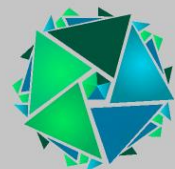
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Key to the Puzzle

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



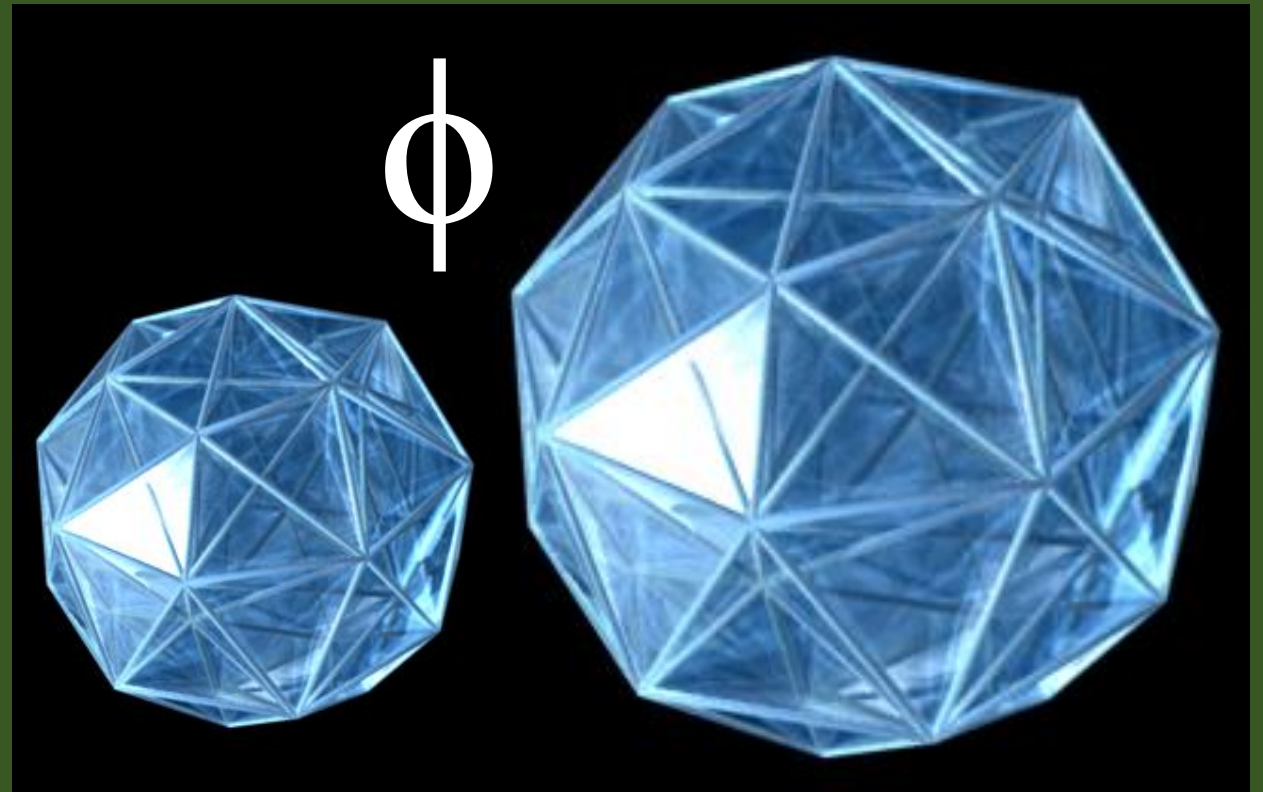
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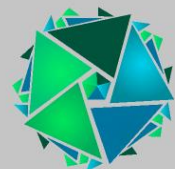
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Key to the Puzzle

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.



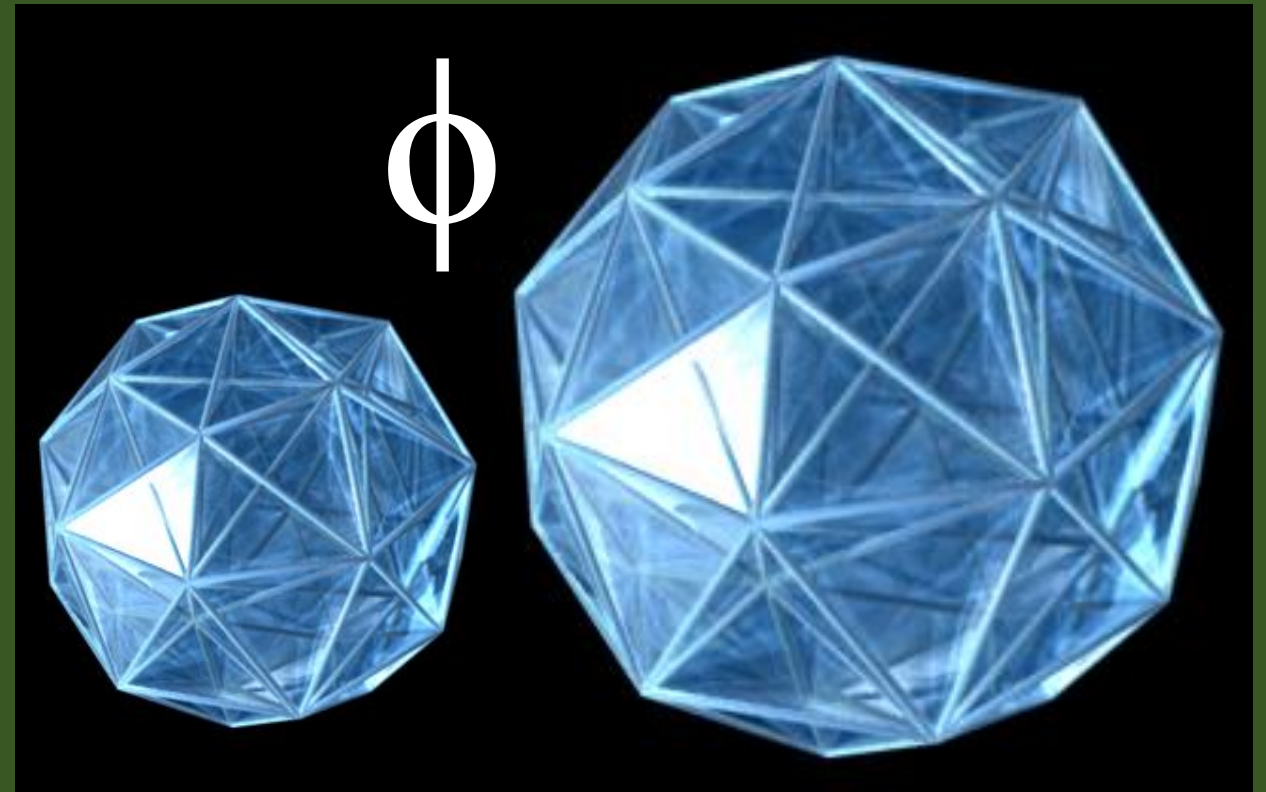
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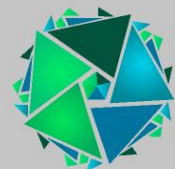
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Key to the Puzzle

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



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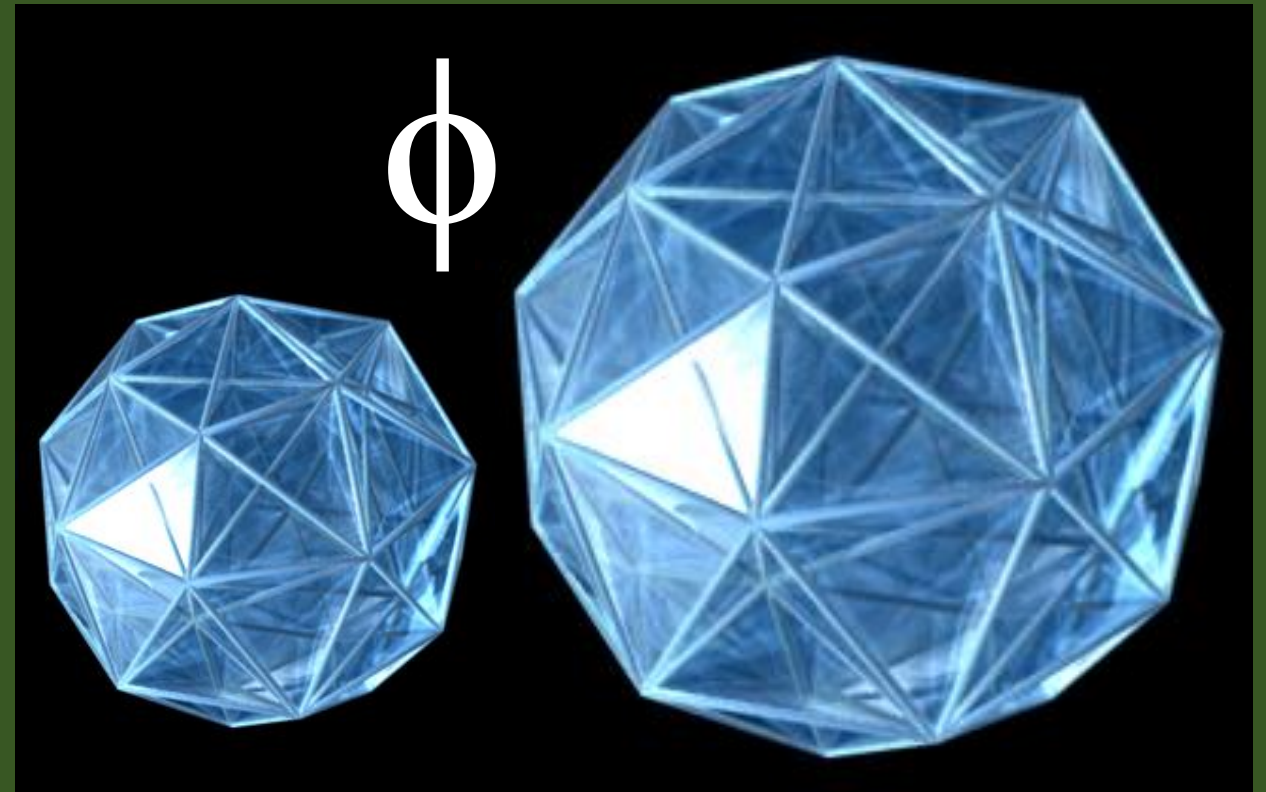


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Key to the Puzzle

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

...specifically it is a language of waves or vibrations.



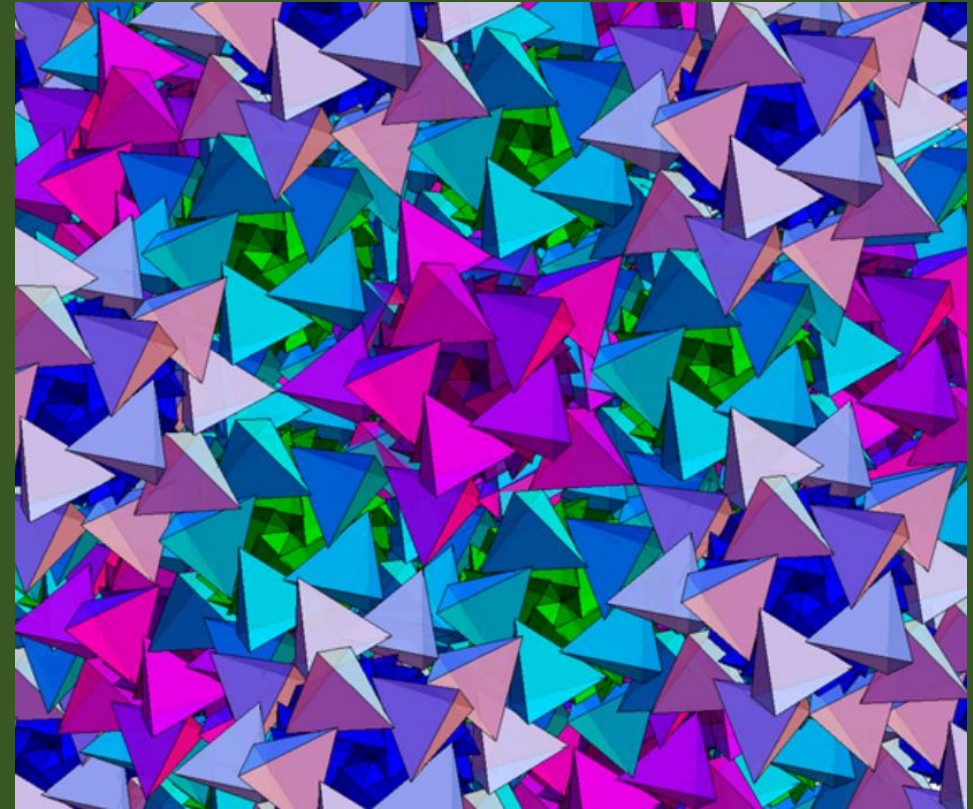
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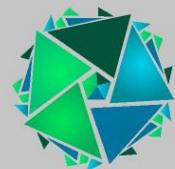
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Key to the Puzzle

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



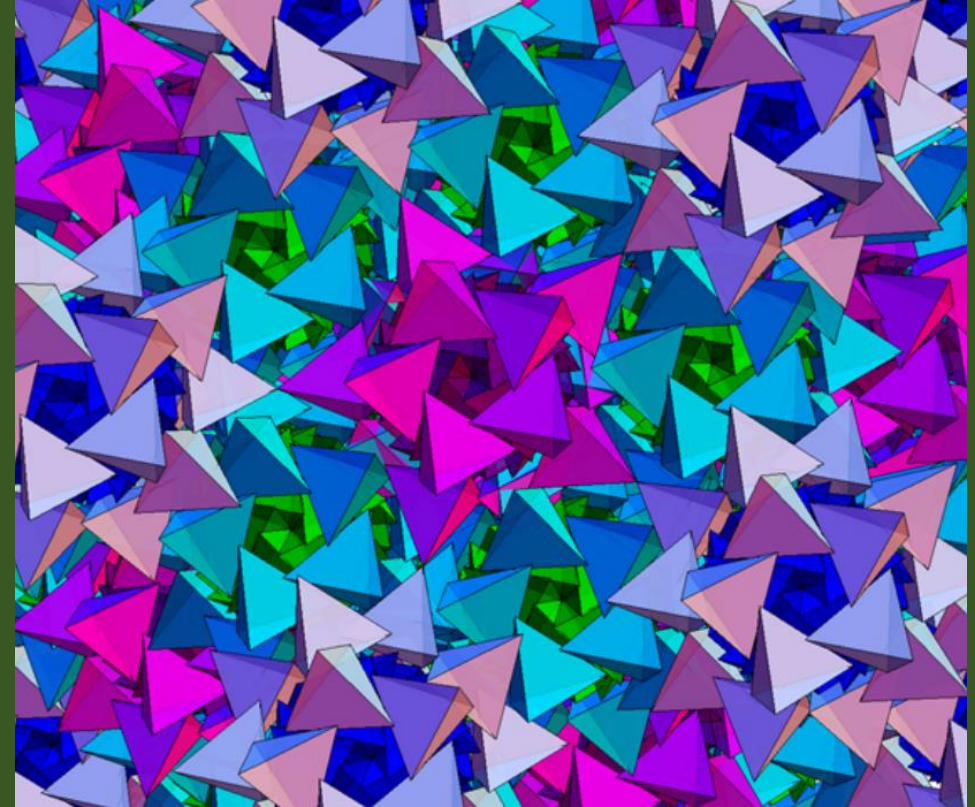
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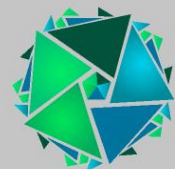
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Key to the Puzzle

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.



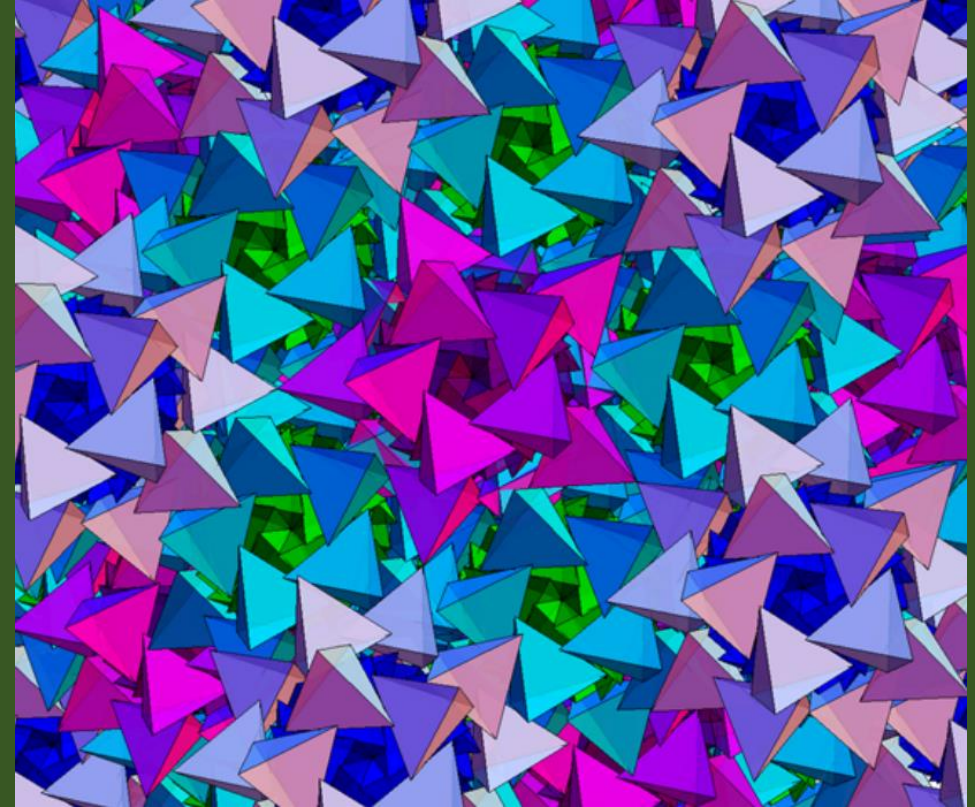
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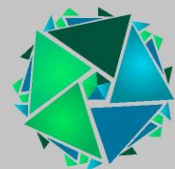
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Key to the Puzzle

Over many quasicrystal frames, dynamic wave and particle-like patterns emerge.



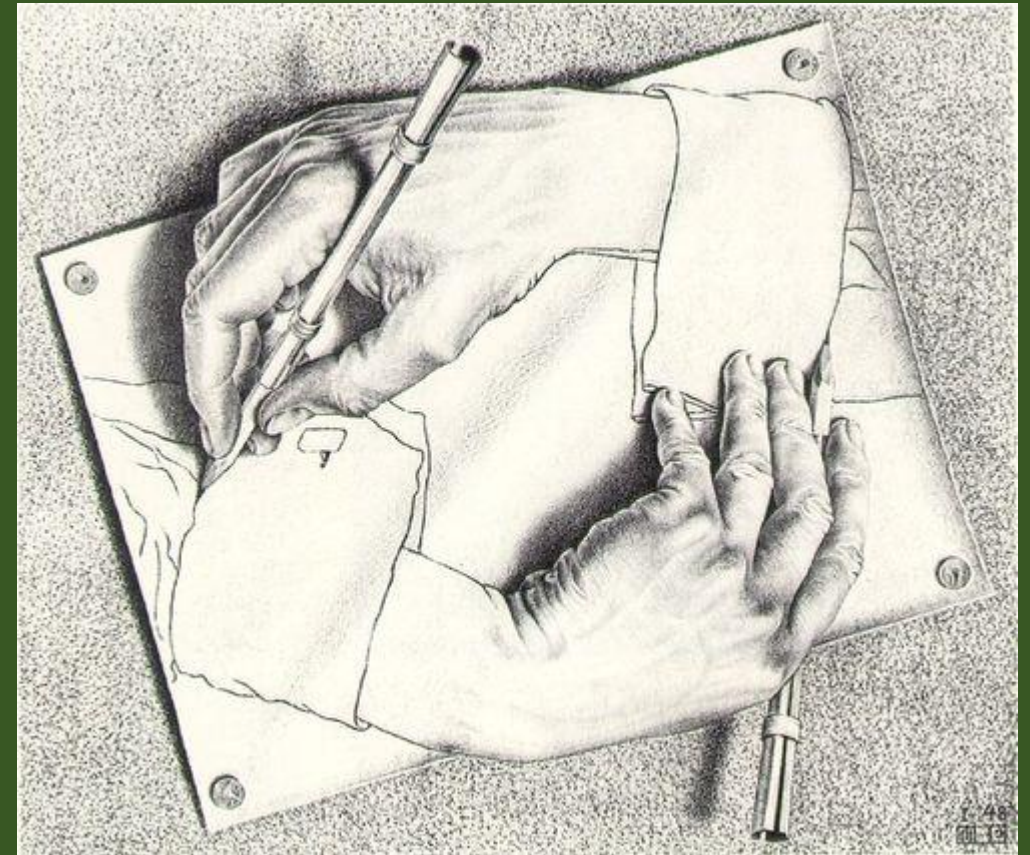
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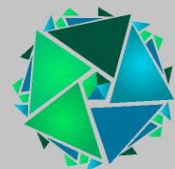
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Key to the Puzzle

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



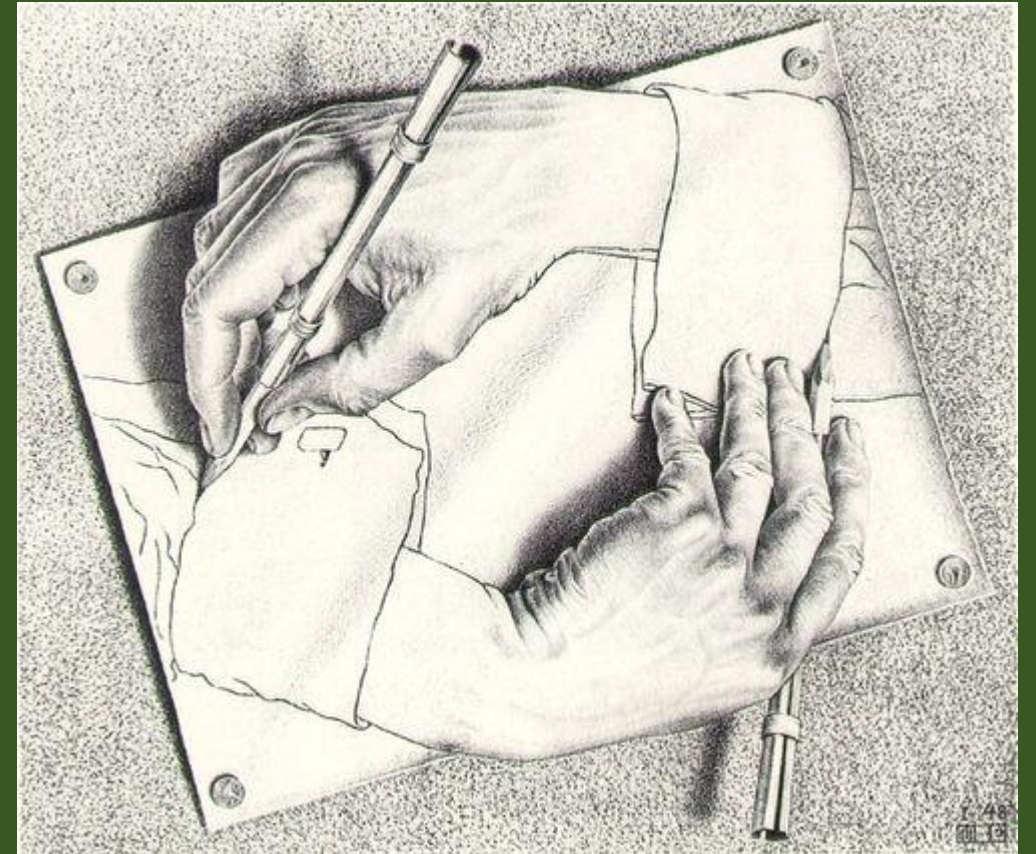
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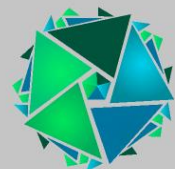
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Key to the Puzzle

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



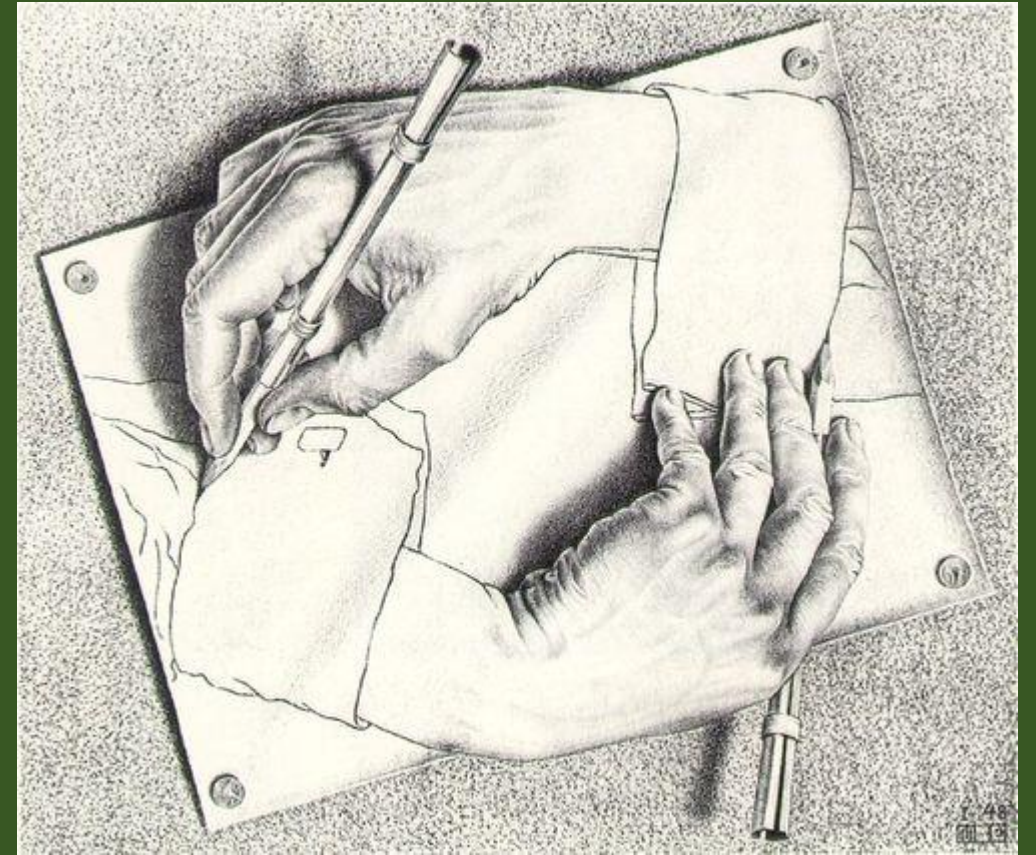
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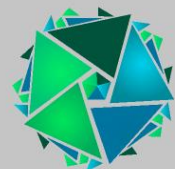
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Key to the Puzzle

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



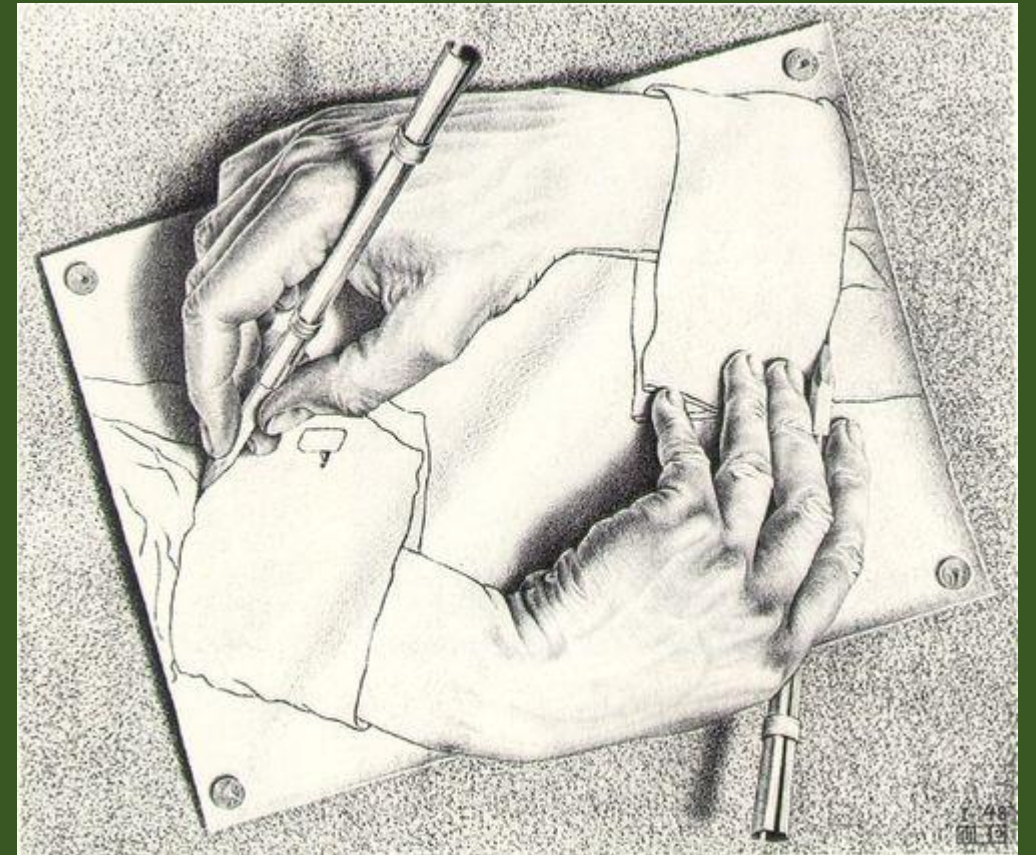
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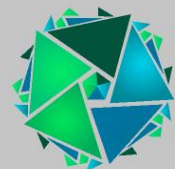
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Key to the Puzzle

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



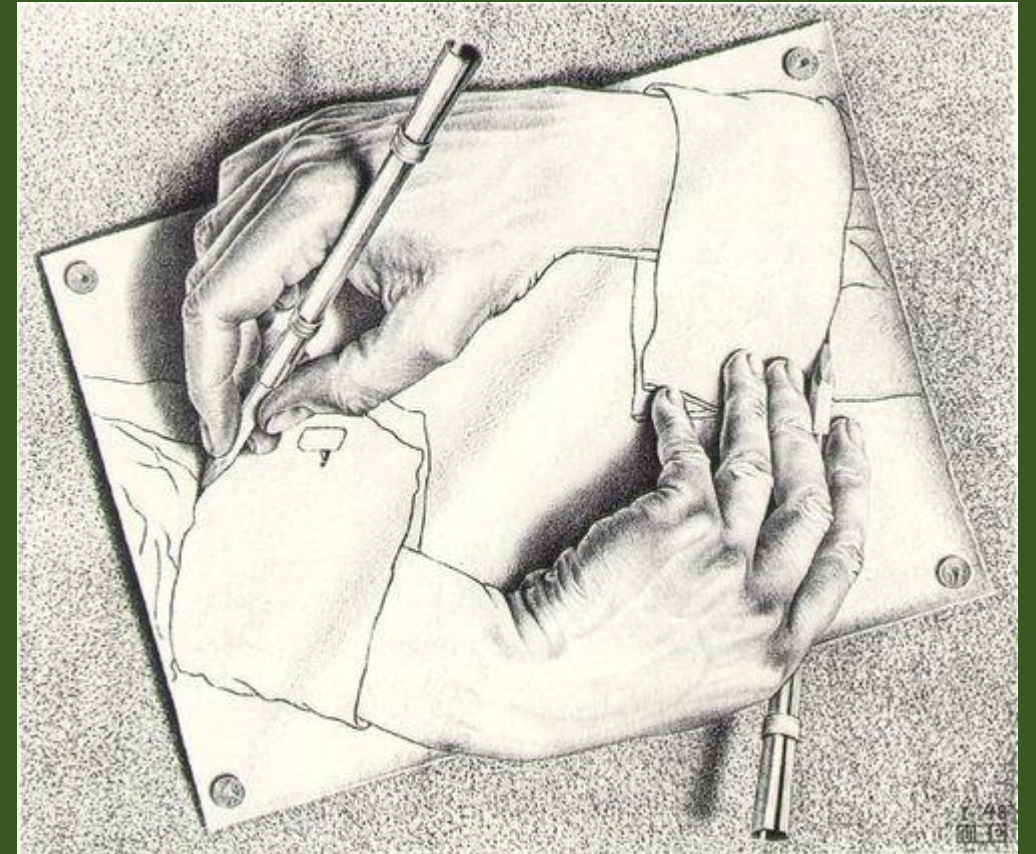
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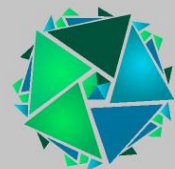
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Key to the Puzzle

And again, randomness does not generate meaning in languages.



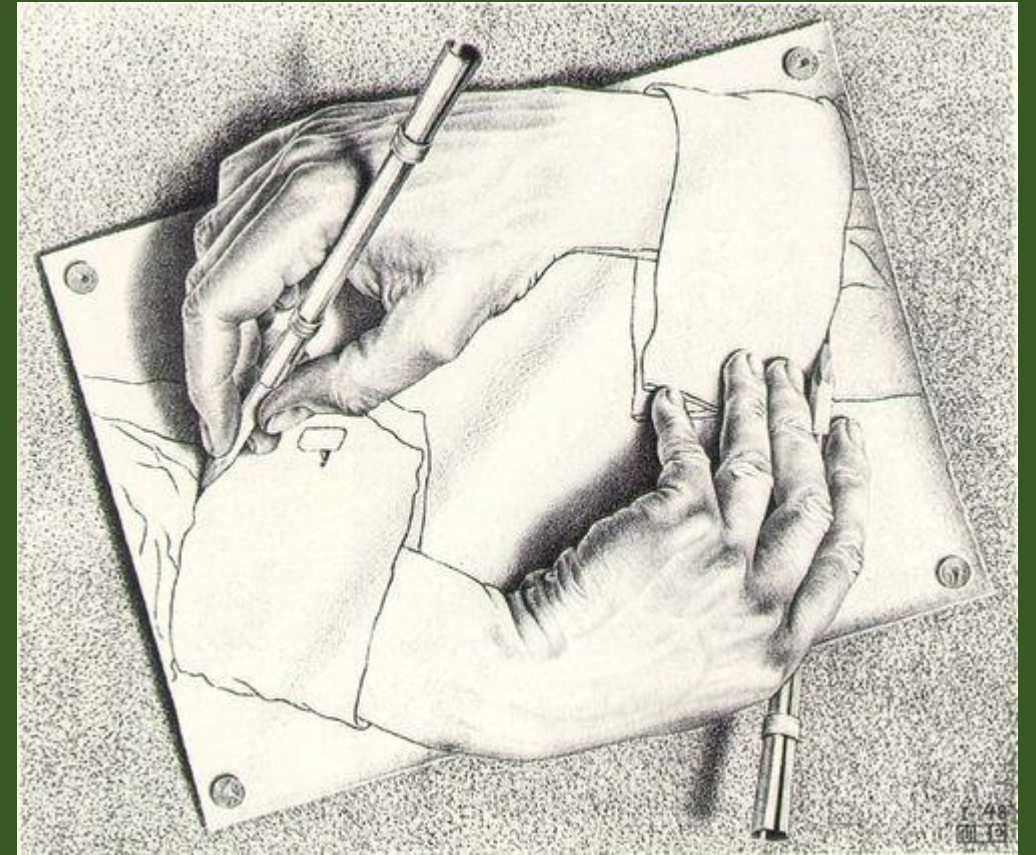
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Key to the Puzzle

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



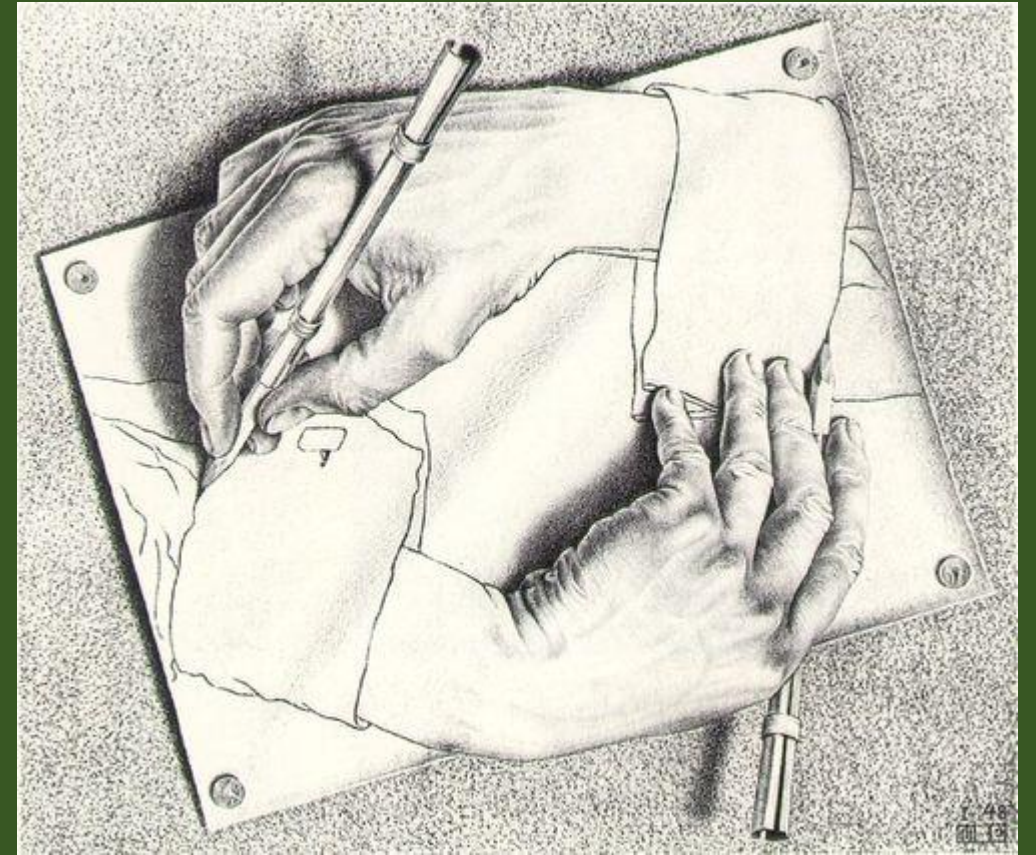
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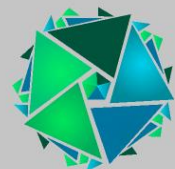
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Key to the Puzzle

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?



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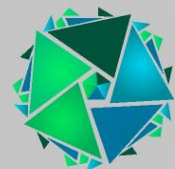
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Key to the Puzzle

A universal collective consciousness could be the answer.



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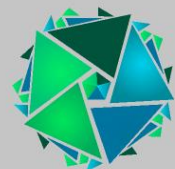
Key to the Puzzle

A universal collective consciousness could be the answer.

But that sounds New Age and religious.



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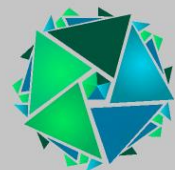
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Key to the Puzzle

And besides, how could such a thing emerge from a universe made of information?



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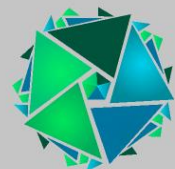
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Key to the Puzzle

And how would the information emerge in the first place?



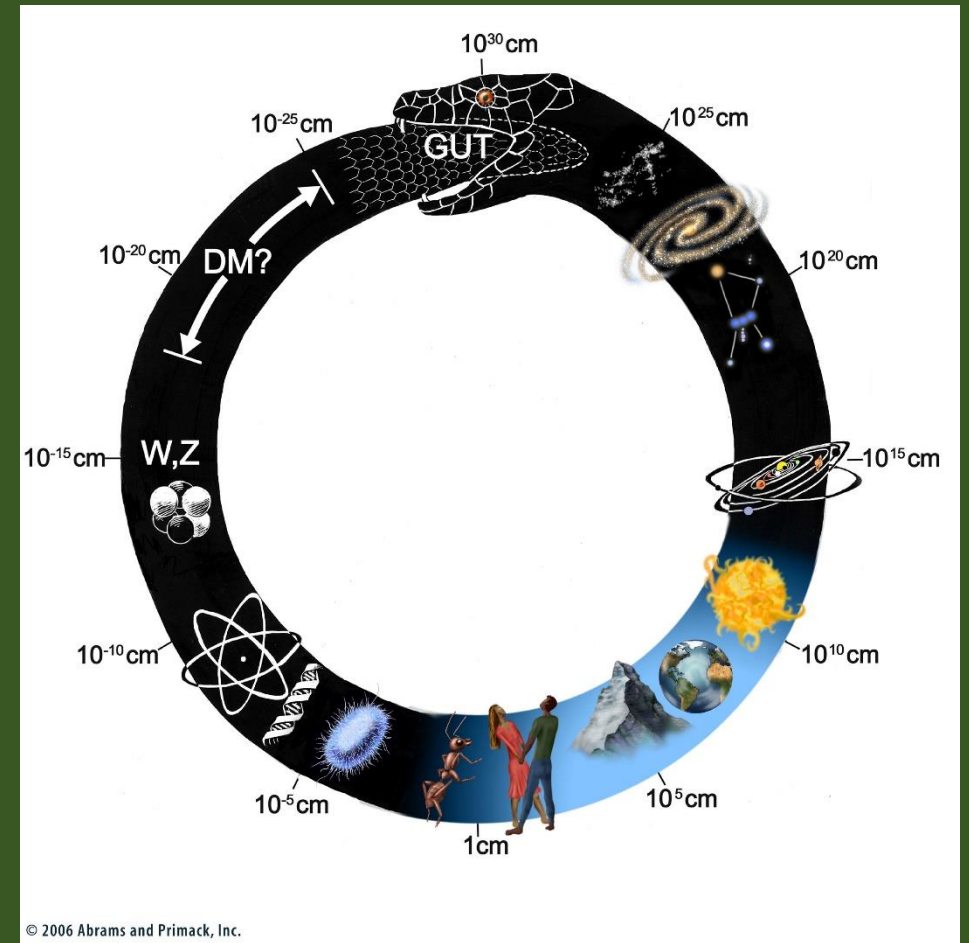
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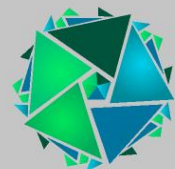
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Key to the Puzzle

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



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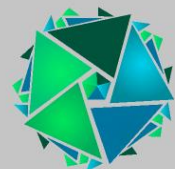
Key to the Puzzle

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

...where small and simple things self-organize into larger emergent things.



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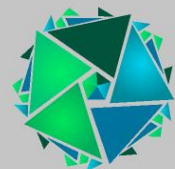
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Key to the Puzzle

Our consciousness is an extreme example of emergence via self-organization.



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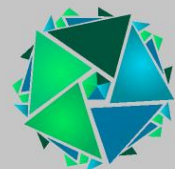
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Key to the Puzzle

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.



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Key to the Puzzle

Networks harness the mathematical power of exponential connectivity and growth.



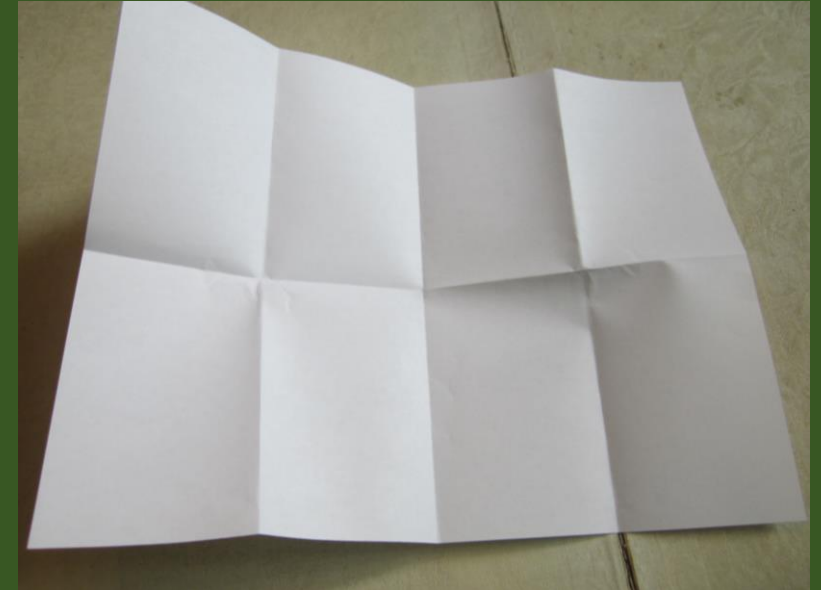
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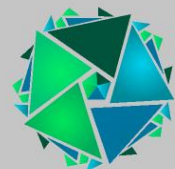
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Key to the Puzzle

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



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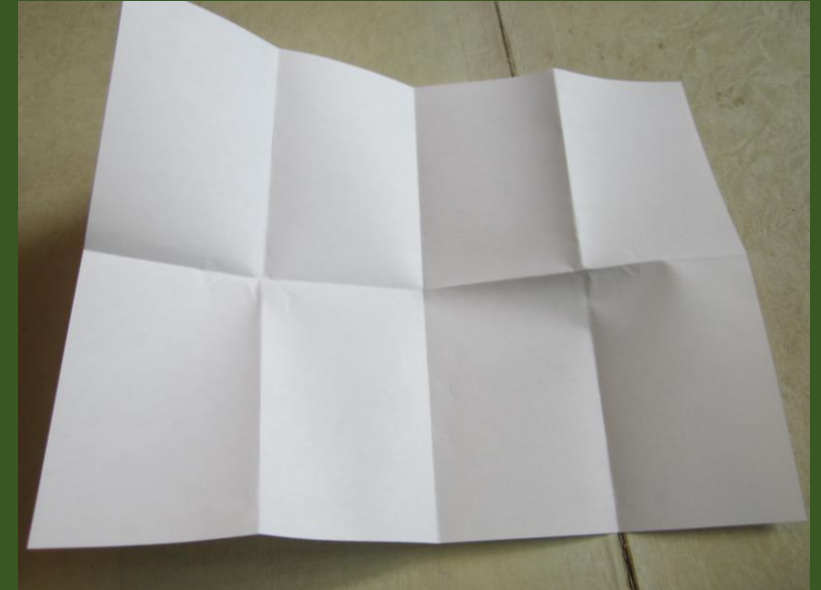


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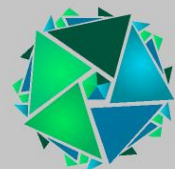
Key to the Puzzle

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

It's still just a few millimeters thick.



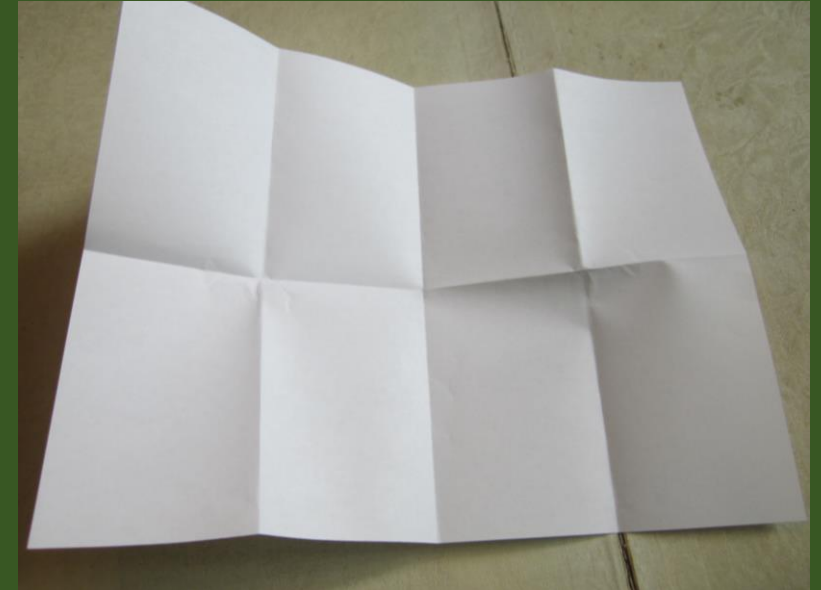
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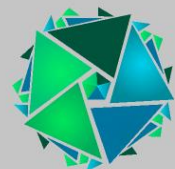
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Key to the Puzzle

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



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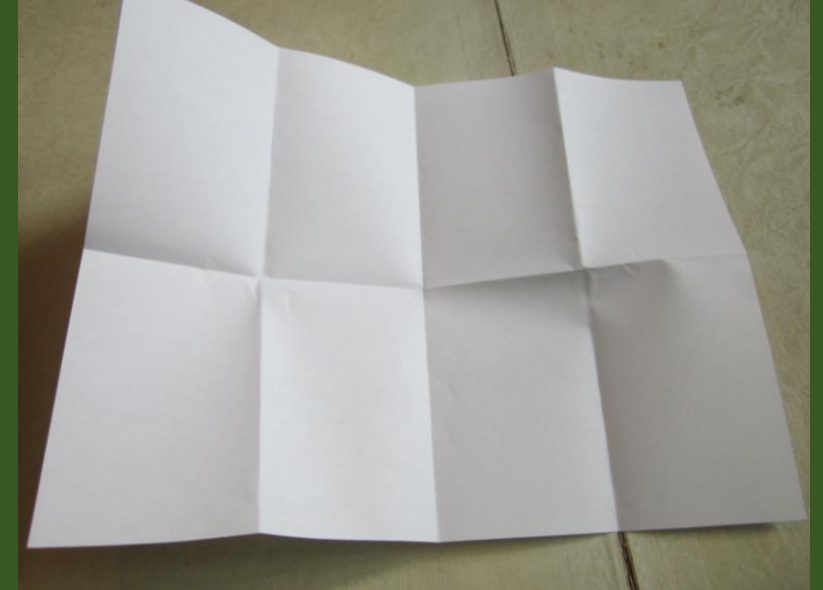


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Key to the Puzzle

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...



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The Universe

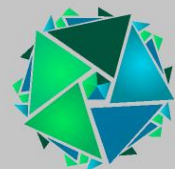


Key to the Puzzle

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.



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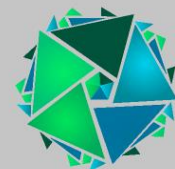
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Key to the Puzzle

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.



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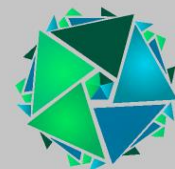
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Key to the Puzzle

Given enough time, what can happen will eventually happen.



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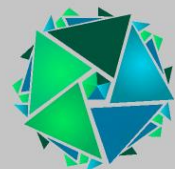
Key to the Puzzle

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.



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Key to the Puzzle

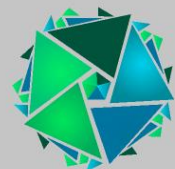
Given enough time, what can happen will eventually happen.

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.



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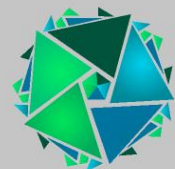
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Key to the Puzzle

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.



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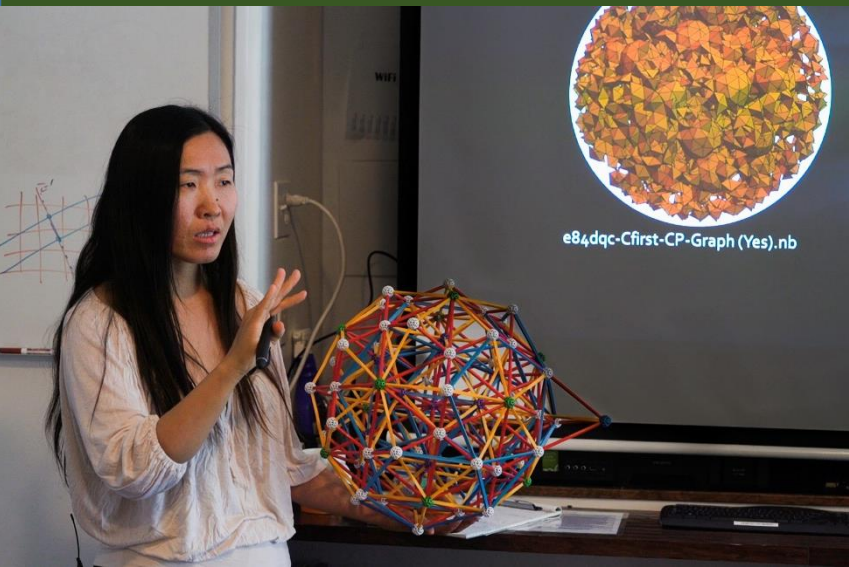


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In summary, our geometric reality may be a lower dimensional code of shape-numbers called simplex-integers derived from a hyper-dimensional lattice via projective geometry.



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