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The electro-ultimate particles and a new method for detecting the photon static mass

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Abstract

In allusion to the high-speed electronic energy convergence phenomena, according to the relevant electromagnetic theory as well as the mass-energy and kinetic energy equation of Einstein's special relativity, the study concluded that a moving electronic charge would follow along with its static mass synchronously to be lost. Since an electron can be further broken down, then there should be a kind of more fundamental particles to compose, which can be referred to as "electro-base particles". It should be the electro-ultimate particles whose charge-mass ratio is equal to that of electronic physical constants. A corollary is that all photons radiating from the electrons in a storage ring are composed of the electro-base particles. Then based on de Broglie's matter wave concept, it is pointed out that the high-speed particles' energy convergence effect should be the primary factor in causing spectral redshift. Finally, using HLS 800MeV electron storage ring as an example, we have calculated the moving speed of electrons, and estimated the approximate ranges of the wavelength and static mass. And further, by the aid of a well known experimental fact in the industry but it seems to have been neglected, based on the Law of Energy Conservation, in allusion to the radiated photon whose characteristic wavelength is 2.427 (nm), we have calculated the moving speed and static mass, as well as the deflection radius in the magnetic field. Moreover, to verify whether the above arguments are set up, this paper introduces a method about measuring the wavelength value of electrons in a storage ring.

1. Introduction

The so-called a photon static mass is equal to zero^[1], which goes against the mass-energy and kinetic energy equations^[2] of Einstein's special relativity, because it has energy in reality. The main purpose of this study is to explore a method of measuring the photon static mass from a new perspective which is the high-speed electronic convergence phenomena. Proceeding further, we use a well known experimental fact in the industry but it seems to have been neglected that the energy of a photon radiating from the electron storage ring is increased about billions times than before, while the radiation occurring before and after for an instant. Finally, based on the Law of Energy Conservation and de Broglie's matter wave concept^[3], its moving speed and static mass, as well as the deflection radius in the magnetic field have been calculated.

2. Special Relativity can be used to Explain the Experimental Data Submitted by Jihao

Based on the experimental data ^[4-6] submitted by Jihao, we have got two tables after collating as follows:

In Table 1, all of the "Measured radius" values from the trajectories were $R=18$ (cm), which were six kinds of energy electrons moving in a same uniform magnetic field, and perpendicular to the magnetic induction intensity, $B=0.121$ (T). In Table 2, the "Measured temperature-rising" values were measured with the calorimetry directly out of the electrons energy, and the experimental results showed that the values which were provided from four kinds of energy electrons, 8 to 15 (MeV), all were 1.03 °C generated in the same lead target. All kind of the electron beams used in both experiments were from the same U.S. Varian 2300C/D linear accelerator. As a control, the current prevailing theoretical values were listed in the tables.

Table 1. The relationship between electron energies and measured radius values, $B=0.121$ (T).

Electron energy E/MeV	20	16	12	9	6	4
Relative speed $\beta=v/c$	0.99 97	0.99 95	0.99 92	0.99 86	0.99 69	0.99 08
Theoretical radius R/cm	55	44	33	25	17	11
Measured radius R/cm	18	18	18	18	18	18

Table 2. About the energy and temperature values comparing between the theoretical and measured.

Electron energy E/MeV	15	12	10	8	6	1.6
Relative speed $\beta=v/c$	0.99 95	0.99 92	0.99 9	0.99 8	0.99 7	0.97 0
Theoretical temperature-rising /°C	6.29	5.03	4.20	3.36	2.52	0.67
Measured temperature-rising /°C	1.03	1.03	1.03	1.03	1.0	0.97

This seems to imply that the mass of electron doesn't change so much like the theory of relativity predicted when it is moving close to the speed of light in vacuum. In view of the above, teacher Jihao laid claim to question ^[5] the mass-speed equation,

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \quad (1),$$

of Einstein's special relativity. In this formula 1, m is the dynamic mass when the electron speed is equal to v , or called relativistic mass; m_0 is the electron static mass, or called rest mass, it will no longer be a constant in this paper; c is the value of the speed of light in vacuum.

It should be noted that each electron has been acquiesced in an elementary particle which can not be further broken down, and put the static mass m_0 as a constant, this is the main basis questioned by teacher Jihao. It is this "main basis" which goes against the experimental data submitted by Jihao. However, it is precisely these experimental data that can form a perfect combination with Einstein's special relativity. Of course, we can visually see the high-speed electronic energy convergence phenomena to discuss, and this is precisely a valuable point of the experimental data submitted by Jihao.

3. Qualitative Analyses of the High-Speed Electronic Energy Convergence Phenomena

In allusion to the experimental data submitted by Jihao, we just need to qualitative analysis by the aid of the kinetic energy equation ^[5],

$$E_k = E - E_0 = m_0 c^2 \left(\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} - 1 \right) \quad (2),$$

of Einstein's special relativity, it can be seen when an electron speed is very close to the value c , its static mass m_0 only can be closed to zero little by little because of the energy showing a finite value and convergence phenomenon. In the formula 2, the static energy, $E_0 = m_0 c^2$, and total energy E , both of them belong to the same moving electron. This is the famous mass-energy equation,

$$E = mc^2 \quad \text{or} \quad \Delta E = \Delta mc^2 \quad (3),$$

in Einstein's special relativity. The implication ^[2] is that if a moving electron (or body) releases energy E in the form of radiation, its mass will reduce the E/c^2 . According to the formula 1, it is essentially the static mass m_0 decreasing.

Also explain, the relativistic mass m of a moving electron (or body) in the formula 1 and 3, which is a transitional state when conversion between the static mass m_0 and energy. Considering m did have the inertia features of mass, Albert Einstein once reluctantly called it "the mass of a moving body" ^[7]. For the sake of distinction, the mass of an electron (or body) in this paper is called the "static mass" and represented by m_0 . And the so-called "relativistic mass" m , only as a transitional intermediate result to be used, the conversion relationship between m_0 and m follows the formula 1.

High-speed electrons in the acceleration process will release energy in the form of radiation, which has been widely applied ^[8]. According to the formula 1 and 3, this means that the static mass of an accelerated electron will gradually be lost in the form of radiation. Then according to the formula 2, you will come to realize why the energy

convergence effect can be revealed out, when the static mass of an electron is reduced to a certain degree.

4. To Observe and Study the Charge-Mass Ratio Whether it has Varied with the Accelerated Electrons

Once it is identified that the static mass m_0 of an accelerated electron will gradually be lost in the form of radiation, then we have to observe and study whether its charge-mass ratio, e/m_0 , is equal to the physical constant, $e_0/M_0 = -1.75882015 \times 10^{11} (C/kg)$? In this formula, $e_0 = -1.602176487 \times 10^{-19} (C)$, $M_0 = 9.10938215 \times 10^{-31} (kg)$, they respectively are the elementary charge and the rest mass, both of them are the fundamental constants of physics.

The answer is yes. Now the electron storage rings [9] widely in use are taken as an example to demonstrate the following. By the electromagnetic theory, if an electron is moving in the uniform magnetic field perpendicular to magnetic field lines, it will continue to do uniform circular motion with radius R . In fact, this is a kind of accelerated motion. The electron storage rings are large-scale science facilities based on this principle to have been built. In the storage ring, an electron momentum [10] is

$$p = mv = eBR \quad (4).$$

In this formula, e is an electronic charge, it will no longer be a constant in this paper; B the magnetic induction intensity.

In view of the high-speed electrons, relativistic effects should be considered. By formula 1 and 4, the electronic relative speed,

$$\beta = \frac{v}{c} = \frac{\left(\frac{e}{m_0}\right)^2}{\left(\frac{e}{m_0}\right)^2 + \left(\frac{c}{BR}\right)^2} \quad (5),$$

can be deduced. Because the magnetic induction intensity B and the curvature radius R both are calibration values in the storage ring, by the formula 5, it can be seen the electron speed depends upon the charge-mass ratio, e/m_0 .

Let us suppose the charge-mass ratio is changed, and then the electron speed should be changed along with it. Well, that is the case only, the curvature radius R should be changed, and electron beams will strike the inner wall of the tubular vacuum chamber, because the direction and intensity both of the magnetic field of bending magnets in the storage ring have not changed. If so, under the gaze of physicists it should never escape easily. However, in energy electron storage rings all over the world, the above phenomenon has not happened. In other words, the charge-mass ratio, e/m_0 , of the accelerated electrons in these storage rings whose value remains unchanged is called a constant. So there are only two possibilities that the static mass has not changed, or the electric charge has

synchronously lost along with it. Only choose the latter, our interpretation can also be reasonable to cover the experimental data submitted by Jihao. There is the following formula,

$$\frac{e}{m_0} = \frac{\Delta e}{\Delta m_0} = \frac{e_0}{M_0} = -1.75882015 \times 10^{11} (C/kg) \quad (6),$$

to be true.

Up to this point, it has been proved in the storage ring that a high-speed electronic charge will follow along with its static mass synchronously to be lost, and its charge-mass ratio and speed all are determined values. Furthermore, we can be pretty sure that there is a kind of more fundamental particles to form electrons.

5. Calculating Quantitatively according to the Experimental Data Submitted by Jihao

Substituting $B = 0.121 (T)$ and $R = 18 (cm)$ both in Table 1 into formula 5, then merging with formula 6, $\beta = v/c \approx 0.99695$ can be calculated. Because the electron beams used in both experiments were all from the same U.S. Varian 2300C/D linear accelerator, well then, four kinds of energy electrons from 8 to 15 (Mev) in Table 2, which should be also the same speed. Both of different experiments have shown that the value of each electronic kinetic energy was no longer to continue to increase and tended to convergence, and formed an inflexion point near $v \approx 0.99695 c$.

In allusion to the data in Table 2, teacher Jihao wrote in the experiment reports [4-6]: "A total number of 2.36×10^{13} electrons were received, ..., the lead target was used for the experiments and weigh 70 grams. The temperature was increased by $1^\circ C$, the energy required $0.031 \times 70 \times 4.18 = 9.0$ joules."

From this knowable, 2.36×10^{13} electrons made the lead target temperature to increase $1.03^\circ C$ and should pay a total of their kinetic energy, $w_k = 9.0 \times 1.03 = 9.27 (J)$. So, near the energy inflexion point, here $v \approx 0.99695 c$, each electronic kinetic energy is

$$E_k = \frac{w_k}{2.36 \times 10^{13}} \approx 3.928 \times 10^{-13} (J),$$

and can be converted into 2.452 (Mev). According to formula 2, there is the following formula,

$$3.928 \times 10^{-13} = m_0 c^2 \left(\frac{1}{\sqrt{1 - 0.99695^2}} - 1 \right),$$

to be true. The static mass, $m_0 \approx 3.69846 \times 10^{-31} (kg)$, can be calculated. Then, according to formula 6, its electronic charge, $e \approx 6.504929 \times 10^{-20} (C)$, can be worked out.

The implication is that the static mass and electronic

charge have been synchronously fallen to original 40% about, here $v \approx 0.99695c$, near the energy inflection point. Only such electrons, a perfect combination can be formed to make the experimental data submitted by Jihao and Einstein's special relativity.

Generally, the electronic charges gathered on the lead target does not cause temperature rise, which will be consumed by the parts of higher resistance value in the loop circuit if you use wires to release. It is a pity thing that in the experimental data submitted by Jihao, there was no any electric current value generated by the charges to be released. Of course, if you want to get a more complete experimental data, should also measure the electronic wavelength value.

6. Conceiving New Ideas need to Consider the Past, the Electro-Ultimate Particles and De-Broglie Matter Wave

A moving electronic charge e will follow along with its static mass m_0 synchronously to be lost, and it seems to have hoodwinked physicists. It is never electronic cheating, but there is a kind of traditional inertial thinking that each electron has been acquiesced in an elementary particle which can not be further broken down. So it seems to have originated from this tiny careless about oversight that they consider the static mass m_0 in formula 1 or 2 as a constant, and the electron radiating out energy is only a part of its kinetic energy.

According to the formula 2, it can be seen that if there is a particle which moving at the speed of light in vacuum, its static mass can only be equal to zero, and its energy will be surely equal to zero also. In reality, it does not exist, but can be considered as an ideal state. This means that a particle has energy but its static mass is equal to zero, which is contrary to the formula 2. In other words, the relationship between energy and (static) mass is a unity of oppositeness, no matter where as long as there is energy, (static) mass must exist. Must exist at the same time, carry each other, be short of one cannot. Therefore, it is vital that how can we correctly comprehend and make a distinction between the speed of light in vacuum and reality.

Since an electron can be further broken down, then there should be a kind of more fundamental particles to compose, which can be referred to as "electro-base particles". It should be the electro-ultimate particles whose charge-mass ratio is equal to that of electronic physical constants according to the formula 6. A corollary is that all photons radiating from the electrons in a storage ring are composed of the electro-base particles. So, the moving photons must also follow the formula 4, in the uniform magnetic field perpendicular to magnetic field lines, it will continue to do uniform circular motion with radius R . The phenomenon

of refraction of light, which really means when photons moving through a strong magnetic between atoms, occur as deflexion. Furthermore, based on the theory of electron-positron colliding and some experimental facts^[11] which have been shown, a corollary is that the electro-base particles can constitute a variety of "elementary particles" with different natures, and whose natures depend upon the binding force inside.

In the early 1920 s, the famous de Broglie matter wave equation^[3, 12],

$$\lambda = \frac{h}{p} = \frac{h}{mv} \quad (7),$$

has shown us that high-speed particles (electrons or photons), their momentum and energy can't increase unlimited, and are restricted by the Planck's constant h . Then merging with formula 1 to consider, since the electron speed v is a determined value in a storage ring, if the static mass m_0 to be reduced, its momentum p and energy pc both of the values also decreased, while the wavelength value λ increased, this phenomenon is usually referred to as redshift.

However, due to the interference of the Uncertainty principle, the high-speed particles' energy convergence effect which has been not caused enough attention. Yet for now, this first factor in causing spectrum redshift has been replaced by the Doppler effect, least bit of difference a mile, so that gradually deduction into celestial bodies are moving away from us ...^[13]

A review of Uncertainty principle, can be further described as when momentum p is determined, the speed v can not be sure; and if determine speed v , the momentum p is uncertain. Investigate its reason, seems to be due to the static mass m_0 can not be measured accurately. Now we have realized that electrons and photons with the same charge-mass ratio, so based on the foregoing formulas, as long as measuring their wavelength values λ , the static masses m_0 can be calculated. Well then, the so-called "uncertainty", whether it would be become a "certainty"?

The answer is no. Later will reveal that each photon energy radiating from an electron storage ring is increased about billions times than before. This experiment fact, coupled with the radiation direction of uncertainty, is real "culprit".

The studies described above, which are own ideas. It is worried about either speciosity or my true to be denied. How can we judge? The most simple and effective identification method is to measure the wavelength value λ of electrons in a storage ring. By the aid of modern science and technology, it is much the same ease that Galileo did the experiment of "Two iron ball while landing" in the Leaning Tower of Pisa hundreds of years ago.

7. Estimating the Approximate Range of Electron Wavelength in HLS 800 MeV Storage Ring

HLS (Hefei Light Source) 800 MeV electron storage ring has been affiliated with the National Synchrotron Radiation Laboratory (NSRL), which locates on the University of Science and Technology of China (USTC), in Hefei, Anhui Province. Parts of the parameters^[14-16] on HLS 800 MeV electron storage ring are listed in Table 3. So-called each electron energy 800 (MeV), this is a nominal energy parameters on the electron storage ring. From the above discussion, it is merely a nominal value.

In Table 3, the bending magnets radius, $R_1 = 2.2221$ (m), and magnetic induction intensity, $B_1 = 1.2$ (T), both are calibration values in the storage ring. Thus, according to the formula 5 and 6, we can calculate the moving speed, $v_1 \approx 0.9999997957c$, of the electrons in the storage ring.

In Table 3, an electron moving in storage ring, the energy loss caused by radiation per lap is 16.31 (keV). The energy value actually plays a damping role in electron motion along the tangential direction. Therefore, a single electron each turn, its speed along the tangential direction will be decreased to cause a smaller curvature radius than R_1 . Then, through high frequency cavity to replenish its energy, the electron again returns to its original orbit of the curvature radius for R_1 .

Table 3. Parts of the parameters on HLS 800 MeV electron storage ring.

Nominal electron energy /MeV	800	Bending magnets radius R_1 /m	2.2221
Circulating beam current I /mA	100-300	Magnetic induction intensity B_1 /T	1.2
Electron radiative energy per lap /keV	16.31	Electron cyclotron frequency /MHz	4.533
Characteristic wavelength λ_c /nm	2.427	Vacuum chamber inner diameter /mm	80

In Table 3, the inner diameter of the cylindrical beam current pipe vacuum chamber is 80 (mm)^[16]. The distance between the inner wall of the tubular vacuum chamber and the electron beam orbital radius, $R_1 = 2.2221$ (m), is $80/2=40$ (mm). When the circulating beam current I gradually decreasing to 100 (mA) nearby, due to the damping effect caused by the radiant energy, the electron beam orbital radius will each circle appear a lower value which is somewhere near $R_2 = R_1 - 0.04 = 2.1821$ (m). At this point, the number of electrons which are just touching the inner wall of the tubular vacuum chamber will increase, and appear as the circulating beam current I declining quickly. Substituting $R = R_2 = 2.1821$ (m) into formula 5, the electron speed, $v_2 \approx 0.9999997881c$, in the storage ring, can be calculated, while it just touches the inner wall of the tubular vacuum chamber.

In this state, an electron moving in the beam current piping, its energy loss caused by radiation per lap is the

same 16.31 (keV). According to formula 2, there is the following equation,

$$E_1 - E_2 = (E_{k1} - E_{k2}) + (E_{01} - E_{02}) = 16.31(\text{keV}),$$

to be true. In this formula, the energy E_1 and E_2 , kinetic energy E_{k1} and E_{k2} , static energy E_{01} and E_{02} , respectively correspond to the curvature radii, R_1 and R_2 , of the single moving electron. Because of the electron speed is very close to the value c as well as almost all of the kinetic energy, the static energy difference and a minuscule variation of the static mass m_0 in a single circle, both of them can be ignored. Hence, there is the following equation,

$$E_{k1} - E_{k2} \approx m_0 c^2 \left(\frac{1}{\sqrt{1 - \frac{v_1^2}{c^2}}} - \frac{1}{\sqrt{1 - \frac{v_2^2}{c^2}}} \right) \approx 16.31 \quad (\text{keV}),$$

to be true. Make both sides of the equation to unify the energy units and solve it,

$$m_0 c^2 \left(\frac{1}{\sqrt{1 - 0.9999997957^2}} - \frac{1}{\sqrt{1 - 0.9999997881^2}} \right) \approx 16310 \times 1.602176487 \times 10^{-19} (J).$$

The static mass, $m_{0.1} \approx 1.0325 \times 10^{-33}$ (kg), of a moving electron can be calculated when the circulating beam current I is down to 100 (mA) nearby. Substituting it into the formula 6, we can calculate its charge $e_{.1} \approx 1.8159 \times 10^{-22}$ (C); according to the formula 1 and 7, the wavelength $\lambda_{.1} \approx 1.3808 \times 10^{-12}$ (m); to the formula 1 and 3, the energy $E_{.1} \approx 0.8979$ (MeV).

Before estimating for the previous values corresponding to the above, while the circulating beam current, $I = 300$ (mA), there are two points must be carefully weighed. One is due to the damping effect caused by the radiant energy, it was found during debugging that the orbital center of the beam current was always biased towards the inner side of the circular piping^[17], and after adjusting the frequency of high frequency cavity, the actual effect was to make the beam orbital radius slightly greater than $R_1 = 2.2221$ (m). Second is Quantum lifetime, Vacuum lifetime and Touschek lifetime, as well as other influences of the focusing magnetic field^[16]. In allusion to the total number of electrons in the storage ring, both have an opposite effect.

The two points above are combined as a whole to consider, and let us suppose the electrons to have lost in the storage ring, which account for 40% of the original total. If the rest of these electronic charges did not follow along with the static masses synchronously to be lost, the circulating beam current is not 100 (mA), but 100/0.6 (mA). Therefore, it should be in proportion as 100:180 to convert the above corresponding to $I = 100$ (mA) into the previous values while the circulating beam current $I = 300$ (mA). As a result, we can calculate that the static mass of an

electron is $m_{0,3} \approx 1.8585 \times 10^{-33}$ (kg), charge $e_3 \approx 3.2687 \times 10^{-22}$ (C), wavelength $\lambda_3 \approx 7.6712 \times 10^{-13}$ (m), energy $E_3 \approx 1.6162$ (MeV), when the circulating beam current $I = 300$ (mA) in the storage ring.

The purpose of the above analysis is mainly in order to provide a research method. As for exactly how many the wavelength of electrons in HLS 800 MeV storage ring is, of course, it should be based on the experimental value shall prevail. If continuing to maintain that each electron has been acquiesced in an elementary particle which can not be further broken down, in that way, according to the formula 1 and 7, the experimental values of the electron wavelength should be $\lambda \approx 1.551 \times 10^{-15}$ (m) nearby. The difference value between the both views, is hundreds times and very easy to identify.

8. Calculating the Photon Static Mass and the Deflection Radius in a Magnetic Field

Suppose there are two microscopic particles which are composed of the electro-base particles, their static masses correspond to m_{01} and m_{02} , charges to e_1 and e_2 , speeds to v_1 and v_2 , wavelengths to λ_1 and λ_2 , momenta to p_1 and p_2 , whose moving in the two uniform magnetic fields perpendicular to the directions of magnetic induction intensity to B_1 and B_2 , while to do uniform circular motions with radiuses to R_1 and R_2 , respectively. According to formula 1, 4, 6 and 7, there is the following formula,

$$\frac{m_{01}\lambda_1}{m_{02}\lambda_2} = \frac{v_2 \sqrt{c^2 - v_1^2}}{v_1 \sqrt{c^2 - v_2^2}} = \frac{m_{01}p_2}{m_{02}p_1} = \frac{B_2 R_2}{B_1 R_1} \quad (8),$$

to be true. If there is a photon which radiating from the electron storage ring, while the radiation occurring before and after for an instant, we can think of $m_{01} = m_{02}$, $B_1 = B_2$, in the formula 8. So, there is the following formula,

$$\frac{\lambda_1}{\lambda_2} = \frac{v_2 \sqrt{c^2 - v_1^2}}{v_1 \sqrt{c^2 - v_2^2}} = \frac{p_2}{p_1} = \frac{R_2}{R_1} \quad (9),$$

to be true. Among them, before the radiation occurring for an instant, the moving speed and deflection radius of the photon are the same as of the electron in this storage ring.

The beam lifetime in HLS 800MeV electron storage ring is 8 hours^[14-16], the meaning is to point the duration when the circulating beam current gradually decreasing from 300 (mA) to 100 (mA). In Table 3, an electron moving in the storage ring, the energy loss caused by radiation per lap is 16.31 (keV), and the cyclotron frequency 4.533 (MHz). So, from a radiated photon having

energy, in this light, the total energy of each electron losses due to radiation and accumulated by 8 hours is

$$E_r = 16310 \times 1.602176487 \times 10^{-19} \times 4.533 \times 10^6 \times 3600 \times 8 \approx 3.4115 \times 10^{-4} (J),$$

and can be converted into 2.1293×10^9 (MeV). Obviously, this value is greater than the nominal energy (800 MeV) of the electron in ring millions times. This is a well known experimental fact in the industry. However, according to the front has been estimated, when the circulating beam current gradually decreasing from 300 to 100 (mA), the actual value of each electron energy loss is

$$E_3 - E_1 = (1.6162 - 0.8979) \times 10^6 \times 1.602176487 \times 10^{-19} \approx 1.1509 \times 10^{-13} (J),$$

Between the two actually differs

$$E_r \div (E_3 - E_1) = (3.4115 \times 10^{-4}) \div (1.1509 \times 10^{-13}) \approx 2.9642 \times 10^9 (\text{Times}).$$

As mentioned above, it is related to the binding force inside an electron. The truths are always hidden in the experimental facts. Based on the Law of Energy Conservation, there is a microscopic particle which has been composed of the electro-base particles, when it is decomposed again, will release energy in the form of radiation; instead, should absorb energy.

According to formula 2 and 3, you can have a conclusion that the moving speed of photons is increased by the radiation effect; almost at the same moment, leading to sharp increase in its kinetic energy, and showing more energy released. In other words, the energy of each photon which radiating from an electron in this storage ring, it is about 2.9642×10^9 times than own's energy before radiation if its speed is reduced to the same speed with the electron. Then, according to formula 3 and 4, there is the formula $pc = \beta E \approx E$ to be true. And merging with formula 9 to consider, the curvature radius of a radiated photon is also about 2.9642×10^9 times than of the electron beam in this storage ring.

Now take the photon whose characteristic wavelength $\lambda_c = 2.427 \times 10^{-9}$ (m) in Table 3 as an example. The radiation occurring before and after for an instant, its static mass is the same value, $m_{01} = m_{02}$, charge also the same value, $e_1 = e_2$, and both move in a same uniform magnetic field perpendicular to the directions of magnetic induction intensity, $B_1 = B_2 = 1.2$ (T). Before the radiation occurring for an instant, the moving speed v_1 and deflection radius R_1 of the photon should be the same as of the electrons in this storage ring, while the momentum is p_1 , energy E_1 . After the radiation occurring, the photon moving speed has been increased to v_2 , leading to its energy E_2 to 2.9642×10^9 times than before. According to formula 9, there is the following formula,

$$c = \sqrt{\frac{v_1^2 v_2^2 \left[\left(\frac{B_2 R_2}{B_1 R_1} \right)^2 - 1 \right]}{\left(\frac{B_2 R_2}{B_1 R_1} \right)^2 v_1^2 - v_2^2}} = \sqrt{\frac{v_1^2 v_2^2 \left[\left(\frac{m_{01} \lambda_1}{m_{02} \lambda_2} \right)^2 - 1 \right]}{\left(\frac{m_{01} \lambda_1}{m_{02} \lambda_2} \right)^2 v_1^2 - v_2^2}}$$

Looking forward, based on the experimental facts that each photon energy radiating from an electron storage ring is increased about billions times than before, positive and negative photons collision experiments would become possible. In addition, the manuscripts in Chinese, please refer to the following url: <http://prep.istic.ac.cn/main.html?action=showFile&id=2c9282823f190b1d0141c3f5feba0226>

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