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Pseudo-Heracletean Dynamics and Electron Spin G-Factor (On the Way Back to Reality)

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Abstract: *Previously one introduced the discrete communication model between mass particles in Heracletean world. In this paper applying pseudo-Heracletean dynamics the direct communication between electron and proton-nucleus in the ground state of Hydrogen atom is proposed. As a consequence of the effort the electron circulation-translation time period ratio* $n = 2{,}002319$ *being roughly equal the electron spin g-factor is revealed.*

Keywords: *Heracletean and pseudo-Heracletean dynamics, discrete and direct communication, circulation-translation time period ratio, electron spin and spin g-factor, shortened Bohr radius and circumference, ground mass-equivalent and ground speed, ground momentum and ground wavelength, ground circumstances and ground state of Hydrogen, electron and proton-nucleus, lower and higher circulation speed.*

1. Theoretical Background

In Heracletean dynamics [1] two speeds v_{lower} and v_{higher} belong to every mass-equivalent m. They are related by the dynamic constant k as follows[1]:

$$v_{lower}\ x\ v_{higher} = \frac{k}{m^2}. \tag{1}$$

Being identical in the ground circumstances both speeds (then denoted v_{ground}) are expressed as [1]:

$$v_{lower} = v_{higher} = v_{ground} = \frac{\sqrt{k}}{m_{ground}}. \tag{2}$$

The lower speed v_{lower} is downside limited [2]:

$$v_{minimal} = \frac{ck}{\left(e^{\frac{m_{ground}^2\ c^2}{k}+lnk} - k\right)\sqrt{1+\frac{k}{e^{\frac{m_{ground}^2\ c^2}{k}+lnk} - k}}} \le v_{lower}\ . \tag{3}$$

And the higher speed v_{higher} is limited upside [2]:

$$v_{higher} \le c\sqrt{1+\frac{k}{e^{\frac{m_{ground}^2\ c^2}{k}+lnk} - k}} = v_{maximal}\ . \tag{4}$$

To be Heracletean the speeds should be located inside the next interval (3), (4):

$$v_{minimal} \le v_{Heracletean} \le v_{maximal}\ . \tag{5}$$

The speeds outside the interval (5) are not Heracletean. For them the pseudo-Heracletean dynamics is proposed where lower speed v_{lower} and higher speed v_{higher} belongs to the ground mass m_{ground} related by the dynamic constant k as follows:

$$\left(v_{lower}\ x\ v_{higher} = \frac{k}{m_{ground}^2}\right). \tag{6}$$

The pseudo-Heracletean meaning is denoted by parenthesis.

The ground mass-equivalents m_{ground} differ regarding the self-mass m_0[1]:

$$m_{ground} = \frac{\sqrt{k(1-lnk)+m_0^2c^2}}{c}. \tag{7}$$

But all of them have the same ground momentum [1]:

$$p_{ground} = m_{ground}\, v_{ground} = \sqrt{k}. \tag{8}$$

As well as the same de Broglie ground wavelength λ_{ground} is attributed to any ground mass-equivalent m_{ground} (8):

$$\lambda_{ground} = \frac{h}{p_{ground}} = \frac{h}{\sqrt{k}}. \tag{9}$$

The same wavelength enables the communication between all mass particles. In Heracletean dynamics it can be made by the means of lighter and therefore faster mass particles (8). In pseudo-Heracletean dynamics the communication is carried out by the particles themselves (6). The object of interest in this paper is to examine how it is done in the ground state of Hydrogen atom.

2. THE GROUND STATE OF HYDROGEN ATOM

As already shown previously [3] the communication between mass particles can be made the most effectively with the help of the zero self-mass particles which are the fastest. The circulation of electron with the lower speed $v_{lower} = \alpha c$ provided on the circumference $2\pi R_{Bohr}$ around proton-nucleus is maintained with the help of the translation of two zero self-mass particles moving on Bohr radius R_{Bohr}. [3] They prevent a drop of electron in the proton-nucleus. The question arises if the mentioned prevention is sufficient since the electron could possess the higher circulation speed $v_{higher} = \frac{k}{m^2 v_{lower}}$ $(1), (6)$, too. And after all, having the ground speed $v_{ground} = \frac{\sqrt{k}}{m_{ground}}$ (2) in the radial direction it should move towards and apart from the proton-nucleus.

2.1. Ranging of Circulation Speeds of Electron

Using CODATA values of electron mass m_e and speed of light c[5] as well as taking into account from the discrete communication model predicted value of the dynamic constant $k = \left(\frac{2h}{R_{Bohr} - (r_{electron} + r_{proton})}\right)^2 = 6{,}2723515(15)\, x\, 10^{-46} kg^2 m^2 s^{-2}$[3] both extreme Heracletean speeds of electron $v_{minimal}$ (3) and $v_{maximal}$ (4) are calculated:

$$v_{minimal} \approx \frac{kc}{e^{\frac{m_e^2 c^2}{k} + lnk}} = 2.30\, x\, 10^{-6} c. \tag{10}$$

And

$$v_{maximal} = c. \tag{11}$$

Knowing the lower circulation speed of electron $v_{lower} = \alpha c$ where α is fine structure constant the higher circulation speed of electron v_{higher} $(1), (6)$ is given:

$$v_{higher} = \frac{k}{m_e^2 \alpha c} = 1.15c. \tag{12}$$

Ranging the concerned speeds we have:

$$v_{minimal} = 2.30\, x\, 10^{-6} c < v_{lower} = \alpha c < v_{maximal} = c < v_{higher} = 1.15c. \tag{13}$$

It is evident that the higher circulation speed of electron $v_{higher} = 1.15c$ being higher than the maximal allowed Heracletean speed c can obey only the pseudo-Heracletean dynamics $(5), (6)$.

2.2. The Pseudo-Heracletean Dynamics of Electron

Respecting the pseudo-Heracletean dynamics $(6), (12)$ the electron at the higher circulation speed $v_{higher} = 1.15c$ retains the ground mass-equivalent m_e. But because of the two-body problem in the circulation around proton-nucleus [4] the reduced mass of electron takes a role of the circulation mass $m_{circulation}$ as follows:

$$m_{circulation} = \left(1 + \frac{m_e}{m_p}\right)^{-1} m_e. \tag{14}$$

Inserting the lower circulation speed of electron $v_{lower} = \alpha c$ in the equation (6) the higher circulation speed of electron with mass $m_{circulation}$ (13) is given:

$$v_{higher} = \frac{k}{\left(1+\frac{m_e}{m_p}\right)^{-2} m_e^2 \alpha c}. \tag{15}$$

It is provided at the circulation time $t_{circulation}$ in the path on Bohr circumference:

$$s_{circulation} = 2\pi R_{Bohr}. \tag{16}$$

For more precise calculations the shortened Bohr radius $R_{Bohr} - (r_{electron} + r_{proton})$ which equals two ground wavelengths λ_{ground} should be used [3].

2.3. The Translation of Electron on Bohr Radius

Taking into account the ground mass-equivalent of electron $m_{ground} = m_e$ the ground speed of electron on Bohr radius is given (2):

$$v_{ground} = \frac{\sqrt{k}}{m_e}. \tag{17}$$

Using CODATA values for m_e [5] and from the discrete communication model predicted value of the dynamic constant k[3] the next value of the ground speed of electron is calculated:

$$v_{ground} = 0{,}092\, c. \tag{18}$$

It is provided at the translation time $t_{translation}$ in the path on Bohr radius:

$$s_{translation} = 2R_{Bohr}. \tag{19}$$

Again, for more precise calculations the shortened Bohr radius $R_{Bohr} - (r_{electron} + r_{proton})$ which equals two ground wavelengths λ_{ground} should be used [3].

2.4. The Circulation-Translation Time Period Ratio

The circulation time period of electron $t_{circulation}$ spent on the circumference $2\pi R_{Bohr}$ around Hydrogen proton-nucleus is longer than the translation time period of electron $t_{translation}$ spent on the two Bohr radii since the circulation path is longer than translation path $(2\pi > 2)$:

$$s_{circulation} = 2\pi R_{Bohr} > s_{translation} = 2R_{Bohr}. \tag{20}$$

And the circulation speed is smaller than translation speed $(17), (18)$:

$$v_{circulation} = \frac{k}{\left(1+\frac{m_e}{m_p}\right)^{-2} m_e^2 \alpha c} < v_{translation} = \frac{\sqrt{k}}{m_e}. \tag{21}$$

So because of $t = \frac{s}{v}$ holds:

$$n = \frac{t_{circulation}}{t_{translation}} = \frac{\alpha^{-1}\sqrt{k}}{2\pi\left(1+\frac{m_e}{m_p}\right)^{-2} m_e c} > 1 \tag{22}$$

Here m_e, m_p, c, α^{-1} is electron mass, proton mass, official speed of light and inverse fine structure constant, respectively, and n is the circulation-translation time period ratio showing how much longer lasts the cycle of circulation on the orbit regarding the cycle of translation on the radius.

3. The Circulation-Translation Time Period Ratio and Electron Spin G-Factor

Using again CODATA values of α^{-1}, m_e, m_p, c [5] and from the discrete communication model predicted value of the dynamic constant k[3] the next circulation-translation time period ratio is calculated:

$$n = 2{,}00231880(24). \tag{23}$$

The given value resembles the electron spin $g_{factor} = \mathbf{2{,}002319}30436182(52)$.[4] It differs from it only on the seventh decimal place:

$$g_{factor} - n = 0.00000050(24). \tag{24}$$

4. The Adjustment of the Circulation-Translation Time Period Ratio N and Electron Spin G-Factor

Applying some higher value of the inverse fine structure constant α^{-1} in the equation (22) the identical value of the circulation-translation time period ratio n and electron spin g_{factor} may be obtained. For instance, the theoretical inverse fine structure constant of the infinite-sided distribution of path around Bohr orbit [6] $\alpha^{-1} \approx \alpha^{-1}_{\infty-sided} = 137{,}036018$ can completely satisfy the equality between concerned numbers.

5. Conclusion Remarks

The small difference between the circulation-translation time period ratio n and electron spin g_{factor} is worthy of attention. The electron should make a half spin on its translation path on Bohr radius from orbit to orbit. The value of n being more than 2 is reasonable since it only implies the radial path of electron does not lead through the proton-nucleus. Instead, the electron path at some angle repel from it. The offered theoretical similarities contribute to the aesthetic value of the research rather than the functional one. But take precedence over the previous conclusions [3] extracting from pure imagination, i.e. the number 84.

Dedication

This fragment is dedicated to S**love**ne – my mother tongue. And **Love** – mother language of everyone

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