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About Electron Position in Ground State of Hydrogen Atom

(Another Variation on a Theme)

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Abstract: *In this paper according to Heracletean dynamics the electron radial position in the ground state of Hydrogen atom is introduced, i.e.* $r_{1,2} = R_{Bohr} \mp 1.226301\lambda_{Compton}$ *of the electron.*

Keywords: *Heracletean dynamics and electron radial position in the ground state of Hydrogen atom, pseudo-Heracletean dynamics on double surface and electron position radius*

1. PREFACE

The subject of interest of this paper is with the help of Heracletean dynamics[1]to enlighten the electron position in the ground state of Hydrogen atom.

2. THE GROUND CIRCUMSTANCES

At Heracletean dynamics [1] mass particles possess zero kinetic energy at the non-zero speed. It happens at the ground circumstances where mass, denoted m_{ground} , and speed, denoted v_{ground} , is related by the dynamic constant k as follows[1]:

$$m_{ground}\ x\ v_{ground} = \sqrt{k}\,. \tag{1}$$

For the purpose of the present paper it is convenient to express the speed in the units of official speed of light c as:

$$a_{ground} = \frac{v_{ground}}{c}. \tag{2}$$

Hence(1), (2):

$$m_{ground}\ x\ a_{ground} = \frac{\sqrt{k}}{c}. \tag{3}$$

3. THE ELECTRON GROUND CIRCUMSTANCES

Taking into account $k = 6.2723515\ x\ 10^{-46} kg^2 m^2 s^{-2}$[2] and $c = 2.99792458\ x\ 10^8 \frac{m}{s}$[3] the electron with the ground mass $m_{ground} = 9{,}109\ 382\ 15(45) x\ 10^{-31} kg$[3]has the next ground speed expressed in the units of official speed of light c:

$$a_{ground} = \frac{v_{ground}}{c} = 0{,}091707650973. \tag{4}$$

4. THE GROUND STATE OF HYDROGEN ATOM

In the ground state of Hydrogen atom the electron possesses the non-zero kinetic energy $W_k = \Delta mc^2$. The concerned non-zero mass equivalent Δm is related to the inverse fine structure constantα^{-1}[4]:

$$\Delta m = \frac{m_{ground}}{2\alpha^{-2}}. \tag{5}$$

Applying (5) is evident that the electron non-ground mass m is related to the inverse fine structure, too:

$$m = m_{ground} + \Delta m = m_{ground}\left(1 + \frac{1}{2\alpha^{-2}}\right). \tag{6}$$

Two different speeds $a_1 < a_{ground}$ and $a_2 > a_{ground}$ belong to the non-ground mass m of the electron in the ground state of Hydrogen atom[1]:

$$a_1 x\, a_2 = \frac{k}{m^2c^2}. \tag{7}$$

The above speeds are given solving the panta rei equation[1]:

$$m^2c^2a^2 = e^{\frac{m_{ground}{}^2c^2 - k(1-lnk)+m^2c^2(a^2-1)}{k}}. \tag{8}$$

For the theoretical inverse fine structure constant $\alpha^{-1} = 137.036006$ deduced from the double surface concept[5], for instance, the electron non-ground speeds $a_1 and\, a_2$ in the ground state of Hydrogen atom are the next:

$$a_1 = 0.086594611656 < a_{ground} = 0{,}091707650973 < a_2 = 0.096912605053. \tag{9}$$

And the average electron speed $\bar{a}$ in that state yields:

$$\bar{a} = \frac{a_1 + a_2}{2} = 0.091753608354 = 1{,}000501129200\; a_{ground}\,. \tag{10}$$

5. THE ELECTRONPATH IN THE GROUND STATE OF HYDROGEN ATOM

In the ground state of Hydrogen atom the electron circulates with the average speed $\bar{a}(10)$on Bohr circumference of the length $\bar{s} = \alpha^{-1}$ expressed in Compton wavelengths of the electron[6]. With the lower speed a_1 the electron circulates below and with the higher speed a_2 above that average orbit. To pass the different circulation paths s in the same time t the ratio of paths s should equal the ratio of speeds a:

$$t = \frac{s_1}{a_1} = \frac{\bar{s}}{\bar{a}} = \frac{s_2}{a_2}. \tag{12}$$

Hence:

$$\frac{s_1}{\bar{s}} = \frac{a_1}{\bar{a}} \quad and \quad \frac{s_1}{s_2} = \frac{a_1}{a_2} \quad and \quad \frac{s_2}{\bar{s}} = \frac{a_2}{\bar{a}}. \tag{13}$$

The same holds true for the corresponding circulation radii $r = \frac{s}{2\pi}$:

$$\frac{r_1}{R_{Bohr}} = \frac{a_1}{\bar{a}} \quad and \quad \frac{r_1}{r_2} = \frac{a_1}{a_2} \quad and \quad \frac{r_2}{R_{Bohr}} = \frac{a_2}{\bar{a}}. \tag{14}$$

Using the relations (13) and (14) the circulation circumferences and corresponding radii can be calculated. The mentioned data are collected in the Table1.

Table1. *The electron speeds, circumferences and corresponding radii in the ground state of Hydrogen atom*

	Circulation speed (c)	Circulation circumference $(\lambda_{Compton})$	Circulation radius $(\lambda_{Compton})$
Higher position	$a_2 = 0.096912605053$	$s_2 = 144.741080 = \alpha^{-1} + 7.705074$	$r_2 = 23.036258 = R_{Bohr} + 1.226301$
Average position	$\bar{a} = 0.091753608354$	$\bar{s} = 137.036006 = \alpha^{-1}$	$\bar{r} = 21{,}809958 = R_{Bohr}$
Lower position	$a_1 = 0.086594611656$	$s_1 = 129.330932 = \alpha^{-1} - 7.705074$	$r_1 = 20.583657 = R_{Bohr} - 1.226301$
Extreme difference	$\Delta a = a_2 - a_1 = 0.010317993397$	$\Delta s = s_2 - s_1 = 15.410148$	$\Delta r = r_2 - r_1 = 2.452602$

It is evident from the Table 1 that the proposed higher and lower electron position in the ground state of Hydrogen atom is found at 1.226301Compton wavelengths of the electron apart from Bohr radius. And the radial distance between both extreme electron positions Δr is the next:

$$\Delta r = r_2 - r_1 = 2.452602\; \lambda_{Compton}\,. \tag{15}$$

Following pseudo-Heracletean dynamics on double surface the electron should be found somewhere on its position radius $r_{position} = 2.487435$ expressed in Compton wavelengths of the electron[7]what is in accordance with the given result(15):

$$\Delta r = 2.452602\; \lambda_{Compton} < r_{position} = 2.487435\; x\; \lambda_{Compton}\,. \tag{16}$$

6. CONCLUSIONS

The proposed extreme radial distance between the electron positions in the ground state of Hydrogen atom Δr is a consequence of Heracletean dynamics. On the other hand the electron position radius $r_{position}$ is a consequence of pseudo-Heracletean dynamics. The observed similarity of numbers shows the common essence of both aspects of the theory.

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