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Uncertainty in Heracletean Dynamics

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Abstract: *The uncertainty of time and space position as a consequence of the duality of time in Heracletean dynamics has been proposed.*

Keywords: *Heracletean dynamics, particle and wave time, uncertainty of time and space position*

1. Introduction

The subject of interest of this paper is with the help of the duality of time – real and imaginary wave time – to propose the uncertainty of time and space position in Heracletean dynamics [1].

2. Particle and Wave Time

In Heracletean dynamics expressed as F = dp/dt + d(k/p)/dt where the dynamics constant k of the ordinary matter equals the product of Planck constant h and the speed of light c we have deal with two fundamental times of matter at ground circumstances, that is the fundamental time of particle $t_{particle}=\sqrt{\frac{h}{c^3}}$ as well as the fundamental time of wave $t_{wave}=\frac{h}{m_{ground}c^2}$ where m_{ground} denotes ground mass. [1] Both times can be related with the help of imaginary wave time $it_{wave}=i\frac{h}{m_{ground}c^2}$ on the elliptic time sphere of radius R_{time} expressed by the spherical law of cosines as follows[1]:

$$\cos\frac{t_{particle}}{R_{time}}=\cos\frac{t_{wave}}{R_{time}}\cos\frac{it_{wave}}{R_{time}}. \tag{1}$$

Or

$$\cos\frac{\sqrt{\frac{h}{c^3}}}{R_{time}}=\cos\frac{\frac{h}{mc^2}}{R_{time}}\cos\frac{i\frac{h}{mc^2}}{R_{time}}. \tag{2}$$

This means that every part of matter spins in the same fundamental time $t_{particle}=\sqrt{\frac{h}{c^3}}$ with each part of the mass manifested as a wave on the different elliptic time sphere radius R_{time}. The wave nature of matter is realized in the – of the mass dependent – real time $t_{wave}=\frac{h}{m_{ground}c^2}$ which is not detected by the observer thanks to the imaginary wave time $it_{wave}=i\frac{h}{m_{ground}c^2}$.

Hyperbolic time sphere has not been taken into account as a possibility for the manifestation of the wave time duality since there the concerned sphere radius should be imaginary. *(See appendix)*

The time sphere radius R_{time} and the length sphere radius R_{length} are related by the speed of light c:

$$\frac{R_{length}}{R_{time}}=c. \tag{3}$$

3. Particle Time – Wave Time Relation

At very large elliptic time sphere radius R_{time} the simplified Hardy's approximation for the cosine function $\cos\frac{t}{R_{time}}=\cos x$ is applicable [2]:

$$\cos x\approx 1-kx^2\ \ and\ \ \cos ix\approx 1+kx^2,\qquad k=\frac{\sqrt{24}}{\pi^2}. \tag{4}$$

So the spherical law of cosines (1) can be approximately written as follows:

$$1-k\left(\frac{t_{particle}}{R_{time}}\right)^2 \approx \left(1-k\left(\frac{t_{wave}}{R_{time}}\right)^2\right)\left(1+k\left(\frac{t_{wave}}{R_{time}}\right)^2\right) = 1-k^2\left(\frac{t_{wave}}{R_{time}}\right)^4. \qquad (5a)$$

Simplified as

$$\frac{t_{particle}}{R_{time}} \approx \sqrt{k}\left(\frac{t_{wave}}{R_{time}}\right)^2,$$

$$t_{particle} \approx \frac{\sqrt[4]{24}}{\pi}\frac{(t_{wave})^2}{R_{time}}. \qquad (5b)$$

4. Mass – Elliptic Time Sphere Radius Relation

With the help of the equation (5b) and taking into account $t_{particle} = \sqrt{\frac{h}{c^3}}$ and $t_{wave} = \frac{h}{m_{ground}c^2}$ the mass – elliptic time sphere radius relation is given:

$$\sqrt{\frac{h}{c^3}} \approx \frac{\sqrt[4]{24}}{\pi}\frac{\left(\frac{h}{m_{ground}c^2}\right)^2}{R_{time}},$$

$$m_{ground}^2 R_{time} \approx \frac{\sqrt[4]{24}}{\pi}\sqrt{\frac{h^3}{c^5}} = 0.772\ 209\ 631\ x\ 10^{-71} kg^2 s. \qquad (6)$$

The elliptic time sphere radius and ground mass are in inverse proportion. Smaller time sphere belongs to the greater mass, and vice versa. Only an infinite mass possesses indisputably certain time position in one moment. On the other hand a time position of zero mass is completely uncertain being dispersed in the infinite elliptic time sphere.

5. Mass – Elliptic Length Sphere Radius Relation

With the help of the equations (3) and (6) the mass – elliptic length sphere radius relation is given:

$$m_{ground}^2 R_{length} \approx \frac{\sqrt[4]{24}}{\pi}\sqrt{\frac{h^3}{c^3}} = 2.315\ 026\ 233\ x\ 10^{-63} kg^2 m. \qquad (7)$$

The elliptic length sphere radius and ground mass are in inverse proportion, too. Smaller length sphere belongs to the greater mass, and vice versa. Only an infinite mass possesses indisputably certain space position in one point. On the other hand a space position of zero mass is completely uncertain being dispersed in the infinite elliptic length sphere. For illustration the length sphere radii of the elementary particles electron, proton and neutron are presented in Table1.

Table1. *Examples of the mass - elliptic length sphere radius relation*

Particle	Ground mass (m_{ground})	Length sphere radius (R_{length})
zero	0	∞
electron	$m_{electron} = 9.109\ 383\ 56\ x\ 10^{-31} kg$	$1149\ 824\ 632\ \lambda_{electron}$
proton	$m_{proton} = 1836{,}15\ m_{electron}$	$341\ \lambda_{electron}$
neutron	$m_{neutron} = 1838{,}68\ m_{electron}$	$340\ \lambda_{electron}$
infinite	∞	0

6. Conclusion

The elliptic length sphere radius is a measure of uncertainty in Heracletean dynamics.

Dedication

To opportunity – the bright side of uncertainty

Figure1. *Cheers*

APPENDIX

On the hyperbolic sphere holds the hyperbolic law of cosines [2]:

$$\cosh \frac{t_{particle}}{R_{time}} = \cosh \frac{t_{wave}}{R_{time}} \cosh \frac{it_{wave}}{R_{time}}. \qquad (A1)$$

Or applying $cosh\, x = \cos ix$ and $\cosh ix = cosx$ we have:

$$\cos \frac{it_{particle}}{R_{time}} = \cos \frac{it_{wave}}{R_{time}} \cos \frac{t_{wave}}{R_{time}}. \qquad (A2)$$

At very large hyperbolic time sphere radius R_{time} the simplified Hardy's approximation for the cosine function $\cos \frac{t}{R_{time}} = \cos x$ is applicable [2]:

It can be approximately written as follows:

$$1 + k\left(\frac{t_{particle}}{R_{time}}\right)^2 \approx \left(1 + k\left(\frac{t_{wave}}{R_{time}}\right)^2\right)\left(1 - k\left(\frac{t_{wave}}{R_{time}}\right)^2\right) = 1 - k^2\left(\frac{t_{wave}}{R_{time}}\right)^4. \qquad (A3)$$

Simplified as

$$\frac{t_{particle}}{R_{time}} \approx i\sqrt{k}\left(\frac{t_{wave}}{R_{time}}\right)^2,$$

$$t_{particle} \approx i\frac{\sqrt[4]{24}}{\pi}\frac{(t_{wave})^2}{R_{time}}. \qquad (A4)$$

Taking into account $t_{particle} = \sqrt{\frac{h}{c^3}}$ and $t_{wave} = \frac{h}{m_{ground}c^2}$ the mass – hyperbolic length sphere radius relation is given:

$$\sqrt{\frac{h}{c^3}} \approx i\frac{\sqrt[4]{24}}{\pi}\frac{\left(\frac{h}{m_{ground}c^2}\right)^2}{R_{time}}. \qquad (A5)$$

Or shown more clearly

$$m_{ground}^2 R_{time} \approx i\frac{\sqrt[4]{24}}{\pi}\sqrt{\frac{h^3}{c^5}} = i\, 0.772\,209\,631\, x\, 10^{-71} kg^2 s. \qquad (A6)$$

So

$$R_{time} \in i\mathbb{R} \;\; as\ well\ as\ R_{length} = cR_{time} \in i\mathbb{R}. \qquad (A7)$$

References

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