The Symmetry of N-domain and Numbers Conjectures

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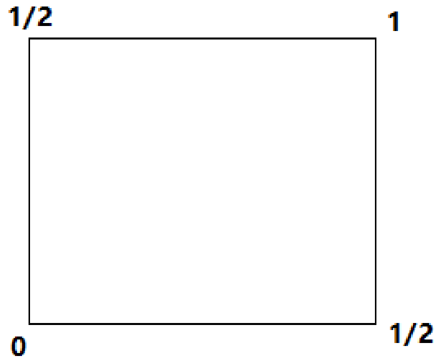
Abstract In this paper, we discuss the symmetry of N-domain and we find that using the symmetry characters of Natural Numbers we can give proofs of the Prime Conjectures: Goldbach Conjecture、Polignac's conjecture (Twins Prime Conjecture) and Riemann Hypothesis. . We also gave a concise proofs of Collatz Conjecture in this paper.

Keywords $D_{1/2\times1/2}$ N domain Riemann Hypothesis Prime numbers Conjectures Collatz Conjecture

1. Division of $D_{1/2\times1/2}$



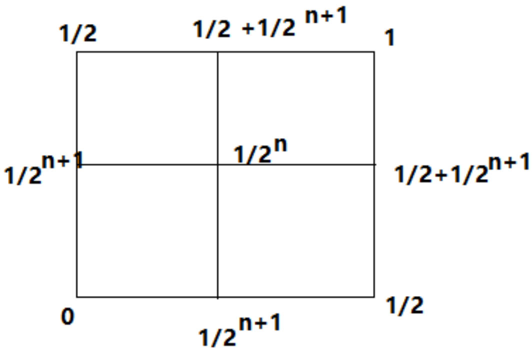


Fig.1. D-domain($D_{1/2\times1/2}$) **Fig.2. $D_{1/2\times1/2}$ regularization division by $1/2^n$**

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.2

the matrix is:

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

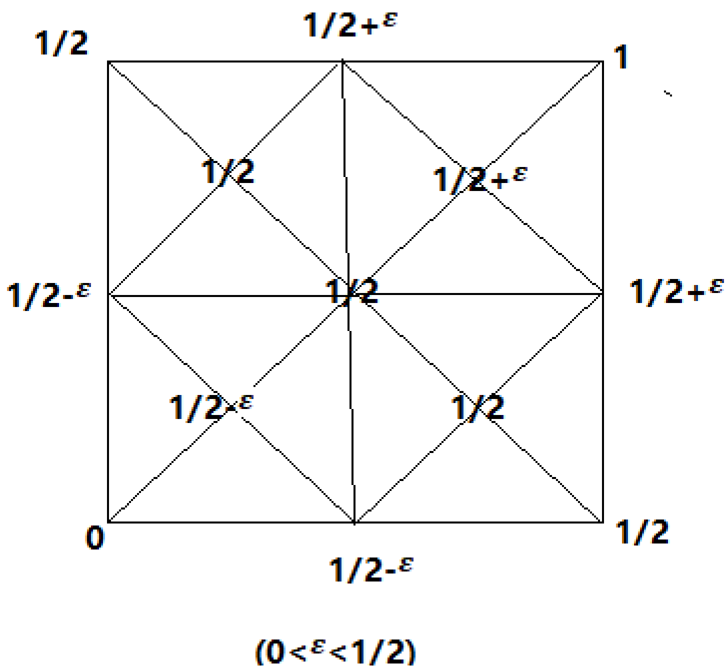


Fig.3. $D_{1/2\times 1/2}$ diagonalization division by ε (0<ε<1/2)

and we can also give a diagonalization division by **ε (0<ε<1/2)** as show Fig.3

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 $1/2^n$ and **ε (0<ε<1/2) just show as on Fig.4**

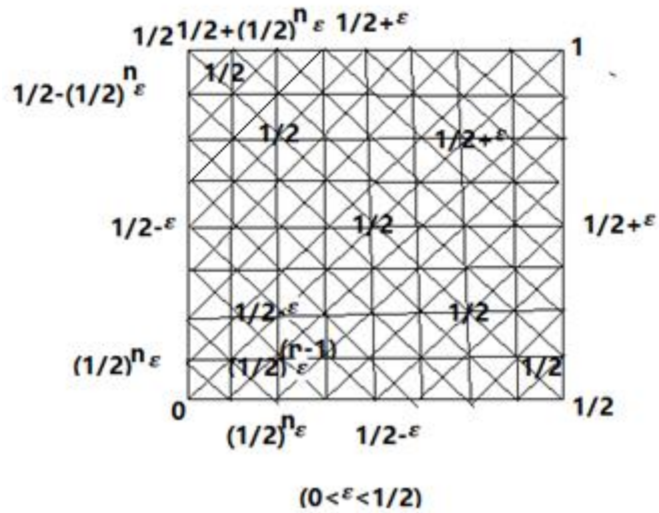


Fig.4. $D_{1/2\times 1/2}$ division by $1/2^n$ and ε (0<ε<1/2)

the matrix is:

$$
\begin{bmatrix}
\mathbf{1/2} & \frac{1}{2}+\frac{1}{2^{n-1}}\varepsilon & \cdots\cdots.. & \cdots\cdots & 1 \\
\frac{1}{2}-\frac{1}{2^{n-1}}\varepsilon \cdots & \cdots\cdots & \cdots\cdots. & \frac{1}{2}+\frac{1}{2^{n-1}}\varepsilon & \cdots\cdots. \\
\cdots\cdots\cdots & \cdots\cdots. & \mathbf{1/2} & \cdots\cdots.. & \cdots\cdots.. \\
\cdots\cdots.. & \frac{1}{2}-\frac{1}{2^{n-1}}\varepsilon & \cdots\cdots. & \cdots\cdots & \cdots\cdots. \\
0 & \cdots\cdots.. & \cdots\cdots\cdots & \cdots\cdots\cdots & \mathbf{1/2}
\end{bmatrix}
$$

The tr(A)=**1/2*n**

ε (0<ε<1/2) we notice $\boldsymbol{\varepsilon} \rightarrow \frac{\mathbf{1}}{\boldsymbol{n}}$ $\quad \boldsymbol{n} \sim (\mathbf{3},\ \mathbf{4},\ \ldots\ldots\ldots)$

All the zero point would be: $\frac{1}{2} \pm \frac{1}{2^{n-1}} \frac{1}{n}$

And when **n** is a prime number **p**, the **zero point would be:** $\frac{1}{2} \pm \frac{1}{2^{p-1}} \frac{1}{p}$

Those are non-trivial zero points.

2. Proof of Riemann Hypothesis.

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 $Re(s) = {}^1/_2$.

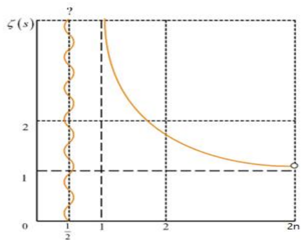
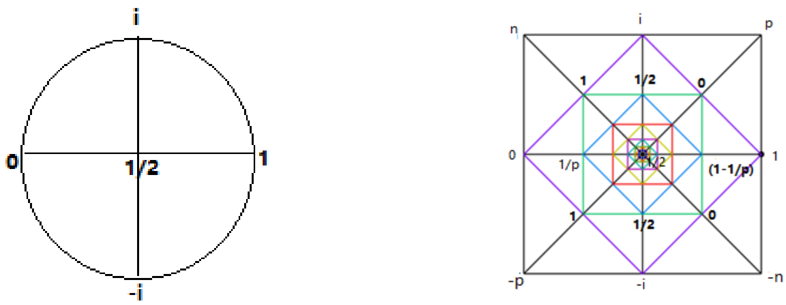


Figure.5. Riemann Hypothesis: all the non-trivial Zero points of Riemann zeta-function are on the 1/2 axis.



(a) $L^{1/2}{}_{(0\ 1/2\ 1)}$ space

(b) N-domain division by $1/2^n$and 1/p

Fig.6. N-domain analytic continuation with1/p in $L^{1/2}{}_{(0\ 1/2\ 1)}$ space

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

$$\frac{1}{p} \to 0$$

$$1 - \frac{1}{p} \to 1$$

$$i^{2n} = \pm 1 \quad i^n = (i \quad -1 \quad -i \quad 1)$$

$$i^p = \pm i$$

$$zp0 = \frac{1}{2} + (1 - \frac{2}{p})i$$

$$zpn = \frac{1}{2} - (1 - \frac{2}{p})i$$

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

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 Fig.6. So we give a proof of Riemann Hypothesis.

In fact, we have

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

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

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

3. 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

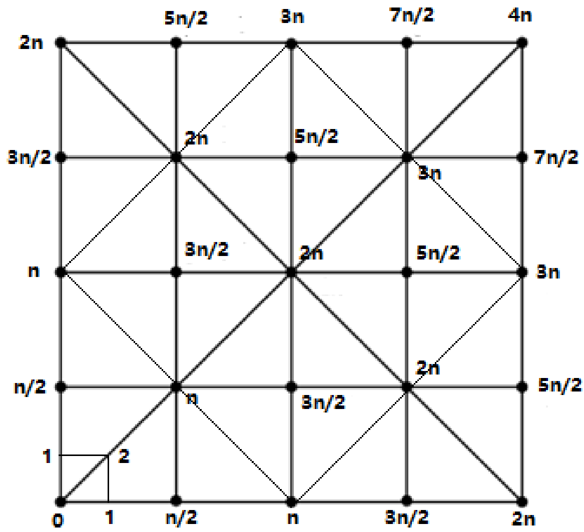


Fig.7. N-domain (2n×2n) Regularization division by n/2

we can get figure.7

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

p0∈P ~(0 , n) pn∈P ~[n , 2n)

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

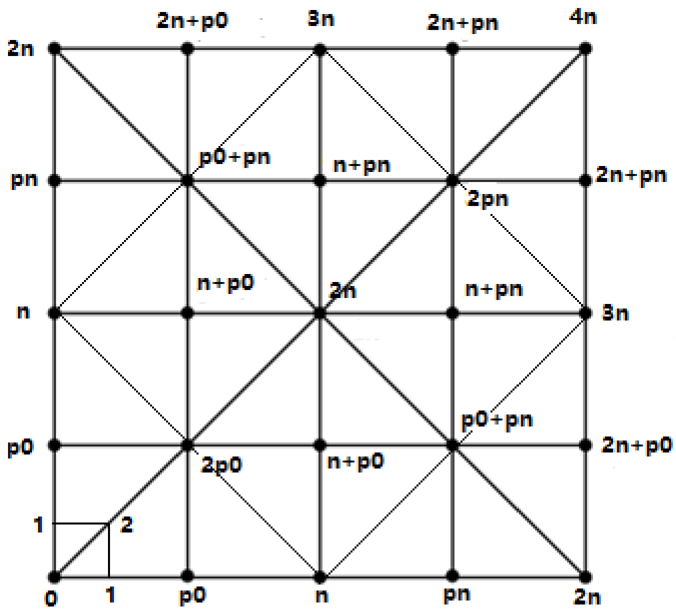


Fig.8. N-domain (2n×2n) Regularization division by n and P

we can get figure.2 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.9 :

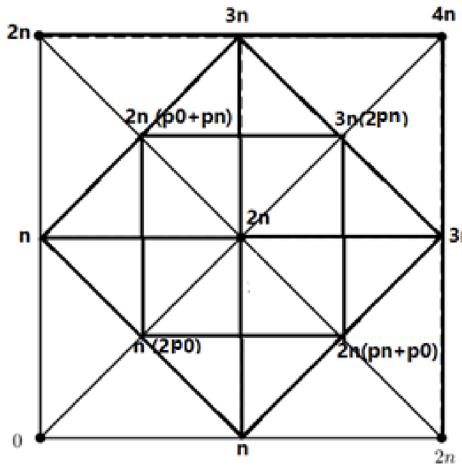


Fig.9. The Symmetry of N-domain 2n×2n (2n=p0+pn)

And All the numbers mod (4n)， then we get fig.10.

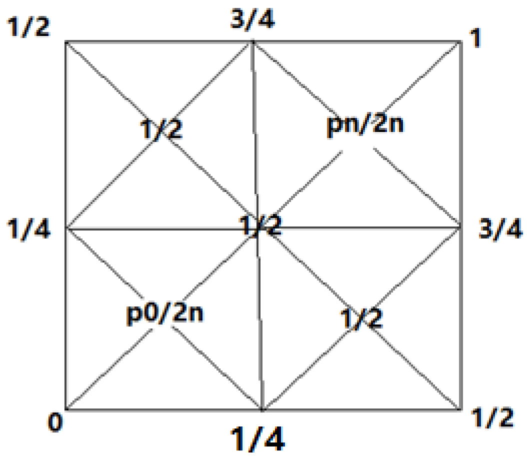


Fig.10. The Symmetry of D-domain 1/2×1/2

So we have:

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

This is the proof of Goldbach conjecture.

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

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

This is the proof of Polignac's conjecture.

And when

$$k = 1$$

$$pn - p0 = 2$$

This is the proof of Twin Primes Conjecture.

In fact we can get a square as show on fig.11.

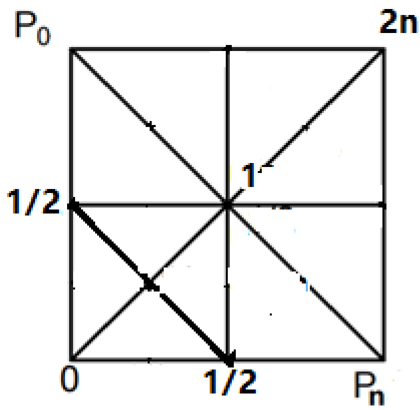


Fig.11. The N-domain (p0×pn)

the matrix is:

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

p0∈P **pn**∈P

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

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

So we have:

$$\frac{2n - p0}{pn - 0} = 1$$

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

This is the proof of Goldbach conjecture.

$$\frac{pn - p0}{2n - 0} = 1$$

$$pn - p0 = 2n$$

$$n \sim \left(1, 2, 3, 4, \ldots\ldots\ldots \right)$$

This is the proof of Polignac's conjecture.
And when

$$n = 1$$
$$pn - p0 = 2$$

This is the proof of Twin Primes Conjecture.

4. Concise proof of Collatz Conjecture

Collatz Conjecture:

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

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

We can get figure.10

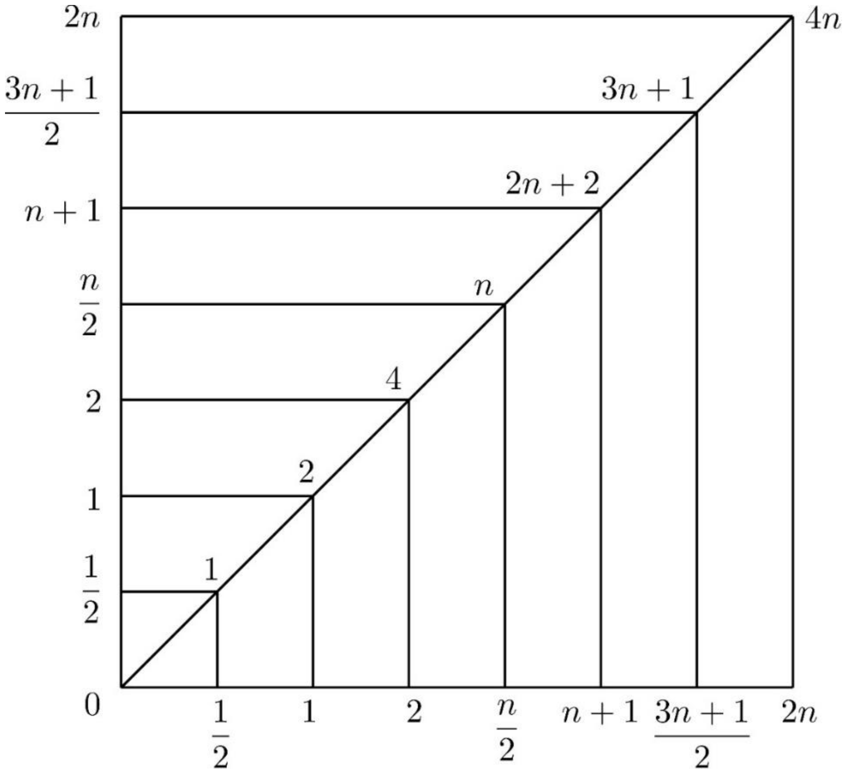


Fig.12 N-domain(2n×2n) Diagonalization division by n/2

n~$\left(1\ ,\ 2\ ,\ 3\ ,\ 4\ ,\ \ldots\ldots\ldots\right)$ all the natural numbers excepted 0

we have:

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

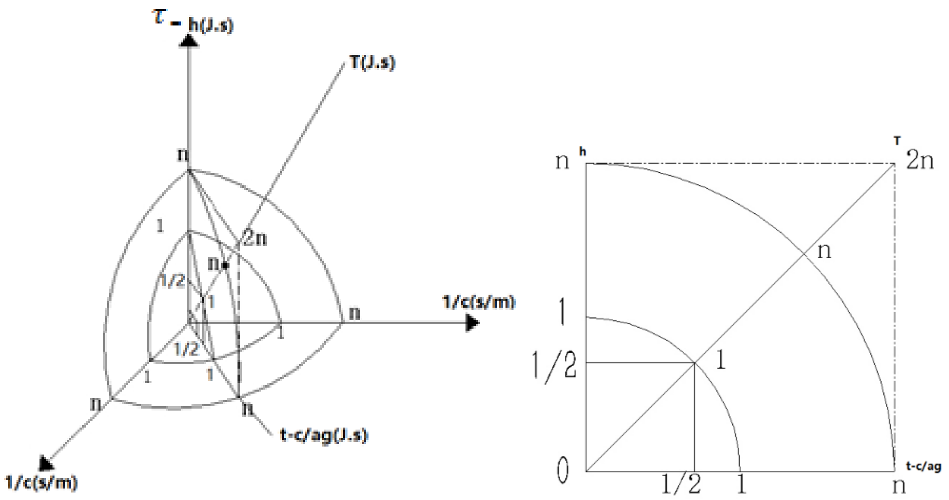
$$= 2 = \sum \frac{1}{2^N}$$

N~ (0, 1, 2,3,4……) all natural numbers. **This is a concise proof of Collatz Conjecture.**

Note

Time quantization

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 and get a **Unified Field Theory.**



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

Fig. 13. Time -space with energy coordinate

τ can be defined as

$$\tau \sim nh \ \ (J.s) \quad n\sim(1,2,3,\dots)$$

h is **Planck constant.**

$\boldsymbol{t}$ can be defined as τ

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

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 (h-1/c-c/ag-T-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 every moment $T\sim 2n$(J.s) show as **fig.12(b)**

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

$$nh = nc/a_g$$

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

So we have:

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

We can define a time space with energy as :

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

$$S_0 \sim \frac{1}{4} * h * \frac{c}{a_g} \quad S_n \sim n^2\, h * \frac{c}{a_g}$$

$$\frac{S_n}{S_0} = 4n^2 \ (\text{J}^2.\text{s}^2)$$

$$\frac{m}{m_0} \sim n^3 \ (\text{J}^3.\text{s}^3)$$

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.**

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