

A New Perspective on the Riemann Hypothesis, String Theory, and Topological Insulators Says the Universe Is Not Expanding

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Abstract

This article isn't proposing a solution to the Riemann hypothesis. It's merely a short communication suggesting a new approach which the author tries to explain. It says the proof of the Riemann hypothesis may not be able to be revealed by equations alone but combines the 18th century's Euler's identity and the Wick rotation of the 20th (the rotation is seen as far more than mathematical convenience). Put together correctly, this past maths casts light on information theory and cosmology's holographic principle, giving revolutionary views of the nature of - and travel within - spacetime. Specifically, this perspective on the Riemann hypothesis is not primarily concerned with the distribution of prime numbers. The hypothesis predicts the future warping of spacetime and its consequences for interstellar as well as intergalactic journeys, as well as for trips to any period in either the future or the past. One of the proposed changes in our view of space-time is that science's String Theory could be modified so that the ultimate, fundamental composition of every fermion and boson in the universe becomes strings of the bits (binary digits) of one and zero which assemble the Mobius strip and figure-8 Klein bottle. Trillions of these topological figures respectively form the photon and graviton. Agreeing with a paper by Einstein which asked if gravitation and electromagnetism form elementary particles, the pressure from interaction of trillions of each particle is interpreted as matter or antimatter. Support for the present article's conclusions is given by the new perspectives given in the headings

1. Topological Insulators,
2. Flat and Simply-Connected,
3. Cosmological Entanglement in the Participatory Universe,
4. Mobius Matrix - Surgery in the 4th Space Dimension, and
5. A Brief History Of Gravity.

Keywords: Euler's Identity; Wick Rotation; Riemann Hypothesis; Holographic Principle; Quantum Mechanics; Spacetime

The Riemann Hypothesis

Euler

Euler's identity (or equation) of $E^{i\pi} + 1 = 0$ is named after the Swiss mathematician Leonhard Euler who lived from 1707 to 1783. He was a mathematician, physicist, astronomer, logician, geographer, music theorist and engineer. Subtracting 1 from both sides of the equation means $E^{i\pi} = -1$ (i stands for "imaginary number" and equals the square root of negative one).

The next sentence speaks of an exponent canceling a square root so a simple example is appropriate. $3^2=9$ and $\sqrt{9}=3$, therefore it can be said that the exponent cancels - and is canceled by - the square root and returns the mathematics to the original number 3. The exponent π cancels, and is canceled by, the square-root sign in $i=\sqrt{-1}$ and returns the -1 part to the position formerly occupied by E i.e. $E^{i\pi} = -1$ becomes $-1 = -1$.

Wick

Relating this to Wick rotation which was developed last century by Italian theoretical physicist Gian Carlo Wick (1909 1992).

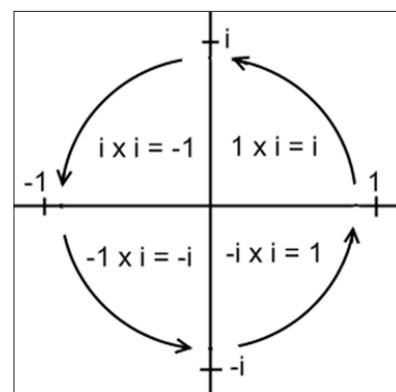


Figure 1: Wick Rotation

The complex plane reveals i 's special relationship with cycles via the circle of i , also known as Wick rotation. Whenever a point on the complex plane is multiplied by i , it moves a quarter rotation around the origin or center of the plane. **Since imaginary numbers are essential in quantum mechanics, Wick rotation's real plus imaginary numbers may act like a timepiece which is built into particles, displaying and recording their motions and coordinates.** At the start of the 20th century, physicist Max Planck assumed that electromagnetic radiation can only be emitted or absorbed in discrete packets, called quanta. He thought of his discovery as nothing more than a math device ... a kind of trickery). Albert Einstein developed his explanation of the photoelectric effect from this "mathematical convenience". So it appears entirely possible that another supposed mathematical trickery (Wick rotation) will find practical application in the future. (Source : The aim is to convert Euler's equation ($E^{[i\pi]} + 1 = 0$) into Wick-rotation terms. The step $E^{(i\pi)} = -1$ has been established, so it takes us to the -1 location in Figure 1. $R(O, 180^\circ)$ (a 180 degree counterclockwise rotation) translates into the Figure's position 1, resulting in $E^{[i\pi]} = +1$. The final step in conversion of the equation to Wick rotation is $E^{(i\pi)} + R(O, 180^\circ) [-1 + 1, \text{ in other words}]$ equals zero.)

The equation can be expressed as Wick rotation because $E^{(i\pi)}$ represents continuous rotation around the complex plane. Stanford University states: The representation of continuous rotation around the complex plane is primarily achieved through the use of complex numbers and their corresponding Eulerian representation (Church, n.d.).

Riemann + Space-Time

Now it's time to consider the hypothesis of German mathematician Georg Friedrich Bernhard Riemann (1826-1866). The Riemann hypothesis is concerned with "nontrivial zeros" on the "critical line", stating that these zeros lie on the vertical axis of the Complex Plane i.e. on the y-axis in then-undiscovered Wick rotation which the next paragraph, and the caption to the Figure, says may be related to time (and to space, since the two aren't separate and we live in space-time). The zero in Euler's identity isn't immediately applied to the Riemann hypothesis but goes through Wick rotation first. This is because the critical line links Wick rotation to the Riemann hypothesis. Since Wick may describe time and also the space-time union, spacetime - and not only the distribution of prime numbers - may be describable by Riemann. On a number line, 0 is halfway between +1 and -1 i.e. it's on the y-axis in Fig. 1. The Riemann hypothesis says the real part of every nontrivial zero on the y-axis is $\frac{1}{2}$. The relevance of the hypothesis to space-time means it could also be related to the quantum spin of particles of matter being $\frac{1}{2}$. The critical line pertains to zeros. So the distances in space-time that could be described by the Riemann hypothesis might, after spacetime has been warped, (see next paragraph) equal zero. This would make time travel to both the past and future possible. Times in the past, present, and future would be similar to different coordinates on earlier and later parts of a DVD or Digital Video Disk. The entire disk, and all times, would co-exist but only fractions of a second

could normally be perceived. As well, the total lack of distance would make instant interstellar, or even intergalactic, travel feasible. Since $E^{(i\pi)}$ represents continuous rotation around the complex plane and $E^{[i\pi]} + 1 = 0$, the continuous rotation generates zero continuously. That is, the zeros are infinite - and if the Riemann hypothesis describes space-time, the universe would be infinite, both spatially and temporally (it would be eternal).

Curved space would actually be all the photons and gravitons in the universe following curved trajectories, with the Wick rotation embedded in those particles consequently being on a nonlinear path and constituting curved time. Cosmology's Holographic Principle states that the entropy or disorder of ordinary mass - not just black holes - is proportional to surface area and not volume (see next paragraph); that volume itself is illusory and the universe may really be a hologram. The principle deletes all distances in the 3rd dimension, quantum entangling photons and gravitons. If built into every fermion and boson, Wick rotation can be regarded as time. Wick's complex (real plus imaginary) numbers might, like an electronic clock or watch, display and record the motions and coordinates of particles. Being part of particles, time would not be separate from space but would unite with it to form space-time. Fermions and massive bosons - of, say, the weak nuclear force - could be added to the entanglement (creating universal unification) by Albert Einstein's 1919 paper "Do gravitational fields play an essential role in the structure of elementary particles?" (Einstein, 1919). This paper suggests the pressure from interaction of gravitation and electromagnetism is responsible for the mass of particles, in which case the Higgs field would be an entangling of the gravitational and electromagnetic fields.

Phrased in the language of the Bekenstein bound of black hole thermodynamics developed by theoretical physicist Jacob Bekenstein, maximum entropy in any region scales with the radius squared, rather than cubed as might be expected (Bekenstein, 2005).

The strong nuclear force's massless gluon could be formed by cancellation. Wick is a circle containing two axes that intersect at its origin - a horizontal x-axis whose "real" ends are labelled 1 and -1, plus a vertical y-axis with "imaginary" ends i and $-i$. Whenever a point on this complex plane is multiplied by i , it moves a quarter rotation around the origin or center of the plane (counterclockwise). Start with 1, multiply by i then by i again ($i^2 = -1$), then add the 1 and -1 to get 0 (cancellation of gluon mass).

NOTE: The gluon's $1+(-1)$ may be viewed as the reverse of Euler/Wick's $-1+1$. Both $1+(-1)$ and $-1+1$ recall what theoretical physicist Eugene Wigner (1902-1995) called "The Unreasonable Effectiveness of Mathematics in the Natural Sciences" (Wigner, 1960)- and they conceivably hint at our planet's science playing an essential role in giving the laws of physics the form they have.

Topological Insulators

Phenomena such as topological materials, electrons, phase transitions, Weyl and Majorana fermions are inextricably related to the Riemann hypothesis, Wick rotation, and the cosmos.

The General Theory of Relativity will be useful in this article. Specifically – the analogy of the theory's curvature of space-time to a rubber sheet. A small body like the Earth is said to warp space-time only a little and create a dimple in the sheet. A larger body such as the Sun curves space-time much more and forms a deep valley in the rubber. And a black hole is often pictured as warping space-time so much that it tears a hole through the rubber fabric. In 2004, U.S.A. physicist Charles Kane noticed something strange in his computer simulations of electrons flowing through different materials: an insulator whose quantum state had the equivalent of a hole. Kane had not found the first quantum black hole but had discovered the first topological insulator – a then theoretical material that could conduct electricity on its surface but not within its interior. (In 2007, American physicist M. Zahid Hasan led the team that made the first 3D topological insulator.)

In 1929, while experimenting with the equations of quantum physics, German physicist Hermann Weyl showed that a massless and charged particle (now called the Weyl fermion) could theoretically exist. The Majorana fermion was predicted in 1937 by Italian physicist Ettore Majorana playing with the same quantum math that had intrigued Weyl. Like a Weyl fermion, a Majorana fermion has no mass. It also has no charge, despite being made of a bunch of negatively charged electrons. The Weyl fermion can be related to Topological Insulators, * the Majorana fermion can be related to quantum computers' Topological Superconductors. Topological insulators and topological superconductors may be regarded as the (Mobius dependent) inverse of each other, with the properties of surfaces and holes being interchangeable as a result of the twisting in their Mobius-strip / figure-8-Klein-bottle composition.

* A topological insulator is a material that behaves as an insulator in its interior but whose surface contains conducting states. However, the conducting surface is not the unique character of topological insulators, since the ordinary band insulators can also support conductive surface states. What is special is that the surface states of topological insulators are symmetry protected. Symmetry Protected Topological (SPT) Order is a kind of order in topological insulators where, if symmetry is preserved during the deformation undergone in topology, a phase transition from one state of matter to another must occur (in this case, between insulation and conduction). In other words, if the shape of a Möbius strip (or the union of two strips into a Klein bottle) is preserved, phase transition must occur just as orientation-reversing curves occur in the Möbius and Klein. In three-dimensional topological superconductors, it's more common to have multiple surfaces. But if subatomic particles making up topological superconductors are composed of the topological Mobius strip, they can theoretically only have one surface. Topological insulators can also be composed

of Mobius strips. The key aspect is that the topologically protected states are robust against certain types of perturbations, regardless of the number of surfaces.

Referring to Figure 2, Side DC of parallelogram = Vector 1 electrons and Side DA of parallelogram = Vector 2 electrons.

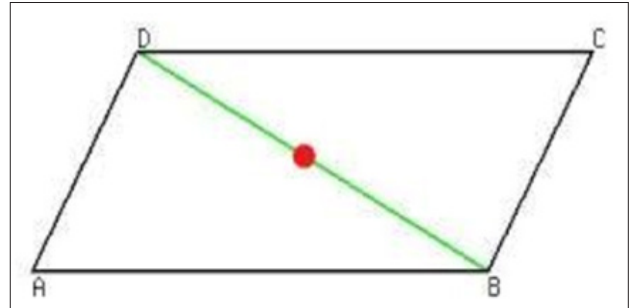


Figure 2: VTS (Vector-Tensor-Scalar) Geometry

Interaction of Gravitation and Electromagnetism Produces a Momentum in Gravitons and Photons (and a Pressure Which is Interpreted as Mass). (Figure drawn by author using "Paint" program)

The two vectors (two groups of charged electrons) interact to form the resultant diagonal DB (the electrons travel ADB and CDB, coming together to behave like a single charged particle called a Weyl fermion). Tensor calculus converts the points on the sides and diagonal into a single scalar point on a nominated side (say, in the centre of the diagonal). And the mass of the vector 1 electrons minus the mass of the vector 2 electrons $[(x \text{ MeV}/c^2) - (x \text{ MeV}/c^2)]$ equals zero, and the massless Weyl. If the electrons flow in the reverse direction, they go in the BD direction, then split and follow the paths DA and DC. This preserves information if one pathway is interfered with, giving robustness against perturbations. They produce the chargeless Majorana because the negative vector-1 electrons minus the negative vector-2 electrons equal $(-y) - (-y) = 0$. The Majorana's lack of mass is attributed to the same process by which the Weyl particle becomes massless.

Why is subtraction essential? This appears to be a consequence of matter, and the Higgs boson, both emerging from photon-graviton interaction. Two adjoining sides of a parallelogram represent the vectors of the photon's spin 1 and the graviton's spin 2. The resultant diagonal represents the interaction of the sides/vectors $(1 \div 2 = \text{the spin } \frac{1}{2} \text{ of every matter particle: and division is merely repeated subtraction e.g. } 4 \text{ subtracted from } 20 \text{ five times equals zero, therefore } 20 \div 4 = 5)$. (By the way - in calculus, the quotient of two vectors is called a quaternion.) Speaking of the Higgs which resides on the diagonal in Figure 1 and has spin 0: zero can be arrived at through $(1 - 2) + 1$ which uses both subtraction and the experimental data of a photon existing in two places simultaneously (it uses the graviton's spin 2 being taken away from the photon's spin 1, and the spin motion of 1 being in more than one place at the same time).

According to their representation by vector-tensor-scalar geometry, the chargeless Majorana's negative vector-1 electrons minus the negative vector-2 electrons equal $(-y) - (-y) = 0$. This can be expressed as $y + (-y) = 0$, which clearly highlights its similarity to the Riemann hypothesis' $\frac{1}{4} + (-1/4) = 0$ (in terms of the paragraph's first equation, this is: $-1/4 - (-1/4) = 0$). The last pair of expressions resolve conflict regarding whether the first term in the lower half-plane of Riemann's hypothesis is positive or negative (either can be used).

Conclusion

This article proposes that the term "universal topology" isn't limited to "the shape of the universe". Instead, every fermion's and boson's fundamental composition is of mathematics' topological figures: shapes known as the Mobius strip and figure-8 Klein bottle. The shapes can be generated from electric pulses / binary digits - with trillions of them producing photons and gravitons that interact in a way first suspected by Einstein to form mass and quantum spin. The Earthly counterpart of this spacetime topology is material such as the topological insulator whose properties are explicable using the Mobius. Also very important to the explanation is a parallelogram described by so called vector-tensor-scalar (VTS) geometry. The geometry has major implications for the Higgs boson and an extension labelled Elliptical VTS Geometry has consequences for the Higgs field as well as meaning consciousness is not restricted to the brain. Topological insulation is connected to the Riemann hypothesis and to Wick Rotation which is often regarded as nothing more than mathematical convenience but is seen here as key to understanding time and vital to revolutionary developments in space-time travel.

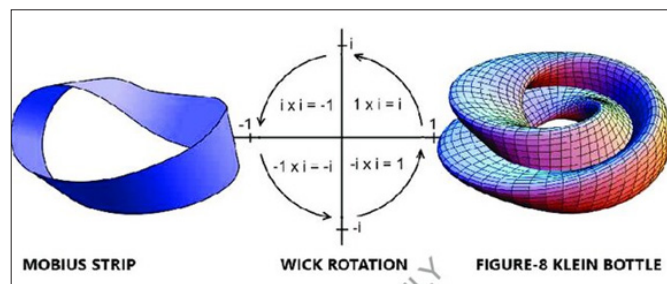


Figure 3: Mobius, Wick, Klein

Source: https://www.researchgate.net/figure/Mobius-strip-Wick-rotation-figure-8-Klein-bottle_fig4_368690023

Referring to the right side of Figure 3, note that the Klein bottle's two different colours (representing positive and negative curvature) fit together to produce the outline of a doughnut. A doughnut (or strictly, a torus) is technically flat. If continuously deformed like a mass of clay, it has the same topological properties as a flat surface (like a piece of paper). When many figure-8 Klein bottles are grouped together, a procedure analogous to computer art's Sky Replacement will cause binary digits to fill in any gaps or holes in the same way that computers can make a sky that's blue from horizon to horizon. In other words, the digits "smooth out" the Klein bottles to produce General Relativity's regular space (often likened to a rubber sheet). But the Klein doesn't become multiply connected like the doughnut. Only the doughnut's

outline (with its hole filled in) is adopted and the bottle retains the property of simple connectedness. (Informally, if an object in space consists of one piece [the outline of one filled-in doughnut] - and has no holes passing all the way through it, it is called simply-connected.) According to the paper "Cosmic Topology", a flat universe that is also simply connected implies an infinite universe that extends endlessly in all directions (Luminet, & Lachièze-Rey, 1995). The switching of bits between "one" and "zero" is comparable to the "quantum fluctuations" associated with Big Bang theory. **Participatory Universe** could show another correspondence with the Big Bang viz a (seemingly paradoxical) definite beginning in real time for the eternal universe.

Cosmological Entanglement in the Participatory Universe

It was officially the wildest idea John Wheeler had yet. A universe made not of matter, not of space-time, not of stuff at all, but of our choices. It wasn't what he'd hoped to find; the physics had led him there. At first, Wheeler thought that observer-participancy involved consciousness. After all, tables and chairs don't make choices about what to measure; conscious observers do. But that was of no help. He saw no way to link the private experiences of individual minds into a single, shared reality. According to this article, individual minds can be linked by everything in time and space being parts in a cosmos of 1's and 0's. This prompts thoughts of a computational or digital universe -

A model of the cosmos might be built that uses the infinite number pi and imaginary time, and resides in Virtual Reality (artificial, computer-generated simulation). The entanglement (both quantum and macroscopic) in the simulated universe is unable to remain separate from the entanglement existing in our perceived reality because computers using so-called "imaginary time" (which is defined by numbers with the property $i^2 = -1$) remove all boundaries between the two universes. This enables them to become one Augmented Reality (known now as technology that layers computer-generated enhancements onto an existing reality but seen here as the related layering of virtual reality onto other points in time and space). The poorly named imaginary time of physics and mathematics unites with pi (both are necessary to generate a non-Big-Bang cosmos i.e. an infinite universe which, because space and time can never be separated, is eternal). This manipulation of time, space, and the universe with virtual and augmented reality might possibly be produced by the two-valued binary-digit system used in electronics traversing a wormhole, or shortcut between folds in space and time, designed by humans of the far future. The augmented reality which is layered on "other" points in space-time actually isn't transmitted to other points - because of the quantum entanglement of every particle (massive or massless) in spacetime, only one ever exists. Thus, transmissions to any (apparently other) places or times wouldn't be restricted to the speed of light but are instantaneous.

The idea of an eternal universe is highly speculative and doesn't quite fit with our current understanding of the universe's origins, such as the Big Bang theory. Any idea that

has been around for a century cannot be easily dismissed but the James Webb Space Telescope is casting potential doubts on the Big Bang. If this continues, we may well find ourselves in need of another theory explaining cosmic origins. An infinite, eternal universe created with technology does this, and it fits in with my ideas on binary digits/topology/Wick rotation/VTS Geometry being fundamental to the universe's structure and functioning.

Mobius Matrix - Surgery In The 4th Space Dimension

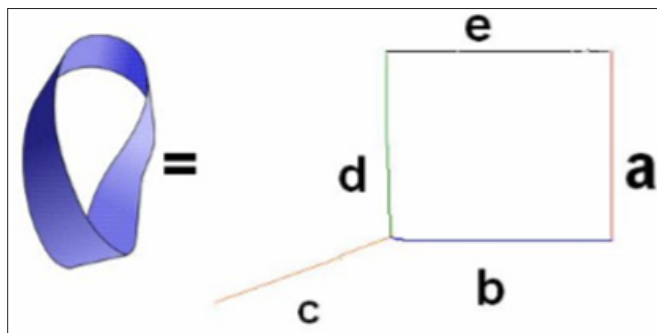


Figure 4: Mobius Matrix (Mobius equals a,b,c,d,e array)

Width *a* is perpendicular to the length (*b* or *e*) which is perpendicular to height *c*. How can a line be drawn perpendicular to *c* without retracing *b*'s path? By positioning it at *d*, which is then parallel to (or, it could be said, at 180 degrees to) *a*. *d* is already at 90 degrees to length *b* and height *c*. *d* has to be at right angles to length, width and height simultaneously if it's going to include the Complex Plane's vertical "imaginary" axis in space-time (the "imaginary" realm is at a right angle to the four known dimensions of space-time, which all reside on the horizontal real plane). In other words, *d* has to also be perpendicular to (not parallel to) *a*. This is accomplished by a twist, like on the right side of the Mobius strip, existing in the particles of matter composing side *a*. In other words, a fundamental composition of matter is mathematics' topological Mobius, * which can be depicted in space by binary digits creating a computer image. The twist needs to be exaggerated, with the upper right of the Mobius descending parallel to side "a" then turning perpendicular to it at approximately the level of the = sign, then resuming being parallel. Thus, 90+90 (the degrees between *b* & *c* added to the degrees between *c* & *d*) can equal 180, making *a* & *d* parallel. But 90+90 can also equal 90, making *a* & *d* perpendicular. (Saying 90+90=90 sounds ridiculous, but it has similarities to the Matrix [of mathematics, not the action-science fiction movie] in which *X* multiplied by *Y* does not always equal *Y* times *X*. The first 90 plus the second 90 does not always equal the second 90 plus the first 90 because 90+90 can equal either 180 or 90).

* Regarding "a fundamental composition of matter (being) mathematics' topological Mobius": this makes sense because you have to go around the endless loop of a Mobius strip twice to reach your starting point, and any particle of matter must undergo two complete revolutions (must be turned through 720 degrees) to attain the previous quantum state.

Adopting the familiar 3D view - a surgeon and a patient's heart normally never touch since they're parallel and at 180 degrees. In this view, a surgeon could only touch a heart by destructive methods such as cutting through tissues with a scalpel (equivalent to moving "a" and/or "d"). 4D can be introduced by accessing a scale trillions of trillions of times smaller than a molecule and then changing the orientation of particles from their existing 90+90=180 configuration to 90+90=90 * (except for the handle, which the doctor needs to be 3D so he can hold it). This means the doctor and cardiac organ are at right angles (90 degrees) to each other and, though seemingly parallel and out of contact, they connect like two walls meeting at a perpendicular angle. The surgeon can now touch the heart while leaving overlying skin, adipose tissue, and muscle intact.

* The paragraph beneath Fig. 4 describes the 4th spatial dimension mathematically. Physically, that dimension is the Mobius strip's existence as a fundamental composition of every particle in space-time, and of 90+90 equaling 90. How might the above paragraph's change from 90+90=180 configuration to 90+90=90 be accomplished? Both arrangements exist simultaneously and next to each other. Perhaps the configuration is altered simply by moving up and down the right side of the Mobius in Fig. 4 ("up" and "down" are referred to as "upsilon" and "delta" in Clifford A. Pickover's book "Surfing Through Hyper space", and as "ana" and "kata" in Toby Hendy's book "A Guide to Making Friends in the Fourth Dimension"). At the level of the = sign in the diagram, perpendicularity to side "a" is possible. Moving just above or just below the sign can make parallelism to "a" feasible.

A Brief History of Gravity

In three dimensions, the gravitational force drops to 1/4 if one doubles the distance. In four dimensions it would drop to 1/8, and in five dimensions to 1/16. The positive direction on the *x*-axis (representing the motions in the length, width and depth of "real" space-time) is an extension of the negative direction on *x* (this may be called the 5th space dimension or complex space-time). Therefore, real gravity is perpetually amplified by complex gravity. Using science's figures, the amplification equals 1/4 multiplied by 1/4 i.e. doubling the distance in 5 space dimensions causes gravity to become 1/16 as powerful. Alternatively, the gravity's strength is reduced 4 times and this number is multiplied by another 4 to reduce it 16 times overall. In the 4th space dimension/2nd time dimension represented by the imaginary axis, this *y*-axis is half the distance (90 degrees) from the real *x*-axis that the complex *x*-axis is (the complex is removed 180 degrees). So gravitational weakening from doubling distance in 4 space dimensions = (reduction of 4 times multiplied by another reduction of 4 times) / 2, for an overall reduction of 8 times to a strength of 1/8.

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