The Symmetry of D_{2n+2n} 、 $D_{2n\times 2n}$ 、 $D_{1/2\times 1/2}$、$D_{\infty+i}$ and Numbers Conjectures

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Abstract In this paper, we discuss the symmetry of **D2n+2n** 、 **D2n×2n** 、 **D1/2×1/2**、**D∞+i** and we find that using the symmetry characters of Natural Numbers we can give proofs of the Prime Conjectures: Goldbach Conjecture、Polignac's conjecture (Twins Prime Conjecture) and Riemann Hypothesis. . We also gave a concise proofs of Collatz Conjecture in this paper. And we found that if the Goldbach Conjecture、Polignac's conjecture (Twins Prime Conjecture) were proofed, we also can get a concise proof of Fermat Last Theorem and get an Unified Field Theory for physic.

Keywords $D_{1/2\times 1/2}$ N domain Riemann Hypothesis Prime numbers Conjectures Collatz Conjecture

1. The symmetry of D2n+2n and a concise proof of Collatz Conjecture

Collatz Conjecture:

$$f(n)=\begin{cases}\frac{n}{2} & if n\equiv 0\ (mod2)\\ 3n+1 & if n\equiv 1\ (mod2)\end{cases}$$

$k\in N\ \rightarrow f^{k}(n)=1$

We can get figure.1

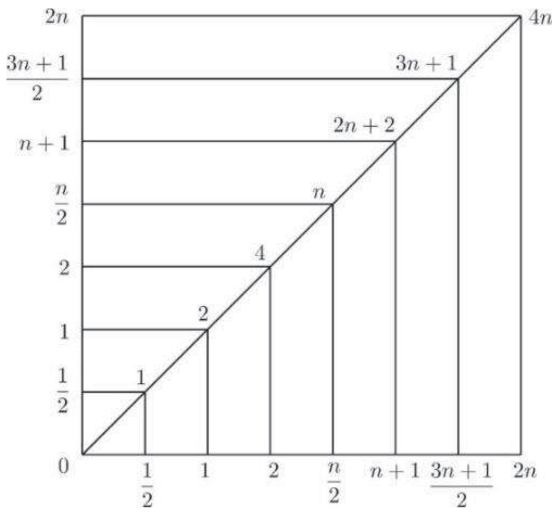


Fig.1 D_{2n+2n} Diagonalization division by n/2

n~(1 , 2 , 3 , 4 , ...) all the natural numbers excepted 0

we have:

$$\frac{n}{\frac{n}{2}}=\frac{3n+1}{\frac{(3n+1)}{2}}=\frac{2n+2}{n+1}=\frac{4n+2n+2}{3n+1}=\frac{4n+4}{2n+2}=\frac{4n}{2n}=\frac{4}{2}=\frac{2}{1}=\frac{1}{\frac{1}{2}}=2$$

n~ (1, 2,3,4……) all natural numbers. **This is a concise proof of Collatz Conjecture.**

2. **The symmetry of D2n+2n and proofs of the Prime Conjectures: Goldbach Conjecture、Polignac's conjecture and Twins prime conjecture**

We have

$n\sim\left(1\ ,\ 2\ ,3\ ,4\ ,\ \ldots\ldots\ldots\right)$ All natural numbers excepted 0

P~$\left(2\ ,3\ ,5\ ,7\ ,\ \ldots\ldots\ldots\right)$ All prime numbers

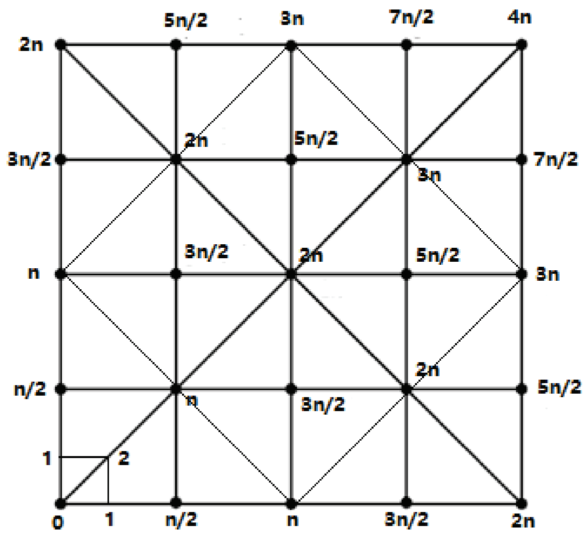


Fig.2. D $_{2n\times 2n}$ Regularization division by n/2

we can get figure.2

as the matrix is : $\begin{bmatrix} 2n & 5n/2 & 3n & 7n/2 & 4n \\ 3n/2 & 2n & 5n/2 & 3n & 7n/2 \\ n & 3n/2 & 2n & 5n/2 & 3n \\ n/2 & n & 3n/2 & 2n & 5n/2 \\ 0 & n/2 & n & 3n/2 & 2n \end{bmatrix}$

p0∈P **~(0 , n)** **pn**∈P **~[n , 2n)**

P~$\left(2\ ,3\ ,5\ ,7\ ,\ \ldots\ldots\ldots\right)$ All prime numbers.

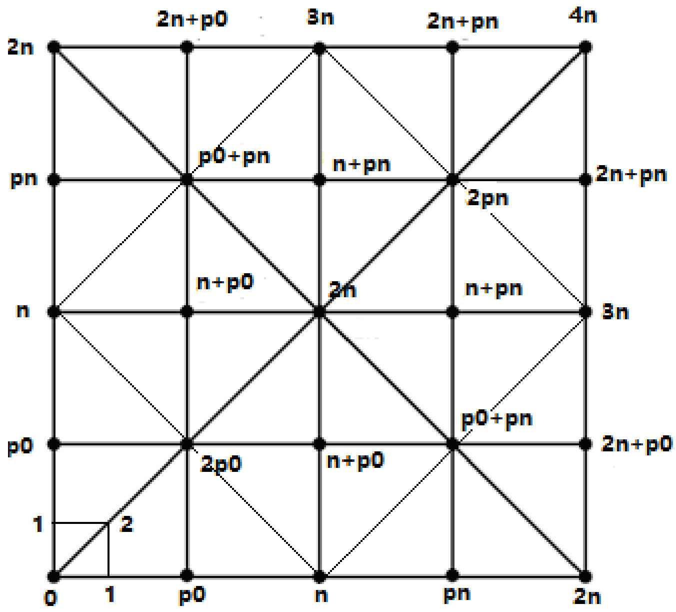


Fig.3. D $_{2n\times 2n}$ division by n and P

we can get figure.3 as the matrix is:

$$\begin{bmatrix} 2n & 2n+p0 & 3n & 2n+pn & 4n \\ pn & p0+pn & n+pn & 2pn & 2n+pn \\ n & n+p0 & 2n & n+pn & 3n \\ p0 & 2p0 & n+p0 & p0+pn & 2n+p0 \\ 0 & p0 & n & pn & 2n \end{bmatrix}$$

We have

$$\frac{1}{2}n \to p0$$

$$\frac{3}{2}n \to pn$$

$$2n \to (\,p0+pn)$$

$$n \to 2p0$$

$$3n \to 2pn$$

so we can get figure.4 :

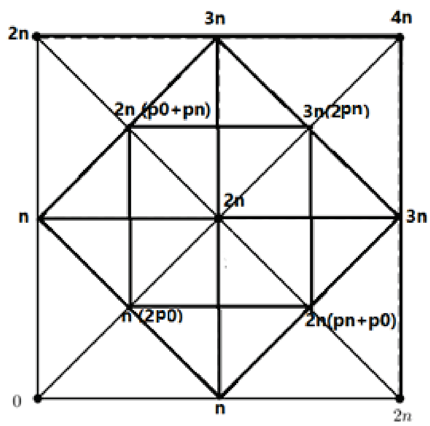


Fig.4. The Symmetry of D $_{2n\times 2n}$ (2n=p0+pn)

And All the numbers mod (4n)， then we get fig.5.

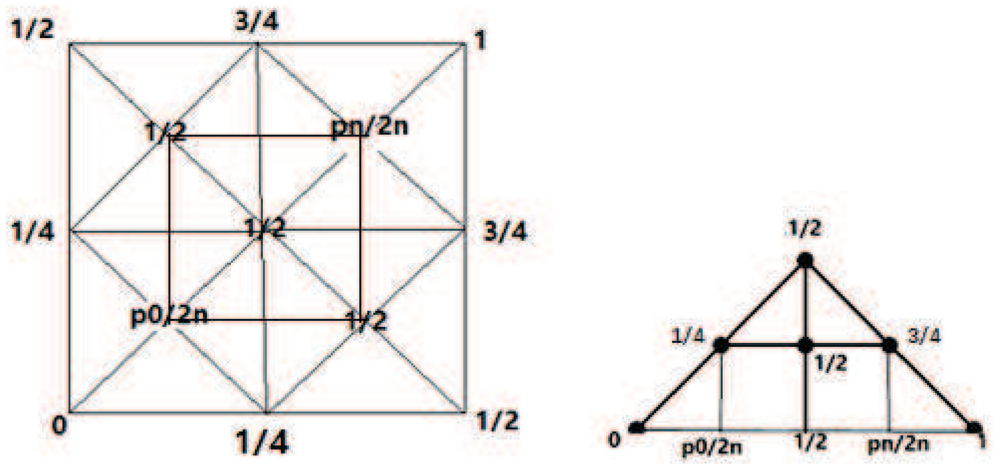


Fig.5. The Symmetry of D-domain 1/2×1/2

So we have:

$\frac{pn}{2n} - 3/4 = 1/4 - \frac{p0}{2n}$ $2n = p0 + pn$ $n\sim(2, 3, 4, \dots\dots\dots)$

This is the proof of Goldbach conjecture.

$$\frac{pn}{2n} - \frac{p0}{2n} = \frac{3}{4} - \frac{1}{4}$$

$$pn - p0 = 3\frac{n}{2} - 1\frac{n}{2} = (3-1)*\frac{2k}{2} = 2k \qquad k\sim(1, 2, 3, 4, \dots\dots\dots)$$

This is the proof of Polignac's conjecture.

And when

$$k = 1$$

$$pn - p0 = 2$$

This is the proof of Twin Primes Conjecture.

3. The symmetry of domain $D_{1/2\times1/2}$ and the Proof of Riemann Hypothesis

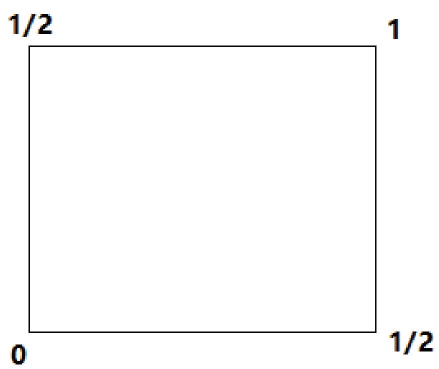


Fig.6. D-domain($D_{1/2\times1/2}$)

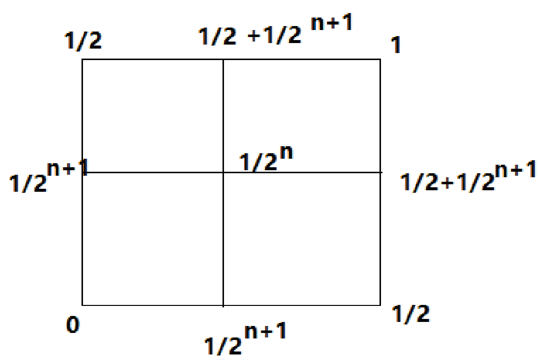


Fig.7. $D_{1/2\times1/2}$ regularization division by $1/2^n$

we can get a square $\begin{bmatrix} 1/2 & 1 \\ 0 & 1/2 \end{bmatrix}$, and we can give a regularization division by

$1/2^n$ as show Fig.7

the matrix is:

$$\begin{bmatrix} 1/2 & \frac{1}{2}+1/2^{n+1} & 1 \\ 1/2^{n+1} & 1/2^n & \frac{1}{2}+1/2^{n+1} \\ 0 & 1/2^{n+1} & 1/2 \end{bmatrix}$$

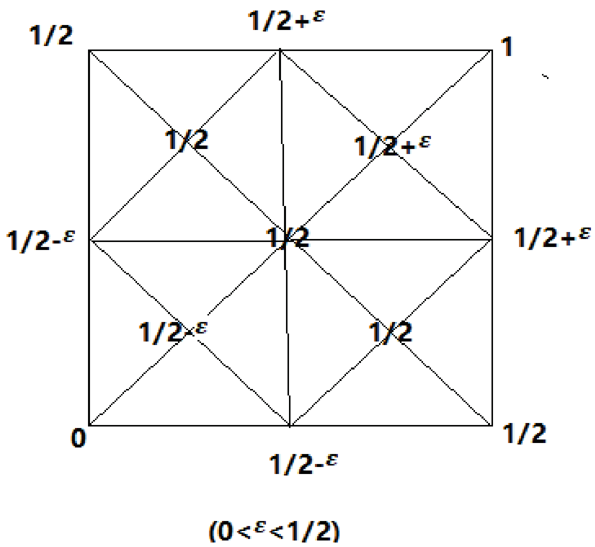


Fig.8. $D_{1/2\times1/2}$ diagonalization division by ε (0<ε<1/2)

and we can also give a diagonalization division by **ε (0<ε<1/2)** as show Fig.8

the matrix is:

$$\begin{bmatrix} 1/2 & \frac{1}{2}+\varepsilon & 1 \\ \frac{1}{2}-\varepsilon & 1/2 & \frac{1}{2}+\varepsilon \\ 0 & \frac{1}{2}-\varepsilon & 1/2 \end{bmatrix}$$

So we can get a division by 1/2 and **ε (0<ε<1/2) just show as on Fig.9**

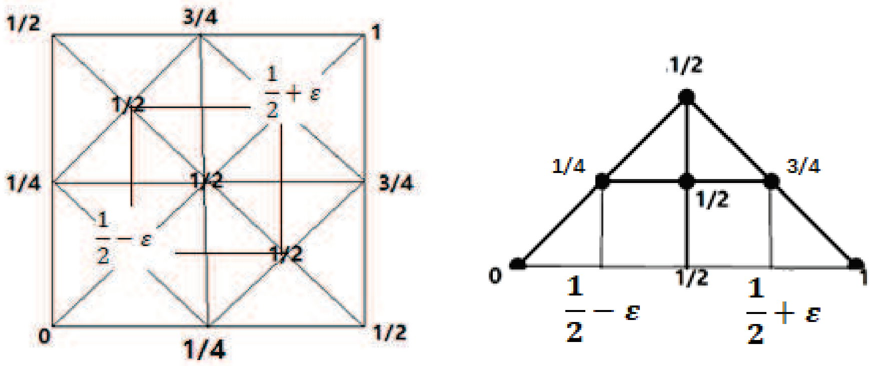


Fig.9. The symmetry of domain D(1/2×1/2)

$$\begin{bmatrix} & & 1/2 & & \\ & 1/4 & 1/2 & 3/4 & \\ 0 & \frac{1}{2}-\varepsilon & 1/2 & \frac{1}{2}+\varepsilon & 1 \end{bmatrix}$$

$$\boldsymbol{zp} = \frac{1}{2} \pm \boldsymbol{\varepsilon}\ \mathbf{(0<\varepsilon<1/2)}$$

Riemann Zeta-Function

$$\xi\ (s) = \sum_{n=1} \frac{1}{n^s} = \prod \frac{1}{1-p^s} \qquad (s = a + bi)$$

Riemann Hypothesis: all the Non-trivial zero-point of Zeta-Function $Re(s) = {}^{1}\!/_{2}$.

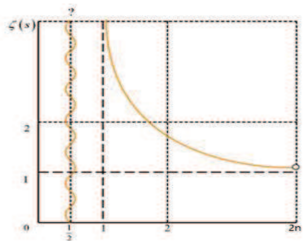


Figure.10. Riemann Hypothesis: all the non-trivial Zero points of Riemann zeta-function are on the 1/2 axis.

We have

$$1/2 = 1/2 \quad 0 = 1/2\text{-}1/2 \quad 1 = 1/2 + 1/2 \quad i^2 = -1$$

$$1/2 = (1/2 + 1/2 \bullet i)(1/2 - 1/2 \bullet i)$$

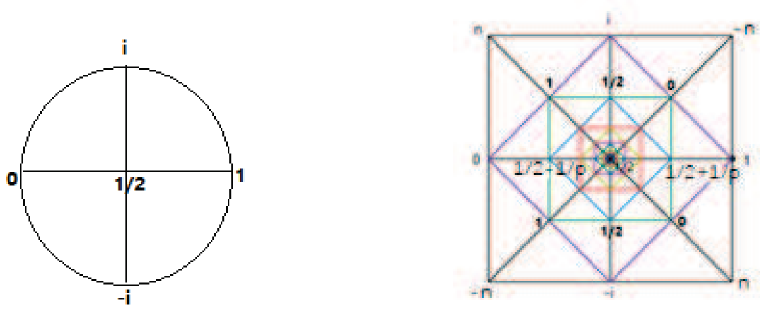
So we can constructure a space with a 1/2 Fixed Point, we call it $L^{1/2}{}_{(0\ 1/2\ 1)}$

We also have

$$\boldsymbol{zp} = \frac{\mathbf{1}}{\mathbf{2}} \mp \boldsymbol{\varepsilon} = \frac{\mathbf{1}}{\mathbf{2}} \mp \frac{\mathbf{1}}{\boldsymbol{p}}$$

p~$\left(3\ ,\ 5\ ,\ 7\ ,\ \dots\dots\dots\right)$ all the odd prime numbers.

So we can get



(a) $L^{1/2}{}_{(0\ 1/2\ 1)}$ space (b) N-domain division by 1/2and 1/p

Fig.11. N-domain analytic continuation with 1/2 and 1/p in $L^{1/2}{}_{(0\ 1/2\ 1)}$ space

$$\begin{bmatrix} n & i & -n \\ 0 & 1/2 & 1 \\ -n & -i & n \end{bmatrix}^{-1} \begin{bmatrix} 1 & 1/2 & 0 \\ \frac{1}{2} - 1/p & 1/2 & 1/2+1/p \\ 1 & 1/2 & 0 \end{bmatrix} = \begin{bmatrix} 1/2 & \ldots\ldots & \frac{1}{2^n}[1+(1-2/p)i] \\ \ldots\ldots & 1/2 & \ldots\ldots \\ \frac{1}{2^n}[1-(1-2/p)i] & \ldots\ldots & 1/2 \end{bmatrix}$$

The tr(A)=1/2*n

This is the proof of Hilbert–Pólya conjecture. This is mean that all the non-trivial Zero points of Riemann zeta-function are on the 1/2 axis just show as So we give a proof of Riemann Hypothesis.

In fact, in N domain (2n×2n)

we have

$$n^2 = \frac{1}{2} \cdot n \cdot 2n = \sum_1^n \frac{1}{2} \sum_1^n \sum \frac{1}{2^N}$$

$N\sim(0, 1, 2, 3, 4, \ldots\ldots)$ all the natural numbers.

$n\sim(1, 2, 3, 4, \ldots\ldots)$ all the natural numbers expected 0.

In S domain (s=a+bi)

We have

$$1 + \frac{e^{ip\pi} - e^{i2N\pi}}{(1+i)(1-i) = \sum \frac{1}{2^N} = 2} = 0$$

$N\sim(0, 1, 2, 3, 4, \ldots\ldots)$ all the natural numbers.

p~$(3, 5, 7, \ldots\ldots)$ all the odd prime numbers.

4. The Symmetry of S∞+i and Prime Number Conjectures

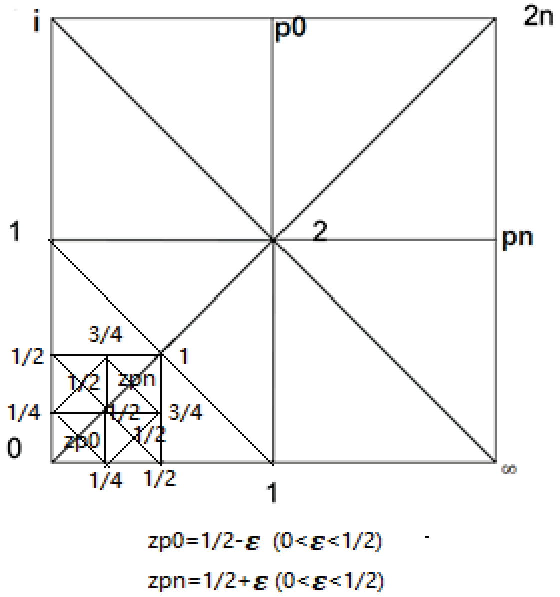


Fig.12. The Symmetry of S∞+i

We can construct S∞+i as figure.12.

the matrix is :

$$\begin{bmatrix} i & p0 & 2n \\ 1 & 2 & pn \\ 0 & 1 & \infty \end{bmatrix}$$

We have

$$1 + i^2 = 0$$
$$0 = 1 - 1 \quad 2 = 1 + 1$$
$$\infty = 1 + 1 + 1 + 1 + \cdots$$

$n \sim \left(1 , \ 2 , 3 , 4 , \ldots\ldots\ldots \right)$ All natural numbers excepted 0

P$\sim \left(3 , 5 , 7 , \ldots\ldots\ldots \right)$ All odd prime numbers

p0∈P **<2n pn**∈P **>2n**

So we have:

$p0 - 2 = pn - 2n \rightarrow 2(n+1) = p0 + pn \qquad n \sim \left(2 , 3 , 4 , \ldots\ldots\ldots \right)$

This is the proof of Goldbach conjecture.

$2\mathrm{n} - p0 = pn - 2 \rightarrow pn - p0 = 2(n-1) \qquad n \sim \left(1 , \ 2 , 3 , 4 , \ldots\ldots\ldots \right)$

This is the proof of Polignac's conjecture.

And when

$$n = 2$$
$$pn - p0 = 2$$

This is the proof of Twin Primes Conjecture.

And $\boldsymbol{zp = \frac{1}{2} \pm \varepsilon}$ **(0<ε<1/2)**

This is a proof of General Riemann Hypothesis (GRH).

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Note1 A concise proof of Fermat' last Theorem.

Fermat' last Theorem:

$\boldsymbol{x^n + y^n = z^n}$ $(x, y, z \in n, \ xyz \neq 0 \ \ n > 2)$ **has no solution.**

$\boldsymbol{n \sim (1, 2, 3, 4, 5, 6\ldots\ldots\ldots}$) all the natural numbers excepted 0

The equivalent proposition of this conjecture is:

$\boldsymbol{x^m + y^m = n^m}$ $(x, y, m \in n, \ xy \neq 0 \ \ m > 2)$ **has no solution.**

$\boldsymbol{n \sim (1, 2, 3, 4, 5, 6\ldots\ldots\ldots}$) all the natural numbers excepted 0

We have

$$\boldsymbol{2n = p0 + pn}\ (p0, pn \in p\ )\ \ \textbf{(Goldbach theorem)}$$

$$\boldsymbol{2k = pn - p0}\ \ \text{(k∽(1 , 2 , 3…..) (Polignac's theorem)}$$

So we can get

$$(\boldsymbol{2n})^{\boldsymbol{2}} + (\boldsymbol{2k})^{\boldsymbol{2}} = \boldsymbol{2pn^2 + 2p0^2}$$

$$(\boldsymbol{2n})(\boldsymbol{2k}) = \boldsymbol{pn^2 - p0^2}$$

n=k

$$(\boldsymbol{2k})^{\boldsymbol{2}} = \boldsymbol{pn^2 + p0^2}$$

$$(\boldsymbol{2k})^{\boldsymbol{2}} = \boldsymbol{pn^2 - p0^2}$$

So

$$(\boldsymbol{2k})^{\boldsymbol{2}} = \boldsymbol{pn^2 + p0^2}$$

$$(\boldsymbol{2k})^{\boldsymbol{2}} + \boldsymbol{p0^2} = \boldsymbol{pn^2}$$

Then we can get

$$(\boldsymbol{2k})^{\boldsymbol{m}} = \boldsymbol{pn^2}(\boldsymbol{2k})^{\boldsymbol{m-2}} + \boldsymbol{p0^2}(\boldsymbol{2k})^{\boldsymbol{m-2}}$$

$$(\boldsymbol{2k})^{\boldsymbol{m}} + \boldsymbol{p0^2}(\boldsymbol{2k})^{\boldsymbol{m-2}} = \boldsymbol{pn^2}(\boldsymbol{2k})^{\boldsymbol{m-2}}$$

$$(\boldsymbol{m > 2}\ m \in n\ \ )$$

If

$$\boldsymbol{p0^2}(\boldsymbol{2k})^{\boldsymbol{m-2}} = (\boldsymbol{Z0})^{\boldsymbol{m}}$$

$$\boldsymbol{pn^2}(\boldsymbol{2k})^{\boldsymbol{m-2}} = (\boldsymbol{Zn})^{\boldsymbol{m}}$$

$$Z0, Zn \in n$$

So

$$(\frac{\boldsymbol{p0}}{\boldsymbol{pn}})^{\boldsymbol{2}} = (\frac{\boldsymbol{Z0}}{\boldsymbol{Zn}})^{\boldsymbol{m}}$$

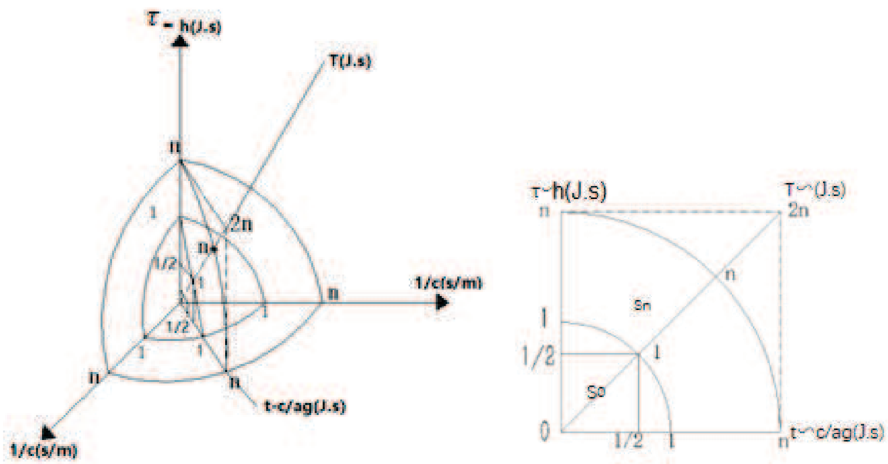
Only

$$\textbf{m=2}\ \textit{and}\ \frac{\boldsymbol{pn}}{\boldsymbol{p0}} = \frac{\boldsymbol{Zn}}{\boldsymbol{Z0}}\ \textit{is the solution.}$$

So we get a concise proof of Fermat' last Theorem.

Note 2 Time quantization and Unified Field Theory

Time is a basic concept in physics. But till now, we have no idea to use mathematical model to describe the structure of **“Time”**. In Newton’s system, Time is an independent existence with space. In Einstein’s system, Time and Space are bonded together just considering the Velocity of Light is a constant **C(m/s).** And then for a Quantum system, we consider the energy is discrete and then the “**Time contentiousness”** disappeared in this system. But It is that the **Dimension** of Plank’s constant **h(J.s) is also including the unit of Time .** So, we think that if we may construct a Dimension system of Time-Space with energy based on two priori conditions: the velocity of light is a constant **C and** the unit of **energy with Time** is **a** constant **h, Plank constant.** And if we can quantized this Time-Space with energy system, Maybe we can get a mathematical model to describe more physics details of the basic structure of Time-space with energy**.**



(a) (1/c –h (-c/ag -T)-1/c) Time-Space **(b) h-c/ag-T** section

Fig. 13. Time -space with energy coordinate

τ can be defined as

$$\tau \sim \mathrm{nh} \ \ (\mathrm{J.s}) \quad \mathrm{n} \sim (1,2,3,\ldots)$$

h is **Planck constant.**

$\boldsymbol{t}$ can be defined asτ

$$\boldsymbol{t} \sim \boldsymbol{n}\left(\frac{\boldsymbol{c}}{a_g}\right) \ (\mathrm{J.s}) \ \ \mathrm{n} \sim (1,2,3,\ldots)$$

And

$$T \sim 2n \text{ (J.s)}$$

C is the velocity of Light（m/s）, and a_g is the Intensity of field of gravitation (m/s^2). So we got a time with energy coordinate system (1/c-**h(-T -c/ag)** -1/c) show as Fig.12(a).

For a physic system, we can define **mass** as:

$$m0 \sim \frac{h}{C^2} (\text{J.s}^3.\text{m}^{-2})$$

$$m \sim n^3 \frac{h}{C^2} \ (\text{J.s}^3.\text{m}^{-2})$$

and at moments $T \sim 2n$(J.s) show as **fig.13 (b)**

$$\boldsymbol{\tau = t}$$

$$nh = nc/a_g$$

$$\frac{1}{a_g} = h/c \ (\text{J.s}^2.\text{m}^{-1})$$

So we have:

$$m_0 a_g \sim 1/c \ (\text{s.m}^{-1})$$

We can define a time space with energy as :

$$T \sim 2n \text{ (J.s) n} \sim (1,2,3,...)$$

$$S_0 \sim \frac{1}{4} * h * \frac{c}{a_g} \quad S_n \sim n^2 \ h * \frac{c}{a_g} \ (\text{J}^2.\text{s}^2)$$

$$\frac{S_n}{S_0} = 4n^2$$

$$\frac{m}{m_0} \sim n^3$$

And we notice that if **Goldbach conjecture** 2n=p0+pn (n is a nature number , and p0, pn are primer numbers)and **Polignac's conjecture** pn-p0 = 2n (n is a nature number , and p0, pn are primer numbers) be proofed, then

$$T \sim 2n = (pn \pm p0)$$

$$\frac{S_n}{S_0} \sim 4n^2 = (pn \pm p0)^2$$

$$\frac{m}{m_0} \sim n^3 = \left(\frac{pn \pm p0}{2}\right)^3$$

This will be a model to explain the **randomness** of the nature and **Quantum Entanglement.**

Competing Interests statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability statement

No datasets were generated or analyzed during the current study.