The Spin Model of Electron and Proton and Unified Calculation of Quantum Constants

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Abstract: Based on the concept that the electron and proton are manacled by own magnetic field，a Resonance Ring Model for spin of electron and proton and new calculation method of quantum constants are described. Many essential parameters for spin of electron and proton are obtained. The calculation results of quantum constants go all the way with known results of calculation and experiment, and that the correlations of quantum constants are showed in more detail. Further, a neutron model, an annihilation mechanism of particle-antiparticle and the new concept that spin velocity is an Intrinsic Velocity are put forward. An attestation that the faster than light of intrinsic velocity is independent of the relativistic bound is given.

Keywords: spin, quantum constant, neutron model, Intrinsic Velocity

1 Introduction

The spin may be one of theory foundation in quantum mechanics and nuclear physics [1-6], but its mechanism still is a puzzle because its mechanism can not be known up to new. As everyone knows, the early rigid ball model not only has no to obtain spin of electron and proton but also is not harmonious with other quantum constants. Here is an attempt to find the spin mechanism and new model for electron and proton. In new model, the electron and proton are revolved in magnetic field that produced by spin, and its wave mutually superimposing forming standing wave on orbit. This case is that the electron and proton are manacled by own magnetic field. Therefore, the ubiquitous states of electron and proton are the Circular Harmonic Oscillator or Resonance Ring in new model.

According to the new model and some basic formula in electromagnetism and

quantum mechanics, we not only obtain the basic parameters of electron or proton but also obtain many quantum constants, such as, their magnetic flux on orbit face just are a flux quantum $h/2e$; the electronic spin orbit radius $2.818\times10^{-15}m$ just is known classical radius; the ratio between electronic spin energy and magnetic induction intensity on orbit face just is Bohr magnetron μ_e; the ratio between proton spin energy and magnetic induction intensity on orbit face just is nuclear magnetron μ_N. Although spin velocity of electron and proton may be faster than light, but many quantum constants all can be harmoniously unified by it. We think that the spin velocity is a new intrinsic parameter, and can be called Intrinsic Velocity. The Resonance Ring is not the close string of superstring, and independent of time-space theory. But it still is an important elicitation for to develop the superstring theory.

The basal suppositions and parameters of Resonance Ring all are first derived (section 2 and 3). Secondly many quantum constants of electron and proton are derived (section 4). Finally, some important questions include a new neutron model, annihilation of particle pair and faster than light of spin velocity are further discussed (section 5-8).

2 The basal suppositions for Resonance Ring Model

Following suppositions are regarded as the theory foundation for Resonance Ring Model of electron and proton:

1) The electron and proton are orbiting in spin magnetic field. The spin magnetic field is produced by the orbiting. The orbiting just is spin.

2) The spin magnetic field on orbit face is uniform. That is the spin magnetic field on orbit face equals to the magnetic field of central point on orbit face.

3) The spin velocity direction is same to direction of magnetic potential at spin orbit.

4) The stability condition of Resonance Ring is $2\pi R=\lambda$.

5) The spin velocity direction is at an angle of 30^0 to direction of orbit radius. That is central point and direction of orbit face all are changed ceaselessly.

3 Calculation of basal parameters for Resonance Ring Model

By supposition 1 and 2, we still have $v/R=eB/m$ according to Lorentz force $e\vec{v}\times\vec{B}$ equals to centripetal force mv^2/R, and then magnetic flux Φ parses through orbit face can be written as $\Phi=\pi R^2B$ where $\vec{v}$ is spin velocity of electron or proton;

$\vec{B}$ is spin magnetic field; R is orbit radius; m is mass, it can be m_e for the electron or m_P proton. By supposition 2 and 3, we have $\Phi = 2\pi RA$, where A is magnetic potential. Therefore, we can obtain $RB = 2A$ and $mv = 2eA$. We can also transform $mv = 2eA$ into $m\vec{v} = 2e\vec{A}$ and $mv^2/2 = e\vec{v}\cdot\vec{A}$, where $mv^2/2$ is kinetic energy, $e\vec{A}$ additional momentum in Hamiltonian [7-10]; $e\vec{v}\cdot\vec{A}$ is additional potential energy in Lagrangian [7-10]. That is additional momentum $e\vec{A}$ must equals to half momentum mv; additional potential energy $e\vec{v}\cdot\vec{A}$ must equals to the kinetic energy $mv^2/2$ in Resonance Ring Model. By $\Phi = 2\pi RA$, $mv = 2eA$, de Broglie formula $mv = h/\lambda$ and supposition 2 i.e. $2\pi R = \lambda$, then

$$\Phi = h/2e \tag{1}$$

Eq. (1) is the flux on orbit face, and just is the known flux quantum formula. That is electron and proton are a magnetic doublet with flux $\Phi = h/2e$.

The spin expression of electron or proton can be written as

$$\vec{s} = m\vec{v}\times\vec{R} \tag{2}$$

By the supposition 5, $2\pi R = \lambda$ and $mv = h/\lambda$, Eq. (2) can be

$$s = mvR/2 = \hbar/2 \tag{3}$$

Eq. (3) is spin of electron and proton. As a rule, the magnetic induction intensity B on central point of current ring can be written as $B = ev\mu_0/4\pi R^2$, where μ_0 is the vacuum permeability. By Eq. (1) and $\Phi = \pi R^2 B$, we can get $h/2e = ev\mu_0/4$, then spin velocity can be

$$v = 2h/e^2\mu_0 \tag{5}$$

By Eq. (5), the spin velocity can also be written as

$$v = 2h\varepsilon_0 c^2/e^2 = c/\alpha \tag{6}$$

where c is velocity of light in vacuum; ε_0 is vacuum dielectric constant; $\alpha = e/2h\varepsilon_0 c$ is fine structure constant, then we obtain $v \approx 137.0c$ i.e. $v = 4.108\times10^{10} m/s$ *. It is a great surprise that the spin velocity of electron and proton can be 137 times bigger than light velocity, and the times just is $1/\alpha$. Therefore, spin velocity v must be Intrinsic Velocity. In fact, the spin velocity v can also be obtained by two known formula i.e. Bohr magneton formula and electronic classical radius formula (see section 8).

By $mv = h/\lambda$, $2\pi R = \lambda$ and Eq. (5), the spin orbit radius of electron and proton are

$$R = e^2\mu_0 / 4\pi m \tag{7}$$

Its value is $2.818\times10^{-15}m$* for electron and $1.535\times10^{-18}m$ for proton. Eq. (7) can also be written as $R = e^2/4\pi\varepsilon_0 m_e c^2 = r_e$ where r_e is classical radius of electron. That is the classical radius of electron is spin orbit radius of electron. The sizes of electron and proton must be small a lot than $2.818\times10^{-15}m$ and $1.535\times10^{-18}m$ respectively.

By Eq. (1), (7), and $\Phi = \pi R^2 B$, magnetic field B on orbit face can be

$$B = 8\pi hm^2 / e^5\mu_0^2 \tag{8}$$

Its value is equal to $8.289\times10^{13}T$ for electron and $2.795\times10^{20}T$ for proton.

By $A = RB/2$ and Eq. (7) and (8), formula of magnetic potential A can be

$$A = hm / e^3\mu_0 \tag{9}$$

Its value is equal to $0.1168Tm$ for electron, and $2.144\times10^{3}Tm$ for proton. By Eq. (5) and $E = mv^2/2$, spin energy E can be written as

$$E = 2h^2m / e^4\mu_0^2 \tag{10}$$

The Eq. (10) can be turned into $E = evA_\psi$ or $E = mc^2/2\alpha^2$. Its value is equal to $9.389\times10^3 mc^2$ or $7.687\times10^{-10}J$ for electron and $1.411\times10^{-6}J$ for proton. The total energy of electron and proton is $2E$.

4 Other constants of electron and proton

By Eq. (8) and (10), the ratio between spin energy E and magnetic field B is

$$E / B = e\hbar / 2m = \mu \tag{11}$$

Let $m = m_e$, then $\mu = \mu_B$ i.e. $\mu_B = 9.274\times10^{-24}J/T$. The μ_B is Bohr magneton. Let $m = m_P$, then $\mu = \mu_N$ i.e. $\mu_N = 5.051\times10^{-27}J/T$. The μ_N is nuclear magneton.

Because current intensity must be flowed electric charge per unit interval, so spin current I on spin orbit is equal to the product between average line charge density $e/2\pi R$ and spin velocity v. Thus we hace $I = ev/2\pi R$. By Eq. (5) and (8), the spin current is

$$I = ev/2\pi R = 4hm / e^3\mu_0^2 \tag{12}$$

Its value is equal to $3.718\times10^5 A$ for electron and $6.826\times10^8 A$ for proton.

By Eq. (8) and (12), the magnetic moment μ of electron and proton can also be $\mu = IS$, where $S = \pi R^2$ is area, then

$$\mu = IS = e\hbar / 2m = se / m \tag{13}$$

The Eq. (13) is same with Eq. (11). By Eq. (11), the physics meaning of Bohr

magneton and nuclear magneton are a ratio between the spin energy E (or potential energy evA) and the magnetic induction intensity B. The physics meaning also is spin energy per unit magnetic induction intensity. On the other hand, by Eq. (13), the physics meaning of Bohr magneton or nuclear magneton just is a product between spin current and spin orbit area, or between spin and specific change.

According to Eq. (11) and (13), we have

$$E = I\Phi \tag{14}$$

That is spin energy E just is the product between spin current and magnetic flux.

In fact, Bohr magneton μ_B is magnetic moment of free electron. In atom, since interactions between electron and nucleus, the μ_B must be $\mu_e = g_e\mu_B$, where g_e is revises coefficient and just is electron g-factor. In the same way, μ_N must be $\mu_P = g_P\mu_N$, where g_P is revises coefficient and just is proton g-factor.

According to Lorentz formula, Lorentz force acting on spin electron or proton can be

$$F = e\vec{v}\times\vec{B} = evB = 16\pi h^2 m^2 / e^6\mu_0^3 \tag{15}$$

Its value is equal to $5.456\times10^5 N$ for electron and $1.839\times10^{12} N$ for proton.

Let ε shows spin mef on orbit, according to $e\varepsilon = 2evA$ we obtain

$$\varepsilon = 4h^2 m / e^5\mu_0^2 \tag{16}$$

Eq. (16) also is formula of electric potential of orbit. Its value is equal to $9.596\times10^9 V$ for electron and $1.762\times10^{13} V$ for proton.

Let ρ show resistance on spin orbit, we obtain

$$\rho = \varepsilon / I = h / e^2 \tag{17}$$

Its value is equal to $2.581\times10^4\Omega$. Although ρ just is Hall resistance, their elements is different because the ρ is produced by spin magnetic field.

Let σ_0 shows resistivity of spin orbit, by $\rho = 2\pi Rr_0$, we obtain

$$\sigma_0 = 2hm / e^4\mu_0 \tag{18}$$

Its value is equal to $1.458\times10^{18}\Omega/m$ for electron and $2.677\times10^{21}\Omega/m$ for proton.

By $E = h\gamma$, $mv = h/\lambda$, Eq. (5) and (9), we obtain frequency γ and wavelengh λ

$$\gamma = 2hm / e^4\mu_0^2 \tag{19}$$

$$\lambda = e^2\mu_0 / 2m \tag{20}$$

By Eq. (19) and (20), $\gamma_e = 1.160\times10^{24} H_Z$ and $\lambda_e = 1.771\times10^{-14} m$ when $m = m_e$; $\gamma_P = 2.130\times10^{27} H_Z$ and $\lambda_P = 9.643\times10^{-18} m$ when $m = m_P$.

We can obtain electron gyromagnetic ratio $\gamma_e / 2\pi$ is equal to $g_e \cdot \gamma_e / B_e$ in atom, then by Eq. (7) and (19),

$$\gamma_e / 2\pi = e g_e / 4\pi m_e \tag{21}$$

Its value is equal to $28.025 GH_z / T$.

The proton gyromagnetic ratio $\gamma_P / 2\pi$ is equal to $g_P \cdot \gamma_P / B_P$ in atom, then

$$\gamma_P / 2\pi = e g_P / 4\pi m_P \tag{22}$$

Its value is equal to $42.577 MH_z / T$.

5 The size of proton and Analogy Hydrogen Model of neutron

Because spin orbit radius of proton is $1.5347\times10^{-18} m$, neutron not only can consider forming by electron, proton and neutrino, but also think that electron is revolving round proton because electronic orbit radius $2.8179\times10^{-15} m$ is much bigger than orbit radius of proton. Although the neutron model resemble hydrogen atomic model, but Lorentz force is primary player because it is nearly 1.878×10^{4} times greater than Coulomb force ($e^2 / 4\pi\varepsilon_0 R_e^2$). The neutron resembles a hydrogen atom which an electron engluts a proton. The neutron model can be called Analogy Hydrogen Model of neutron. In this model, inner charge is positive charge at center and negative charge on border. It is consistent with reality measurement gained [11]. On the other hand, the size of proton can be measured via scattering experiment of proton-proton.

6 Spin Ball Model of charge distribution and annihilation of particle pair

It is possible that charge is evenly distributed on a spherical surface when direction of spin surface is continuously changed. The spherical surface distribution of charge is not decentralization charge on spherical surface, but charge transfer on spherical surface continuously. This case that charge transfer on spherical surface can be called Spin Ball Model. The rigid ball model in classical physics can be replaced with the Spin Ball Model of charge. Thus ubiquitous states of electron and proton all are Spin Ball too. Two models of Resonance Ring Model and Spin Ball Model are uniform in nature, but in Resonance Ring Model, directions of spin magnetic field of electron and proton can be polarization; in Spin Ball Model, the directions of spin magnetic field are

round and round.

According to classical theory, when electronic charge is evenly distributed on a spherical surface of radius R_e, classical radius of electron can be written as $R_e = e^2/4\pi\varepsilon_0 mc^2$; electric potential energy of electron charge on spherical surface can be written as $e^2/4\pi\varepsilon_0 R_e$, and then we have $m_e c^2 = e^2/4\pi\varepsilon_0 R_e$. Therefore $m_e c^2$ is electromagnetic energy of electron. In the same way, $m_P c^2$ exactly is electromagnetic energy of proton. The electromagnetic energy mc^2 is not spin energy evA or $mv^2/2$. The spin energy can be 9389 times bigger than mc^2. After annihilation of electron pair or proton pair, their spin energies are not released because the energy of two creation photon only equals to $2mc^2$. Therefore, although electron pair or proton pair can be annihilation, their still have huge spin energy in vacuum. It is possible to relate spin energy with many phenomena that produced in vacuum which have large numbers of annihilation particle pair.

7 Equivalent spin models of photon and creation condition of particle pair

To found a classical model of photon spin is very useful, but here is only an attempt. The photon of circular polarized can be regarded as an electric doublet that revolves with light velocity. The stability condition of orbiting electric doublet is $2\pi R_L = \lambda$, where R_L is equivalent revolving radius of electric doublet. By $m_L c = h/\lambda$, the equivalent mass of electric doublet m_L can be written as $m_L = h/c\lambda$. According to $m_L c = h/\lambda$, $2\pi R_L = \lambda$ and photon spin $\vec{s} = m_L \vec{c} \times \vec{R}_L$, we obtain

$$s = \hbar \sin < m_L \vec{c}, \vec{R} > \qquad (23)$$

The spin of photon is $s = \hbar$ when $\sin < m_L \vec{c}, \vec{R} >= 1$ i.e. $m_L \vec{c} \perp \vec{R}_L$.

The spin $s = \hbar$ will be unchanged after to superpose many photons because increasing m_L occurs with reducing R_L at the same time in $\vec{s} = m_L \vec{c} \times \vec{R}_L$. This case shows that photon and particle pair can be mutually associated. Further it is prerequisite that the creation particle pair must be from annihilation particle pair when photons create particle pair. That is to create particle pair will be impossible in vacuum which has no annihilation particle pair.

8 Faster than light of spin velocity

In above spin model, the spin velocities of electron and proton may be the faster than light but they are very harmonious with other constants. It is essential that the Lorentz transformation in special relativity only is suitable in linear uniform motion.

Further, if the effect of special relativity is essential in calculation, it is inevitable that the solution of non-special relativity will cannot be harmonious with the known quantum constants, as the shift of interference stripe in Michelson experiments can not be accurately calculated by Galilean transformation. On the side, in revolving orbit, front and back as well as consequence of cause and result all do not appear. Although limit of light velocity may be necessary for linear velocity, but it will be independent of the spin velocity. Contrarily, the quantum constant can not be direct calculated by relativity. It is possible that renormalization method is one of eliminated limit of light velocity in quantum mechanics.

In fact, the spin velocity $v = 2h/e^2\mu_0$ can also be obtained by two known formula i.e. Bohr magneton $\mu_B = e\hbar/2m_e$ and electronic classical radius $R_e = e^2\mu_0/4\pi m_e$. According to $\mu_B = e\hbar/2m_e$ and $\mu_B = IS$ where $I = ev/2\pi R_e$ and $S = \pi R_e^2$, we have $R_e = \hbar/4vm_e$. By $R_e = e^2\mu_0/4\pi m_e$, we obtain $v = 2h/e^2\mu_0 \approx 137c$. Therefore, as a result of Bohr magneton $\mu_B = 9.2740\times10^{-24} J/T$ and $R_e = 2.8179\times10^{-15} m$, spin velocity must be faster than light. On the other hand, since spin is half moment of momentum, by spin $\hbar/2$, radius R_e and mass m_e or electronic momentum $3.7423\times10^{-20} K_g m/s$ and $m_e = 9.1094\times10^{-31} K_g$, we also obtain the velocity $\approx 137c$ That is the faster than light has been contained in same known quantum constants, whether people accept or not. To be more specific, spin velocity must be Intrinsic Velocity, as intrinsic momentum, because the spin velocity of electrons can be gained from to accelerate low velocity electrons; no faster than light can be gained from spin of electron or proton. The spin velocity is independent of limit of light velocity, and is very important quantum constant for study elementary particle.

9 Conclusions

(1) The ubiquitous states of electron and proton are a Resonance Ring or Spin Ball with radius $2.8179\times10^{-15} m$ and $1.5347\times10^{-18} m$ respectively. They are a magnetic doublet with a fluxon $h/2e$ as well as moment μ_B and μ_N respectively. Almost all quantum constants, new neutron model and new annihilation mechanism of particle pair all can be obtained by the Resonance Ring Model. (2) The spin, spin velocity, magnetic flux and orbit resistance are basic intrinsic parameter because they are independent of mass of electron and proton.

Appendix: the table of quantum constants of electron and proton

	Title	Expression**	Value	Units	Note
electron and proton					
1	spin	$s=\hbar/2$	5.27285798×10^{-35}	Js	$mvR2$
2	Magnetic flux	$\Phi=h/2e$	2.06783364×10^{-15}	Wb	πR^2B
3	spin velocity	$v=2h/e^2\mu_0$	4.10823592×10^{10}	m/s	c/α
4	velocity ratio	$v/c=2h/ce^2\mu_0$	137,036000		$1/\alpha$
5	orbit resistance	$\rho=h/e^2$	2.58128076×10^{4}	Ω	ρ_H
electron					
6	orbit current	$I_e=4hm_e/e^3\mu_0^2$	3.71752647×10^{5}	A	first
7	orbit mef	$\varepsilon_e=4h^2m_e/e^5\mu_0^2$	9.59597954×10^{9}	V	$2vA_e$
8	orbit radius	$R_e=e^2\mu_0/4\pi m_e$	2.81794028×10^{-15}	m	r_e
9	magnetic induction	$B_e=8\pi\hbar m_e^2/e^5\mu_0^2$	8.28900024×10^{13}	T	first
10	magnetic potential	$A_e=hm_e/e^3\mu_0$	0.116789538	Tm	first
11	spin energy	$E_e=2h^2m_e/e^4\mu_0^2$	7.68722627×10^{-10}	J	evA_e
12	Bohr magneton	$\mu_B=e\hbar/2m_e$	9.27400899×10^{-24}	J/T	E_e/B_e
13	magnetic moment	$\mu_e=e\hbar g_e/4m_e$	9.28476361×10^{-24}	J/T	$g_e\mu_B/2$
14	electronic momentum	$P_e=2hm_e/e^2\mu_0$	3.74234899×10^{-20}	K_gm/s	m_ev
15	orbit resistivity	$\sigma_e=2hm_e/e^4\mu_0$	1.44578861×10^{18}	Ω/m	first
16	spin frequency	$\gamma_e=2hm_e/e^4\mu_0^2$	1.16014888×10^{24}	H_Z	E_e/h
17	gyromagnetic ratio	$\gamma_{qe}/2\pi=eg_e/4\pi m_e$	2.80249540×10^{10}	H_Z/T	γ_eg_e/B_e
18	wavelengh	$\lambda_e=e^2\mu_0/2m_e$	1.77056410×10^{-14}	m	$4\pi R_e$
19	Lorentz force	$F_e=16\pi h^2m_e^2/e^6\mu_0^3$	5.45591851×10^{5}	N	evB_e
Proton					
6	orbit current	$I_P=4hm_P/e^3\mu_0^2$	6.82594614×10^{8}	A	first
7	orbit mef	$\varepsilon_P=4h^2m_P/e^5\mu_0^2$	1.76196832×10^{12}	V	$2vA_P$
8	orbit radius	$R_P=e^2\mu_0/4\pi m_P$	1.53469825×10^{-18}	m	first
9	magnetic induction	$B_P=8\pi\hbar m_P^2/e^5\mu_0^2$	2.79460046×10^{20}	T	first
10	magnetic potential	$A_P=2hm_P/2e^3\mu_0$	2.14443422×10^{2}	Tm	first
11	spin energy	$E_P=2h^2m_P/e^4\mu_0^2$	1.54949273×10^{-6}	J	$m_Pv^2/2$
12	nuclear magneton	$\mu_N=e\hbar/2m_P$	5.05078317×10^{-27}	J/T	E_P/B_P
13	magnetic moment	$\mu_P=e\hbar g_P/4m_P$	1.41060663×10^{-26}	J/T	$g_P\mu_N/2$
14	momentum	$P_P=2hm_P/e^2\mu_0$	6.87152408×10^{-17}	K_gm/s	m_Pv
15	orbit resistivity	$\sigma_P=2hm_P/e^4\mu_0$	2.67690142×10^{21}	Ω/m	first
16	spin frequency	$\gamma_P=2hm_P/e^4\mu_0^2$	2.13021046×10^{27}	H_Z	E_P/h
17	gyromagnetic ratio	$\gamma_{gP}/2\pi=eg_P/4\pi m_P$	4.25774825×10^{7}	H_Z/T	γ_Pg_P/B_P
18	wavelengh	$\lambda_P=e^2\mu_0/2m_P$	9.64279350×10^{-16}	m	$4\pi R_P$
19	Lorentz force	$F_P=16\pi h^2m_P^2/e^6\mu_0^3$	1.83943926×10^{12}	N	evB_P

** h =6.62606876 $\times10^{-34}$ Js, m_e =9.10938188 $\times10^{-31}$ K_g, e =1.602176462 $\times10^{-19}$ C, m_P =1836.1526675 m_e, c =2.99792458 $\times10^{8}$ m/s, g_e =-2.002319304374, g_P =5.585694675, $\mu_0=4\pi\times10^{-7}$ H/m.

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* h =6.62606876 $\times 10^{-34} Js$, m_e =9.10938188 $\times 10^{-31} K_g$, e =1.602176462 $\times 10^{-19} C$, m_P =1836.1526675 m_e , c =2.99792458 $\times 10^8 m/s$, g_e =-2.002319304374, g_P =5.585694675, $\mu_0 = 4\pi \times 10^{-7} H/m$. [See P. L. Hagelstein, S. D. Sentuvia and T. P. Orlando, *Introductory Applied Quantum and Statistical Mechanies*, John Wiley & Sons, Hoboken, New Jersey, 2004.]

电子和质子的自旋模型以及量子常数的统一计算

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摘要：基于电子和质子被自己的磁场束缚的观念，提出了一个电子和质子自旋的共振环模型及一种计算量子常数的新方法，给出了电子和质子自旋的基本参数。量子常数的计算结果与已有计算和实验结果完全一致，且更能反映这些常数间的相互关系。文中还提出了一个中子模型、粒子和反粒子的湮没机制和内禀速度的新观念，论证了内禀速度超光速与狭义相对论对速度的限止是无关的。

关键词：自旋，量子常数，中子模型，内禀速度