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Sphere in Heracletean Dynamics

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Abstract: The wave propagation and particle spinning of matter in Heracletean dynamics could be coordinated on the elliptic sphere at $m \geq \sqrt{\frac{h}{c}}$ and on the hyperbolic sphere at $m \leq \sqrt{\frac{h}{c}}$.

Keywords: *Heracletean dynamics, elliptic and hyperbolic sphere, nominal equality of Compton wavelength and mass, touchable and untouchable mass*

1. Introduction

To coordinate the wave propagation and particle spinning in Heracletean dynamics the matter has to be manifested according to its mass m in the appropriate time sphere, determined by the radius R_{time}, as well as in the appropriate space sphere, determined by the radius R_{space}, both obeying the spherical and hyperbolic law of cosines in the elliptic and hyperbolic sphere, respectively[1]. Hyperbolic time and space sphere has been taken into account in this article to cover the needs of matter at a very low mass, too, including that one originated from the imaginary ground mass.

2. The Elliptic Sphere

On the elliptic sphere holds the spherical law of cosines. [1] For time:

$$\cos\frac{\sqrt{\frac{h}{c^3}}}{R_{elliptic\ time}} = \cos\frac{\frac{h}{mc^2}}{R_{elliptic\ time}}\ \cosh\frac{\frac{h}{mc^2}}{R_{elliptic\ time}}. \tag{1}$$

And consequently for space:

$$\cos\frac{\sqrt{\frac{h}{c}}}{R_{elliptic\ space}} = \cos\frac{\frac{h}{mc}}{R_{elliptic\ space}}\ \cos h\frac{\frac{h}{mc}}{R_{elliptic\ space}}. \tag{2}$$

Where h denotes Planck's constant. The elliptic time sphere radius $R_{elliptic\ time}$ and the elliptic space sphere radius $R_{elliptic\ space}$ are related by the speed of light c as follows:

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

Taking into account $\lambda = \frac{h}{mc}$ the relation (2) can be written in the next form:

$$\cos\frac{\sqrt{\frac{h}{c}}}{R_{elliptic\ space}} = \cos\frac{\lambda}{R_{elliptic\ space}}\ \cos h\frac{\lambda}{R_{elliptic\ space}}. \tag{4}$$

The above equation (4) is defined in the next interval of elliptic space sphere radii (See appendix 1):

$$\frac{2}{\pi}\sqrt{\frac{h}{c}} \leq R_{elliptic\ space} \leq \infty. \tag{5}$$

In the next interval of Compton wavelengths:

$$0 \leq \lambda \leq \sqrt{\frac{h}{c}}. \tag{6}$$

And because of $\lambda = \frac{h}{mc}$ in the next interval of masses:

$$\sqrt{\frac{h}{c}} \leq m \leq \infty. \tag{7}$$

3. The Hyperbolic Sphere

On the hyperbolic sphere holds the hyperbolic law of cosines [1]. For time:

$$\cosh \frac{\sqrt{\frac{h}{c^3}}}{R_{hyperbolic\ time}} = \cos \frac{\frac{h}{mc^2}}{R_{hyperbolic\ time}} \cosh \frac{\frac{h}{mc^2}}{R_{hyperbolic\ time}}. \tag{8}$$

And consequently for space:

$$\cosh \frac{\sqrt{\frac{h}{c}}}{R_{hyperbolic\ space}} = \cos \frac{\frac{h}{mc}}{R_{hyperbolic\ space}} \cos h \frac{\frac{h}{mc}}{R_{hyperbolic\ space}}. \tag{9}$$

Where h denotes Planck's constant. The hyperbolic time sphere radius $R_{hyperbolic\ time}$ and the hyperbolic space sphere radius $R_{hyperbolic\ space}$ are related by the speed of light c as follows:

$$\frac{R_{hyperbolic\ space}}{R_{hyperbolic\ time}} = c. \tag{10}$$

Taking into account $\lambda = \frac{h}{mc}$ the relation (9) can be written in the next form:

$$\cosh \frac{\sqrt{\frac{h}{c}}}{R_{hyperbolic\ space}} = \cos \frac{\lambda}{R_{hyperbolic\ space}} \cos h \frac{\lambda}{R_{hyperbolic\ space}}. \tag{11}$$

The above equation (11) is defined in the next interval of hyperbolic space sphere radii (See appendix 2):

$$\frac{1}{2\pi}\sqrt{\frac{h}{c}} \leq R_{hyperbolic} \leq \infty. \tag{12}$$

In the next interval of Compton wavelengths:

$$\sqrt{\frac{h}{c}} \leq \lambda \leq \infty. \tag{13}$$

And because of $\lambda = \frac{h}{mc}$ in the next interval of masses:

$$0 \leq m \leq \sqrt{\frac{h}{c}}. \tag{14}$$

4. The Space Between

The matter of the nominal equality of Compton wave length and mass $\lambda_{nominal} = m_{nominal} = \sqrt{\frac{h}{c}}$ exists in the space between of the next minimal space sphere radii (5), (12):

$$R_{minimal\ hyperbolic} = \frac{1}{2\pi}\sqrt{\frac{h}{c}} \ldots R_{space\ between} \cdots \sqrt{\frac{h}{c}} = R_{minimal\ elliptic}. \tag{15}$$

And the corresponding space sphere circumferences:

$$2\pi R_{minimal\ hyperbolic} = \sqrt{\frac{h}{c}} \ldots 2\pi R_{space\ between} \ldots 4\sqrt{\frac{h}{c}} = 2\pi R_{minimal\ elliptic}. \quad (16)$$

5. The Space Sphere Radius and Circumference

The elliptic space sphere radius of any matter is greater or at least equal the elliptic radius of the space between (5):

$$R_{elliptic\ space} \geq \frac{2}{\pi}\sqrt{\frac{h}{c}}. \quad (17)$$

And the corresponding elliptic circumference is greater or at least equal the elliptic circumference of the space between:

$$2\pi R_{elliptic\ space} \geq 4\sqrt{\frac{h}{c}}. \quad (18)$$

The hyperbolic space sphere radius of any matter is greater or at least equal the hyperbolic radius of the space between (12):

$$R_{hyperbolic\ space} \geq \frac{1}{2\pi}\sqrt{\frac{h}{c}}. \quad (19)$$

And the corresponding hyperbolic circumference is greater or at least equal the hyperbolic circumference of the space between:

$$2\pi R_{hyperbolic\ space} \geq \sqrt{\frac{h}{c}}. \quad (20)$$

6. Compton wavelength and Type of Sphere

The elliptic sphere is reserved for Compton wavelengths equal or shorter than $\sqrt{\frac{h}{c}}$. The hyperbolic sphere is reserved for Compton wavelengths equal or longer than $\sqrt{\frac{h}{c}}$.

7. Mass and Type of Sphere

The elliptic sphere is reserved for masses equal or heavier than $\sqrt{\frac{h}{c}}$. The hyperbolic sphere is reserved for masses equal or lighter than $\sqrt{\frac{h}{c}}$.

8. The Untouchable and Touchable Mass

The matter of the nominal equality of Compton wavelength and ground mass $\lambda = m_0 = \sqrt{\frac{h}{c}}$ possesses luminal ground speed $v_0 = c$.[2] In Heracletean dynamics the kinetic energy at ground speed is zero and the kinetic energy at luminal speed is maximal.[2] A matter with mass $\sqrt{\frac{h}{c}}$ at the speed of light can neither offer nor receive any kinetic energy.[2] It is thus anyway untouchable:

$$m_{untouchable} = m = m_0 = \sqrt{\frac{h}{c}}. \quad (19)$$

A touchable matter should have the ground mass m_0 heavier or lighter than $\sqrt{\frac{h}{c}}$:

$$m_0^{touchable} \neq \sqrt{\frac{h}{c}}. \quad (20)$$

And consequently the ground speed v_0 of a touchable matter should be subluminal or superluminal:

$$v_0^{touchable} \neq c. \quad (21)$$

Masses heavier than $\sqrt{\frac{h}{c}}$ are subluminal, and masses lighter than $\sqrt{\frac{h}{c}}$ are superluminal. Energy equivalents greater than 0.834 PeV are subluminal, and energy equivalents smaller than 0.834 PeV are superluminal. The subluminal world is elliptic and superluminal world is hyperbolic. The ground mass and ground speed of touchable matter could be in Heracletean dynamics even imaginary.[2]. To reach the luminal speed the input of kinetic energy is needed to the subluminal elliptic matter as well as to the superluminal hyperbolic matter.[2] More touchable mater has a greater kinetic energy storage capacity of its mass. Sphere characteristics of matter in Heracletean dynamics are collected in Table1.

Table1. *Sphere characteristics of matter in Heracletean dynamics*

Ground Speed	Ground mass	Wavelength	Energy equivalent	Sphere radius	Sphere circumference	Sphere type	Touch
$v_0 < c$	$m_0 > \sqrt{\frac{h}{c}}$	$\lambda < \sqrt{\frac{h}{c}}$	$mc^2 > 0.834$ PeV	$R_{elliptic} > \frac{2}{\pi}\sqrt{\frac{h}{c}}$	$> 4\sqrt{\frac{h}{c}}$	Elliptic	Touchable
$v_0 = c$	$m_0 = \sqrt{\frac{h}{c}}$	$\lambda = \sqrt{\frac{h}{c}}$	$mc^2 =$ 0.834 PeV	$\frac{2}{\pi}\sqrt{\frac{h}{c}} \dots \dots \frac{1}{2\pi}\sqrt{\frac{h}{c}}$	$4\sqrt{\frac{h}{c}} \dots \dots \sqrt{\frac{h}{c}}$	Elliptic-hyperbolic space between	Untouchable
$v_0 > c$	$m_0 < \sqrt{\frac{h}{c}}$	$\lambda > \sqrt{\frac{h}{c}}$	$mc^2 < 0.834$ PeV	$R_{hyperbolic} > \frac{1}{2\pi}\sqrt{\frac{h}{c}}$	$> \sqrt{\frac{h}{c}}$	Hyperbolic	Touchable

9. CONCLUSION

In Heracletean dynamics the matter of macro and micro world can coexist with the help of elliptic-hyperbolic sphere diversity.

DEDICATION

To an unexpected life since it is miracle

Figure1. *Miracle*

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[2] Janez Špringer, (2020). Neutrino Mass and Energy Obeying Heracletean Dynamics (Third time's a charm). International Journal of Advanced Research in Physical Science (IJARPS) 7(11), pp.1-3, 2020.

APPENDIX 1

$$\cos\frac{\sqrt{\frac{h}{c}}}{R_{elliptic\ space}} = \cos\frac{\lambda}{R_{elliptic\ space}}\ \cos h\frac{\lambda}{R_{elliptic\ space}}. \quad (4)$$

Function $\cos y = \cos x \cosh x$ is defined in the range$[0,1]$.

a) The zero value of $\cos y$ is achieved in the next case:

$$\cos\frac{\pi}{2} = \cos\frac{\pi}{2}\cosh x.$$

Taking into account (4) we have:

$$\frac{\sqrt{\frac{h}{c}}}{R_{elliptic\ space}} = \frac{\pi}{2} = \frac{\lambda}{R_{elliptic\ space}}.$$

And consequently $R_{elliptic\ space} = \frac{2}{\pi}\sqrt{\frac{h}{c}}\ and\ \lambda = \sqrt{\frac{h}{c}}.$

b) The unit value of $\cos y$ is achieved in the next case:

$\cos 0 = \cos 0 \cosh 0 = 1.1 = 1.$

Taking into account (4) we have:

$$\frac{\sqrt{\frac{h}{c}}}{R_{elliptic\ space}} = 0 = \frac{\lambda}{R_{elliptic\ space}}.$$

And consequently $R_{elliptic\ space} = \infty\ and\ \lambda = 0.$

APPENDIX 2

$$\cos h\frac{\sqrt{\frac{h}{c}}}{R_{hyperbolic\ space}} = \cos\frac{\lambda}{R_{hyperbolic\ space}}\ \cos h\frac{\lambda}{R_{hyperbolic\ space}}. \quad (11)$$

Function $\cosh y = \cos x \cosh x$ is defined in the range $[1, \cosh 2\pi]$.

a) The unite value of $\cosh y$ is achieved in the next case:

$\cosh 0 = \cos 4.730\ 040\ 745\ .\cosh 4.730\ 040\ 745 = 0{,}017\ 650\ 848\ x\ 56{,}654\ 502\ 383 = 1.$

Taking into account (11) we have:

$$\frac{\sqrt{\frac{h}{c}}}{R_{hyperbolic\ space}} = 0.$$

And consequently $R_{hyperbolic\ space} = \infty$.

Taking into account (11) again we have:

$$\frac{\lambda}{R_{hyperbolic\ space}} = 4.730\ 040\ 745.$$

And consequently $\lambda = \infty$.

b) The value $\cosh 2\pi$ is achieved in the next case:

$\cosh 2\pi = \cos 2\pi \cosh 2\pi.$

$1 = \cos 2\pi.$

$1 = 1.$

Taking into account (11) we have:

$$\frac{\sqrt{\frac{h}{c}}}{R_{hyperbolic\ space}} = 2\pi = \frac{\lambda}{R_{hyperbolic\ space}}.$$

And consequently $R_{hyperbolic\ space} = \frac{1}{2\pi}\sqrt{\frac{h}{c}}\ and\ \lambda = \sqrt{\frac{h}{c}}$.

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