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Self-Interaction Field Theory Part II: Application in the Microworld

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Abstract

Part I of this series of articles is about the scalar self-interaction field theory and its application in Astrophysics which is more about the self-interaction field interaction pattern within a "Self-Interaction blackhole" in the weak field limit. This Part II is about the boundary of the Strong Self-Interaction Field and the interactions among the "Self-Interaction blackholes". This Part II provides a physics description of quantum behavior of microworld particles which is different from the current quantum mechanics. Assuming all elemental particles including proton, neutron, electron, photon, even neutrinos and quarks are bonded together through Strong Self-Interaction (SSI) fields. The physics properties of elemental particles (field being trapped), like the spin, the energy of the system (Einstein's quantum energy assumption), the Pauli exclusion principle and the uncertainty principle of quantum mechanics are discussed in detail from the Self-interaction field theory point of view. Hawking theory for the gravitational blackhole is used to study the strong interaction by replacing the gravitational constant with a Strong Self-Interaction constant. The pion lifetime, nuclear reaction time scale and proton mass is discussed. Planck units are revisited by replacing the gravitational constant with strong self interaction constant. It seems that the current Planck units are mismatched conclusion of physics constants. The origin of fine structure constant is also discussed.

Keywords: Self-interaction field theory; Spin; Pauli exclusion principle; Einstein's quantum energy assumption; Uncertainty principle; Planck Units.

Introduction of self-interaction field theory

Classical physics before special relativity and quantum mechanics is very different from modern physics in many aspects. The quantum mechanics is only for microworld. There are no corresponding quantum macro properties like that in the macro world. The current explanation for the un-observable quantum effects in macro world is due to the smallness of the Planck constant. Why not a bigger Planck constant for macroworld?

The microworld is also very different from macro world in the particle compositions and properties. The microworld has many exactly identical particles [1], but the planets in our solar system are very different from each other both the mass and angular momentum.

Quantum mechanics have several assumptions and the properties assigned to the micro particles, for example, the ½ $\hbar$ spin of all elemental particles and the Einstein's quantum energy assumptions.

The current physics description for elemental particles is that the elemental particles can no longer be divided. But in the Quantum

Electrodynamics theory the electron is allowed to emit virtual particles. Is virtual particles part of the electron? What binds the virtual particles to the electron? Recall that electron has charges, and also is spinning. According to classic physics, electrons must be dissipated very fast due to charge repulsion and centrifuge force caused by the spin. In order for electron to survive, a much stronger force is needed to bind the spinning charges together.
Also, photons are considered as another type of elemental particles. Photon can be re-absorbed by molecules and re-emitted in different wavelength. Is photon part of the electron or proton?

It is believed that protons and neutrons are made of quarks which are in turn the elemental particles. In the domain of current physics, the above type of questions is not asked because the questions are all part of the elemental particle properties. Just like quantum mechanics, several assumptions are made without asking why.

From Part I of this series of papers, the Assumptions of self-interaction field theory are:
(1). The Mesons Mediate Gravitational field (MMG) travel in space time like all other particles in gravitational field.
(2). And the classic gravitational acceleration of any particle in gravitational field is proportional to the local number of mesons mediating the gravitation passing by the space point times the interaction time.

In this paper, the assumptions are extended to the microworld. In the microworld, the self-interaction constant equivalent to gravitational constant is much bigger. The Strong Self-Interaction (SSI) is due to the bound radius is small and the frequency of the self-interaction mesons bounce back and forth is high, the SI mesons density is high. Thus, according to the assumption (2), the Strong-Interaction constant is much bigger comparing with that of gravitation. Einstein's general relativity theory is used to do analysis of the mesons mediating the Strong Self-Interaction field behavior in the space time as the first order approximation to the Strong Self-Interaction (SSI) Field theory we are proposing in this series of papers before the full Self-Interaction field theory is developed.

The assumptions and the scalar self-interaction field theory leads to the conclusion that field can be trapped with a stronger self-interaction constant which is about 10^{39} times of gravitational constant for elemental particles. See Part I of this serial of papers for the detail about the scalar self-interaction field theory and Part III about the tensor-scalar combined self-interaction field theory. In this paper, a strong self-interaction is introduced to re-interpretate the micro world behavior which is different from quantum mechanics and Standard Model without getting into the full Self-interaction field theory.

The strong self-interaction is different from Strong interactions in the Standard Model which is mediated by gluons and is confined to the scale of 1 fm [2]. The SSI mesons mediating the strong self-interaction is not defined yet, but the property of the mesons is the same as the photon in the general relativity, except the SSI mesons source is the energy momentum of the system, not just matter, but also the field itself.

Several important conclusions from self-interaction theory assumptions and the scalar theory can be summarized as following:

1) The field or mesons mediating the SSI can be trapped so that there is no interaction beyond the "Black surface" whose escape

velocity is the speed of light. This means the field and the mass of matter has a boundary defined as the event horizon.

2) The event horizon can expand and collapse as long as the boundary conditions are met. The Self-interaction constant varies as the matter distribution is changed. The SSI can reach the quantum scale of 10-^{10}m or even meter scale.
3) The field can interact with the other particles if particles are spinning and unstable after more energy is transferred to the particles. The boundary shall be oscillating. If $\frac{G_s M}{rc^2}=1$ for the "black surface", and M is constant, G_s increases as r increases or G_s decreases as r decreases.
4) From the scalar self-interaction field theory, the self-interaction term $\frac{1}{2}\nabla\psi\nabla\psi$ will cause the field to self-focus even no matter outside of the boundary if the field escapes from the source.
5) From the next section, we will see that the escaped field (or mesons mediating the SSI field) from the spin will have to form a disk in the equator plane. The field or mesons mediating self-interaction is harder to escape from any other altitude except the equator.

This condition

$$\frac{G_s M}{rc^2}=1 \tag{1}$$

is the key to this present paper which is the event horizon condition for extreme Kerr-Newman blackhole in Einstein's general relativity.

In Section 2, how the SSI-"Blackholes" interact with each other is discussed. In section 3, we will discuss the fundamental assumptions of quantum mechanics from this SSI point of view. In section 4, the strong interaction is discussed using Hawking theory of "blackhole" with the gravitational constant replaced by SSI constant. In Section 5, the relationship between Planck units, fine structure constant and SSI constant is discussed.

2.Interaction between Strong Self-Interaction Blackholes

For a strong spinning particle, the mesons from the non-equator region will be focused on to the equator plane due to self-interaction. The escaped mesons mediate the self-interaction field will form a 2-dimensional surface in the equator plane due to self-interaction. This means that all elemental particles carry a 2-dimensional disk of interaction. There is no self-interaction field on the polar direction because all the mesons mediating self-interaction field will be focused on the equator plane. Using Einstein's general relativity, in the Kerr-Newman Blackhole solution [3],

Solving the quadratic equation $\frac{1}{g_{rr}}=0$ yields the solution of inner and outer event horizon surface:

$$r = GM \pm \sqrt{GM - a^2 - (GQ^2)^2} \tag{1.1}$$

How much the inner and outer event horizon is separated is determined by the value of **a**. This outer event horizon interacts with neighbor particles first. Repeating this step with $g_{00}=0$ gives the inner and outer ergosphere.

$$r = GM \pm \sqrt{GM - (a\cos\theta)^2 - (GQ^2)^2}$$

In Einstein's general relativity, egosphere and event horizon is different. The egosphere separation depends on **a** and the altitude of the interaction. In the self-interaction field theory, the egoshere will be closer to the event horizon because of the field-field self-interaction.

The extreme Kerr-Newman "blackhole" is

$$\sqrt{GM - a^2 - (GQ^2)^2} = 0$$

Above Equation (1.1) gives

$$\frac{G_s M}{rc^2} = 1 \qquad (1)$$

for extreme "Kerr-Newman Blackhole". Figure 1 is the geodesic flow directions of matter in the Kerr-Newman Blackhole. From geodesics, we see that any material right outside of the Blackhole is flowing from the polar to the equator. On the surface other than the equator. The geodesics above or below the equator are almost circulating around the globe because of the spinning and geodesics are flowing outwards on the equator plane. Because of the assumption 1, mesons mediating the gravitation or Strong Self-Interaction (MSSI) are also traveling like that. If we consider the field self interaction, the field escape from the non-equator region will be focused on to the equator faster than the current Kerr-Newman blackhole.

FIG.1. **The Geodesics direction of material in Kerr Newman Blackhole**

The reverse travelling direction of Mesons mediating the Self-interaction is the direction of force on the test particles. From this analysis we can conclude the following:

2.1 Interaction disk from equator:

The interaction between the strong self-Interaction "Blackholes" has a unique property of interacting from the equator if it is away from the inner event horizon radius. At other angles the interaction will only cause the object to flip because mesons mediating the SSI are travelling tangential to the surface. That means the force is only tangential or close to tangential when interacting from a non-zero altitude angle and the force is perpendicular when interacting from the equator. If the impact angle of a photon is non-zero, the photon will cause the electron to rotate and flip the spin of the particle. The photon will scatter away from the electron without losing its energy. This may be the reason why electron interaction needs a certain wavelength and angle to be absorbed by the electron. In the macro scale this phenomenon does not happen unless we are near the self-interaction blackhole of gravitation.

2.2 Interaction disk radius may be oscillating:

Equation (1) indicates that G_s depends on the distribution of the mass over r, if part of the energy (ith part of the mass) moves away, $\frac{M_i}{r_i c^2}$ becomes smaller, G_s will become bigger which will result in the ith part of the mass slowing down its going away or coming back to the parent mass. The process can happen vis versa. This analysis shows us that the spinning "SSI-blackhole" is breathing on the equator region. How far the "SSI-blackhole" reaches outside on the equator needs to be determined from experiments or from solving the full SSI general relativity.

2.3 Electron interaction disk:

Electron has a spin of $\frac{\hbar}{2}$. If we need $m_e c r_e = \frac{\hbar}{2}$,r_e =193.1 , fm which is over 200 times larger than the radius of neutron. If we allow the strong self-interaction to reach 10^5 fm, we only need about 0.193% (about 100 ev) of the electron mass reaching 10^5 fm and rotate at the speed of light. This is maybe why the electron radius is hard to measure and it has wave property because it is breathing in and out all the time on the equator plane. How much part of the electron mass energy reaching the atom scale of 10^{-10} m needs to be determined by experiments or the full self-interaction field theory**.**

2.4 Nucleon interaction disk:

Proton or Neutron also has a spin of $\frac{\hbar}{2}$. If we need $m_p c\, r_p = \frac{\hbar}{2}$, r_p = 0.105 fm which is about 8 times smaller than the radius of neutron. If we allow the strong self-interaction to reach 1 fm, we only need about 10 percent of the mass of the proton or neutron to reach 1 fm and rotate at speed of light. The rest of the mass does not need to rotate. How much part of the mass energy is used to reach nuclei scale needs to be determined by experiments or full self-interaction field theory.

2.5 Photon as an escaped disk:

Photon is the escaped interaction disk of electron or nucleon is a reasonable assumption of this SSI field theory. Electron or nucleon has to have spin to be stable. It means electron or nucleon cannot lose its spin. It can flip and change the spin direction. Photon will be a spin 1 $\hbar$ disk (2 times of the spin of the electron or nucleon) when the electron or nucleon flip its spin. It is easy to understand an accelerated charge will emit photon because the disk does not follow the acceleration and can escape from the parent particle. From a pair of nucleons, which interacts and form a spin 1 $\hbar$ pair, if its interaction disks escapes, it will be a spin 2 $\hbar$ mesons. Is this gravitational field? We will come back to this in a later paper. Photon is a full extreme Kerr-Newman Self-interaction "blackhole" because all energy is in spinning. Unfortunately, the distribution of photon SI field is not spherical or even close to spherical. From section 3.5 we will see that Einstein's quantum energy assumption can be derived easily.

2.6 non-interaction surface boundary of pair or group of particles

The analysis of Section 2.1 to 2.5 is about how the boundary extends in a spinning blackhole. When two particles are in opposite spin so that their interaction region can exchange some mesons mediating the SSI, see Figure 2. When two particles (1 and 2) exchange mesons, they form a new boundary of no-interaction. The physics within the boundary may be different. If the third particle 3 is joining the pair and breaks the boundary of no-interaction, the third particle 3 has to exchange the mesons with the opposite spin particle of the pair. If 3 has opposite spin to 2, 3 can not get closer to 1 because they will be repulsive to each other. These three particles can only travel in straight line, otherwise 3 or 1 must leave the group. If the 4th particle 4 is also joining the three-particle group, 4 can be opposite spin to 1.

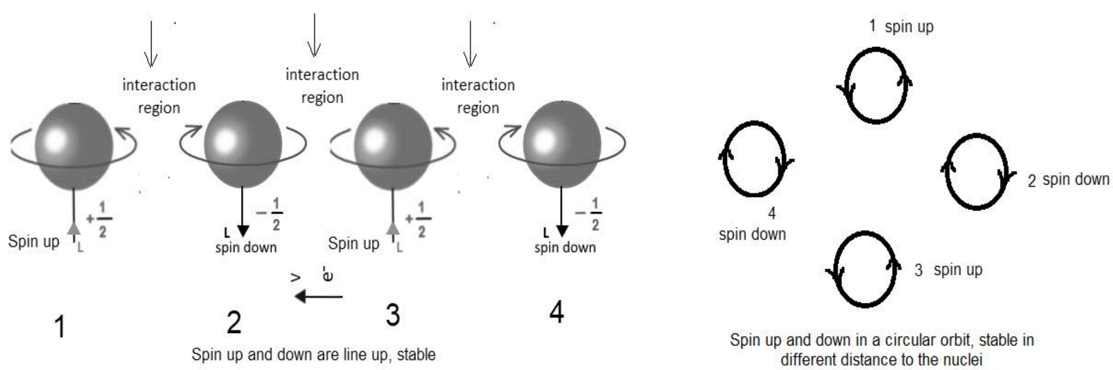

FIG. 2. **Different configuration of spin up and down particles. The first part is the straight-line movement. In the second part particles are in circular orbit unstable unless pair 1&2 in different distance from pair 3&4**

Now it becomes two pairs and as long as the two pairs are in separate orbit, they can be stable. If the four particles are grouped, they are not stable if they are in a flat space because 1 and 3 can also get closer. In a circle grouped configuration (right part of Figure 2), it is stable if it is in a three-dimensional space when 1&2 are in one inner layer, particles 3&4 are in a different outer layer. Is this no-interaction boundary being quantum entanglement? Yes, it is maybe one of the best interpretations of quantum entanglement.

2.7 Background radiation (or temperature) can cause the spin to flip

Due to the background radiation carries energy, it can cause the flip of the electron or the nuclei depending on the wavelength. The nuclei will need higher energy radiation to flip its spin. This is different from quantum mechanics. If the amount of background radiation is low, or the temperature is low, the orbit of the electrons or the nuclei will be more stable and less random. When the electron is closest to the nuclei, the radiation or the interaction between electron and nuclei will cause the flip of the spins so many times per unit time, the total angular momentum will be zero which is hard to understand from the classical physics point of view. The electron probability in different positions will depend on the background temperature which is very different from current quantum mechanics. The extent of randomness of electron orbits can be studied from a macroscopic perspective based on its conductivity relationship with temperature, like superconductivity.

2.8 Magnetic field to limit the spin flipping and increase conductivity

If the magnetic field is perpendicular to the direction particle of movement, the spin and the magnetic field are aligned. The particle intrinsic magnetic field and external field are opposite direction and coupled together. The flip of the spin will be harder. Let's assume the magnetic field is in the Z direction, the electron or nuclei orbit will be limited to the XY plane. The randomness of electron movement in the Z direction is limited because magnetic field will limit the flip of the spin away from Z direction. The interaction disk will be limited in the XY plane. If many of the electrons are limited in the XY plane, there will be empty spaces between electron layers, it will increase the conductivity by many order of magnitude depending on the magnetic field strength and electron intrinsic magnetic field.

3. Foundation of Quantum Mechanics based on Self-interaction field theory

The following items are the foundation of quantum mechanics which are going to be discussed in detail in this section except item (6) which will be discussed in section 5 of this paper.

1) Quantum potentials
2) Uncertainty principles
3) Pauli exclusion principles and spin ½ of elemental particles
4) Einstein's energy and frequency relationship
5) Bohr quantization condition
6) The fine structure constant

Current quantum mechanics is a mathematical description of microworld particles behaviors. There is no physics reasoning of the behavior, but only a tool to describe the properties.

For example, the uncertainty principle: $\Delta x \, \Delta p \geq \frac{\hbar}{2}$ is a mathematic description of the momentum and position relationship when an observation (an interference of the particle movement) is done for position and momentum at the same time. For an electron, if the distance is within 1 fm, the momentum variations based on the uncertainty principle is 197 Mev which is much bigger than the mass of the electron (0.5 Mev). Also, the other equation of Δx and Δp_y is not true when x and y are orthonormal. Why? Current quantum mechanics does not give an explanation. To the author of this Self-interaction field theory, in the classical physics domain, the quantum acceleration is in the direction of motion, or

$$\frac{d^2 x^i}{d\tau^2} \propto \frac{d x^i}{d\tau} \tag{2}$$

Which was excluded from Einstein's theory of general relativity. We will come back to this proposition in the next part of this serial of papers.

3.1 Quantum potential is the potential of self-interaction fields

The new non-Newton's law of gravity for the self-interaction field theory becomes

$$\psi \nabla^2 \psi + \frac{1}{2} \nabla \psi \nabla \psi = -4\pi G \rho$$

Following the equation (19.4) of Part I of this serial of paper, defining ψ^3 as Ψ and divide both side by $\frac{\psi^2}{3}$

$$\eta^{\mu\nu}(\ln\Psi),_{\mu},_{\nu}+\frac{1}{2}\eta^{\mu\nu}(\ln\Psi),_{\mu}(\ln\Psi),_{\nu}=\frac{-3}{\Psi^{2/3}}4\pi G\rho \quad (3)$$

Define $\ln\Psi$ as the field variables, equation (2) can be rewritten as

$$\eta^{\mu\nu}(\Phi)_{,\mu,\nu}+\frac{1}{2}\eta^{\mu\nu}(\Phi)_{,\mu}(\Phi)_{,\nu}= -e^{-\frac{2\Phi}{3}}4\pi G\rho \quad (4)$$

From Equation (3), we see that the interaction between this non-Newtonian law of gravity interacts with matter in a more complicated way. For the microworld, the density of matter is different from our macroworld because the field expands and shrinks all the time. Equation (3) may be the real part of the Schrodinger equation if we know the density distribution of a particle in another field. Quantum interaction is the interaction of equation (3) by define $\Phi = ln(\rho)$,

$$Q = -\frac{\hbar^2}{4m}\left[\nabla\frac{\nabla\rho}{\rho}+\frac{1}{2}\frac{\nabla\rho}{\rho}\frac{\nabla\rho}{\rho}\right]$$

It is clear that quantum potential [4] is a self-interaction field potential. Now let's do the analysis of the strength of this quantum potential.

Schrodinger equation:

$$i\hbar\frac{\partial}{\partial t}\psi(x,t) = \left[-\frac{\hbar^2}{2}\frac{\partial^2}{\partial x^2}+V\right]\psi(x,t)$$

Assume: $\psi = R\ exp\left(\frac{iS}{\hbar}\right)$, S has a dimension of $\hbar$. thus Q also needs to include the $\hbar$.

The strength of quantum potential is $\frac{\hbar}{m}$ per unit mass while the gravitational field strength per unit mass is Gm.

The ratio of Quantum interaction field strength to that of gravitation is

$$\frac{\hbar c}{Gmm}\sim 10^{39}$$

for the protons and the number $\frac{\hbar c}{Gmm}$ will be ~10^{42} for the electron. It seems quantum interaction has the same strength as strong interaction. This is why the coupling constant of strong interaction α_s is about 1.

Dirac's original large number hypothesis is ratio of the gravitational force between electron and proton and the electric force [5]

$$\frac{Gm_p m_e}{e^2}=4.4\times10^{-40}$$

We re-define Dirac's large number it as the gravitational strength over the strong interaction strength.

3.2 Uncertainty principles

Current quantum mechanics uses assumptions and principles to describe the microparticles movement, not using the macroworld concept like velocity, accelerations, or force. It is not clear what force acts on the microparticles and what is the acceleration. With this Self-interaction field theory, let's rewrite the uncertainty principle to see how uncertainty principle is related to Self-Interaction field theory.

$$\Delta x \, \Delta p \geq \frac{\hbar}{2} \tag{4}$$

$$\frac{\Delta p}{\Delta t} \geq \frac{\hbar}{2\Delta x \, \Delta t} = \frac{\hbar \, v}{2\Delta x \, \Delta x} \tag{5.1}$$

If the quantum interaction is propagating at the speed of light, then v = c in equation (5.1).

If we introduce the boundary condition of SSI field theory which is Equation (1) to equation (5.1)

$$\frac{\Delta p}{\Delta t} \geq \frac{\hbar \, v}{2\Delta x \, \Delta x} \frac{G_S M}{r_k c^2} = \frac{m \, r_k v c}{\Delta x \, \Delta x} \frac{G_S M}{r_k c^2} = \frac{G_S M m}{\Delta x^2} \frac{v}{c} \tag{5.2}$$

Where elemental particles spin is $\frac{\hbar}{2}$ and is equal to $mr_k c$ is assumed.

Equation (5.1) is interesting because all elemental particles are interacting through spin and all elemental particles are spin 1/2 $\hbar$. This is why the same theory can be used for all microworld particles. Equation (5.2) brings the self-interaction Newton's Law of gravity with SSI constant to the microworld. The maximum $\frac{\Delta p}{\Delta t}$ is as following when the quantum action propagation speed is the speed of light or v=c.

$$\left(\frac{\Delta p}{\Delta t}\right)_{\max} = \frac{\hbar c}{2\Delta x \Delta x} = \frac{G_S M m}{\Delta x^2} \tag{6}$$

Quantum interaction unique behavior may be because the measurement by physicist is causing the break of the SSI "black boundary". We are outside of the "SI-blackhole" which a trapped SSI field can be coming out or collapsing back if a measurement is done. Quantum interaction is the strong self-interaction reaching to the quantum scale.

It seems that strong interaction, quantum interaction and the interaction which binding all elementary particles may be the same interaction in this self-interaction field theory.

3.3 Spin ½, Pauli Exclusion Principles and relationship between spin and motion

Due to all elemental particles having spin except pion, all elemental particles including photons will be interacting through equator plane. Due to electromagnetic field carries energy momentum, electromagnetic field will also have to follow the path self-interaction field theory defines, the behavior of electromagnetic field in microworld will be limited. We will come back to this in Section 3.6 of this paper.

From the above analysis, all elemental particles have an event horizon surface which can extend to whatever r as long as equation (1) is satisfied. This is the difference between this theory and Standard Model.

Field cannot escape and cannot interact with another field from non-equator region. The non-equator region will only cause the particle to flip or change the spin direction. It will not cause the motion of the particle. Thus,

(a). The motion of elemental particles (a SI-blackhole) is always perpendicular to the direction of spin. See the first two figures of Figure 3.

(b). The spin will have only two possibilities: spin up and spin down. No spin zero or spin parallel to the motion because there is no self-interaction field escape from polar region to interact with other particles. See last figure of Figure 3.

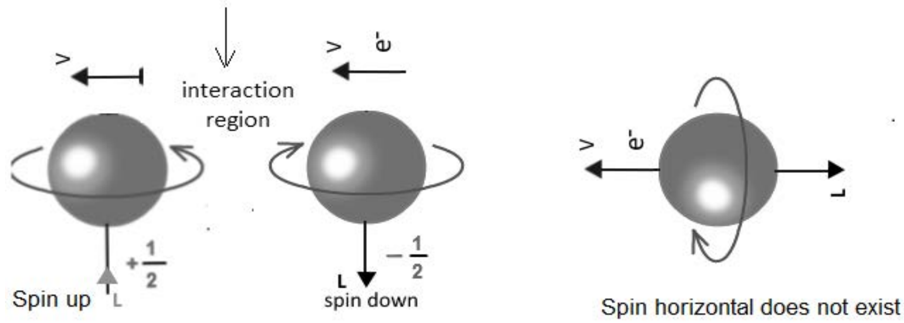

FIG. 3. **The spin and motion. Only spin up and down is allowed.**

No spin horizontal exists because no interaction or force from the polar region.

It is also easy to understand the physics reasoning of Pauli Exclusion principle using this self-interaction field theory. When particles are travelling together and are getting closer, their interaction disk will meet first. Only when one is spinning up and the other is spinning down the pair will not be repulsive to each other because in the interaction region, the particles interacting mesons have the same momentum direction (see the first two figures in Figure 3). If in a pair the mesons in the interaction region are moving in the same direction (the spin-up and spin-down pair), the exchange of mesons will not cause the net force to each individual particle. On the contrary, if in a pair the mesons in the interaction region are moving in the opposite direction (both spin-up or both spin-down pair), the exchange of mesons will cause the opposite force to each individual particle and the particles will move apart. Thus, the orbit of elemental particles traveling in pairs of spin up and down are more stable.

The third particle cannot be in the same orbit because the third particle will be in opposite momentum when getting closer with one of the two particles. When the third particle has the same spin as one of the two original pairs, it will collide and fly away. Pauli Exclusion principle is saying that all pairs will have to have different angular momentum which means different pairs are in different orbitals or in different spacetime. For example, one pair is in the inner layer and another pair is in the outer layer, the orbits are still stable. Based on the angular momentum, the radius of the electron orbit will be different. Even in the same orbit, if their projection of momentum is different, one is spinning in the XY plane and another is in the XZ plane, the electron orbit is still stable. This is maybe why the magic number of stable electron (atom) orbit and nucleon orbit (in the nuclei) is the same.

Pauli Exclusion principle would not work if the orbit were only parallel and straight line to avoid the particles with the same spin direction to meet each other based on this SI theory.

3.4 The Stern–Gerlach experiment

In the original Stern-Gerlach experiment, silver atoms were sent through a spatially varying magnetic field, which deflected them before they struck a detector screen, such as a glass slide. Particles with non-zero magnetic moment were deflected, owing to the magnetic field gradient, from a straight path. The screen revealed discrete points of accumulation, rather than a continuous distribution [6], owing to their quantized spin. Historically, this experiment was decisive in convincing physicists of the reality of angular-momentum quantization in all atomic-scale systems [7-9]. From the Self interaction field theory point of view, the silver atoms form an interaction disk around its angular momentum, the angular momentum is quantized because the spin is either up or down because the disk is so thin that any small amount of torque will flip the angular momentum.

Later experiments were shown in the following Figure 4 which can be used to test this SI theory.

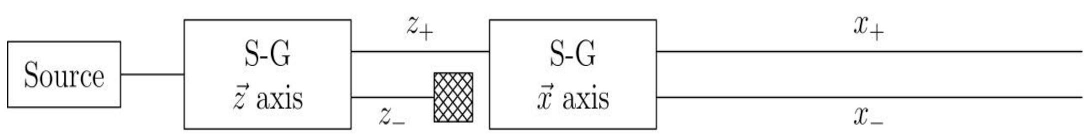

FIG. 4. **The Stern-Gerlach experiment**

Classically, a Z+ spin will not change to X± direction. But it is easy to understand this from the Self-interaction field theory point of view. Because the self-interaction field interacts through an interaction disk and the disk may be super thin and the disk can flip easily by non-equator interaction. Even if the interaction disk is in XY plane and traveling in the X direction, it can be easily flip to XZ plane. This is why the states are quantized. The difference between this SI field theory and current quantum mechanics is that the current SI field theory is physics and has a cause of the phenomena while current quantum mechanics is mathematics tool.

In order to test whether this SI theory is true and quantum mechanics is incomplete, we can arrange experiments from the following three aspects.

1) The temperature is low so that no outside electromagnetic field interferes with the interaction.
2) The magnetic field is weak so that the torque of flip the spin is weak. The chance of angular momentum not flipping can be detected.
3) The Magnetic field is in perfect X direction until the detector so that there is no disturbance when the silver atom reaches the detector. If there are silver atoms in the Z+ direction in Figure 4, it would prove that current quantum mechanics is incomplete because quantum mechanics does not have the spin 0 state when the electromagnetic field is involved. But, this self-interaction field theory allows the particle to stay in the same state without external disturbance to cause the flip of the spin.

3.5 Quantum Energy Assumption: E = hf

We do not know the structure inside photon: Let's assume an interaction disk is circulating in a circle like all other classical particles and the force attracting all the energy inside the disk like classical Newton's Law of gravity except the gravitational constant is replaced with the Strong self-interaction constant:

$$\frac{G_s M m_k}{{r_k}^2} = \frac{{j_k}^2}{m_k {r_k}^3} \tag{7}$$

at boundary of SI "black surface", the Kerr-Newman "blackhole" gives $\frac{G_s M}{r_k c^2}=1$ like Equation (1). Putting Equation (1) into equation (7) and times m_k on both side

$${m_k}^2 c^2 = \frac{{j_k}^2}{{r_k}^2} \qquad \text{then } \sum m_k c = \sum \frac{j_k}{r_k}$$

Times c on both side and take the $E = m_k c^2$ and assume photon is an interaction ring

$$E = \frac{J 2\pi C}{2\pi r} = 2\pi J f = hf \quad \text{or } E=\hbar v \tag{8}$$

where h = $2\pi\hbar$ and f is the frequency. Equation (8) is Einstein's energy quantization assumptions.

It is clear that the boundary condition gives Einstein's energy conditions when Self -interacting Newton's law of gravity with new constant is introduced to balance the centrifugal force.

3.6 The Bohr Model of hydrogen and Einstein's energy quantization and no radiation from ground state

The Bohr model: The electron is held in a circular orbit by electrostatic attraction. The centripetal force is equal to the Coulomb force:

$$\frac{m_e v^2}{r} = \frac{k_e e^2}{r^2} \tag{9}$$

k_e is the Columb constant.

The electric potential energy is

$$E_e = -\frac{k_e e^2}{r} = -m_e v^2 = -m_e v 2\pi r \frac{v}{2\pi r} = -2\pi J f = \text{h f} \tag{10}$$

Equation (10) is the Einstein energy condition for the electric energy of the electron around the proton. We see that the electric energy in Bohr model is limited by Einstein's energy condition which is derived from the attraction of Self-interaction Newton's Law of gravity. The electric energy must be equal to the SI energy otherwise the mesons mediating the electric energy cannot escape from the proton or the electron. Electric energy also carries energy momentum like other mesons or particles and follows the path like other particles.

In macro scale, the charge acceleration produces electromagnetic radiation, while the electron acceleration around the proton in the ground state does not produce electromagnetic radiation because in the ground state, the Self-interaction field and the centrifuge force forming a balance. The SI field cannot escape from the electron in ground state. This is why electrons do not radiate out more energy at ground state. When the electrons are in ground state, the total angular momentum is zero. Based on quantum mechanics, the electron probability distribution is spherical. From the SI field theory point of view, the electron and proton interaction surface are not on the same plane. Also due to the outside temperature not being zero, the outside radiation will also interfere with the motion of the electron and proton while in quantum mechanics it is not believed temperature will cause the electron motion to be changed in ground state.

3.7 Superconductivity

Quantum mechanics has statistical properties. Current quantum mechanics can give the probability distribution of electron movement, but the specific orbit cannot be determined like in classic physics. Temperature does not change the distribution of probability. Under this Self-interaction field theory, the electron movement can be determined. Any outside interference from electromagnetic radiation will cause the randomness of the electron movement. As we know, the higher the randomness of electron orbits, the higher resistance of a conductor. The study on the relationship between temperature or light wavelength and resistance for different material may lead to the discovery of how the electron orbits are changing by outside electromagnetic radiation. If the temperature is very low, no radiation will disturb the movement of a spin-up-and-down pair of electrons. If the spin-up-and down pair movement has no outside disturbance, the movement shall be semi-determined. If the electron has some angular movement, the movement pattern shall be determined and limited with a bigger radius.

From the analysis of 2.8, we also see that a magnetic field perpendicular to the conductive wire will limit the flip of the spins of many electrons if the external magnetic field is strong enough. This limitation of the spin flipping will reduce the randomness of the electron orbit dramatically if the outside magnetic field is strong and in line with the intrinsic magnetic moments. The magnetic field will also limit the movement of the electrons in the inner orbit of a conductive wire, the limitation of the inner electron's movement may not increase the conductivity. A recent experiment has already discovered this effect [11]. Different materials shall have different external magnetic field strength requirements for increasing the conductivity. The electron responsible for the conductivity moves in between the space of the self-interaction theory defined electron orbit shall have superconductive property if the electrons and nuclei orbits are both limited to a certain extent. A detailed calculation of the tensor self-interaction field equations (part III of this serials of papers) or a model of the electron movement based on this SI field theory shall give some inside of what material can be superconductive at low temperature or under the influence of the external magnetic field.

3.8 Quantum entanglement

When electrons are attracted to a nucleus, or a photon comes into an atom, the electron or photon starts to interact with other particles and become a group of interacting particles together through self-interaction fields. If they form a spin-up and down pair, they can exchange mesons mediating the Self-interacting fields like in Figure 5**.**

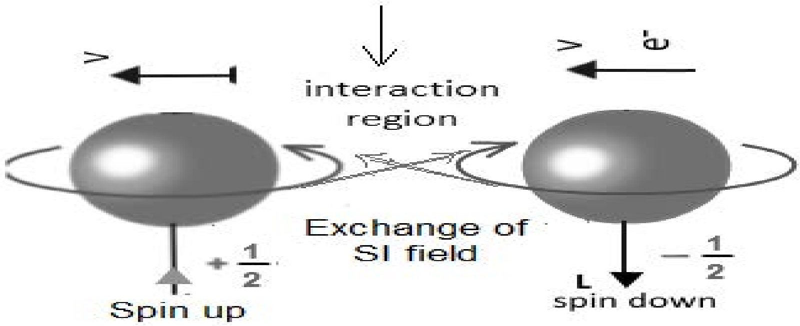

FIG. 5**. Spin-up and spin down pair interact by exchange Mesons mediating SI field**

The spin up and down pair forms a new Self-interacting boundary with the field being trapped. After this up-down pair leave the group, they would still be in contact with each other through 1D trapped field which will be two strings of constant force. How large is the force between two strings have to be determined through experiments. In this aspect, this self-interaction field theory is also different from quantum mechanics. In this self-interaction field theory, the interactions strength between the interaction pair will be different for different particles. For example, the photon pair interaction strength may depend on its wavelength. This author points out in another paper [10] that the virtual particles emitted by electrons may depend on the virtual momentum itself. Surely, the physics within the boundary may be different from our physics and will be further discussed in Part III. When the two particles are going apart, they are still interacting until another particle interaction disk breaks into the boundary and become interacting with one particle of the pair. The current quantum mechanics call this phenomenon “the observation experiments causing the collapse of the wave function”. It is clear that this way of interpreting quantum entanglement is more appropriate than the current quantum mechanics.

3.9 The trapped SI fields interaction in a 1D box

Assume: a particle with a trapped self-interaction field is located at 0.5 a (a is the distance from one wall to another wall) with an initial momentum p_0, the particle emitting a virtual particle of momentum Δp per unit time. Using the uncertainty principle, which is a Self-Interacting Newton’s law of gravity,

$$\Delta x \, \Delta p = n\hbar$$

Due to two walls,

$$\delta p = n\hbar\left(\frac{1}{x} - \frac{1}{a-x}\right) = \frac{n\hbar\left(a-2x\right)}{x\left(a-x\right)}$$

we do not know how frequently the particle emitting the virtual particles and what kind of momentum pattern it is emitting (how Δp is related to p), we just assume constant emitting Δp (Δp is independent of p). By fine tuning the parameters (p_0, Δt, n=1, $\hbar$=1), a back-and-forth movement is recovered. See Figure 6. If p_0 and Δt are well fine-tuned, we shall get a forever back and forth movement, that means the energy shall be quantized. Detailed modeling will be interesting. Along this line of thought, we may be able to recover the energy quantization and quantum tunneling.

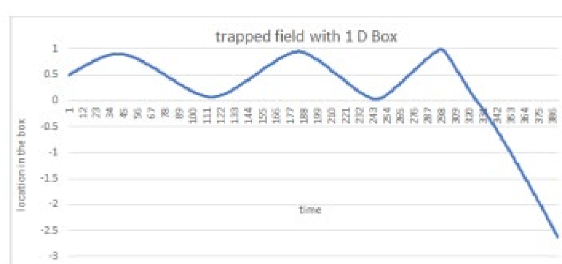

FIG. 6. **The trapped field particle in a 1D box emitting Δp virtual particles per unit time**

4. Hawking theory of "Blackhole" and the Nucleon properties

Before we have the full tensor theory self-interacting field theory to replace Einstein's general relativity, we can just use some concept from Einstein's blackhole theory to study the elemental particles by replacing the gravitational constant with the strong self interaction constant G_s. Einstein's Schwarzschild black hole has a boundary of $\frac{2GM}{rc^2}=1$ and all gravitational field shall be trapped inside this space based on the self-interaction field theory of gravitation. This reminds us that strong interaction is being trapped in the nuclei. Because we do not have the radius information of pion. We use proton as an SSI Kerr-Newman Blackhole to estimate G_s:

In the Kerr-Newman black hole, the horizon is defined as:

$$(r^+)^2 - 2GMr^+ + (GQ^2)^2 + a^2 = 0$$

Using the radius, mass and the spin of proton, we can find the Gs = 2.3×10^{28} N·m^2 ·kg^{-2} = $0.34 \times 10^{39} G$.

Mass of a black hole is related to the irreducible mass as [9]

$$M^2 = \left(mir + \frac{Q^2}{4Gm_{ir}} \right)^2 + \frac{J^2}{4G^2 m^2_{ir}} \tag{11}$$

Considering that π^0 is the irreducible state of nucleons, then m_{ir}=135 Mev. J=0 and $Q^2 = e^2$ for π^+ and π^- , Equation (11) gives the pion mass if we change the gravitational constant G to the strong self-interaction constant Gs.

$$M\left(\pi^+, \pi^-\right) = m_{ir} + \frac{Q^2}{4G_s m_{ir}} = 139.7 Mev$$

The actual value is: 139.5 Mev.

And J=1/2 $\hbar$ and $Q^2 = e^2$ for proton,

$$M(P) = \sqrt{\left(m_{ir} + \frac{Q_2}{4G_s m_{ir}} \right)^2 + \frac{J^2}{4G_s^2 m_{ir}^2}} = 813.37 Mev$$

And J=1/2 $\hbar$ and Q2 =2 e^2 for Neutron, M(N) = 818.10 Mev.

Because Proton and Neutron may have more composite particles, this is why the mass is off by10%.

The temperature for strong interaction "Schwarzschild black hole" is described as [12].

$$T = \left(\frac{\partial M}{\partial S} \right)_{J,Q} = \frac{h}{8\pi k G_s} \frac{1}{M}$$

The energy loss of the "black hole" through blackbody radiation is

$$\frac{dM}{dt} = -\sigma A T^4 = -\frac{2\sigma h^4}{(8\pi)^3 k^4 G_s^{\ 2}} \frac{1}{M^2}$$

The life span of the "black hole" is

$$t = \frac{512\pi^3 K^4 G_s^{\ 2}}{6\sigma h^4} M^3 = \frac{5120\pi G_s^{\ 2}}{hc^4} M^3$$

For a strong interaction "black hole" π^0:

$$t = 3.166 \times 10^{61} M_0^3 = 1.379 \times 10^{-22} \text{ s.}$$

which is not close to 8.4 $\times 10^{-17}$, but closer to the strong interaction time scale.

Another case is that the collapse of a star from initial density ρ(0) to infinite is

$$T = \frac{\pi}{2}\left(\frac{3}{8\pi G\rho(0)}\right)^{1/2}$$

T is about 10^{-23} s if G is replaced by Gs, and ρ (0) with the density of nuclei, which is the time scale of strong interaction.

The "black hole" theory indicates that there are only three parameters observable, J, Q and M. The elementary particles electron, muon and taon also have only three observables, the J, Q and M. Based on the Kerr-Newman metric, the intrinsic singularities is only related to a. The escape of particles can only be from the equator due to the rotation, the interaction of strong self-interaction particles can only interact with the other particles through J (h). The strong interaction can only escape to the Marco-space through its spin, or the quantum interactions. The radius of the observable universe is the speed of light times the lifetime of the universe, R = c T_u and the radius of the nuclei is speed of light times the time scale of strong interaction, r = c T_s. $G/G_s = 10^{-39}$ and $T_s/T_u = r/R = 10^{-39}$

$$\frac{G_s}{G} = \frac{M}{m}\frac{r}{R} = \frac{r}{R} n,$$

thus $n = 10^{78}$

The baryon numbers are about 10^{78} in the universe.

5. Planck units, fine structure constant and Strong self-interaction constant.

From Equation (6), we know that the quantum force is from the interaction disk and the interaction disk radius is oscillating to become smaller or bigger. The max strength of quantum force equivalent to Newton's Law of gravity can be expressed as:

$$F = -\frac{G_s Mm}{r^2}$$

But $\frac{G_s M}{rc^2} = 1$, another form of expression

$$F = -\frac{m}{r} c^2 = -\frac{\hbar c}{r^2} \quad (12)$$

The strong self-interaction may extend to much large scale an the interaction is still part of the field trapping property.

The charge electric force is

$$F = \frac{e^2}{r^2} \quad (13)$$

Equation (12) and (13) defines the fine structure constant α as the ratio of the electromagnetism interaction over maximum strong Self-interaction strength.

$$a = \frac{e^2}{hc} = \frac{1}{137} \quad (14)$$

Equation (14) is suitable for all strong Self-interactions, including both proton and neutron and other nucleons. This is also why the fine structure constant appears in the quantum mechanics frequently because quantum mechanics is part of the strong self-interaction leaked from the equator by the spin. It is also interesting to see that the coupling constant of strong interaction is

$$a_s = \frac{G_s Mm}{\hbar c} \sim 1 \quad (15)$$

Because of the boundary condition $\frac{G_s M}{rc^2} = 1$ and the definition of the angular momentum exchange has to be two time of the nucleon spin $\Delta J = 1\hbar$. The current physicists think if the spin for electron the classical rotation is 1/2 $\hbar$, it would require the speed of light to be greater than c. In fact the radius of electron charge may be smaller than the Strong self-interaction field radius, the interaction disk is extending and shrinking all the time, this is maybe why it is hard to measure the radius of electron.

Another interesting assumption of self-interaction field theory is that the gravitational constant is inversely proportional to the radius of the boundary.

$$G \propto \frac{1}{R} = \frac{\beta}{R} \quad (16)$$

Where β is another constant.

The ratio of gravitational constant to the strong self-interaction constant of proton is

$$\frac{G}{G_S} = \frac{r_p}{R_U} \approx 10^{-39} \quad (17)$$

Put Equation (17) into the boundary condition Equation (1) for both gravitational and strong self-interaction: $\frac{G_S M}{rc^2} = \frac{GM_u}{R_u c^2} = 1$

We have

$$\frac{G_S M_p}{r_n c^2} = \frac{\beta M_p}{{r_n}^2 c^2} = 1 = \frac{GM_u}{R_u c^2} = \frac{\beta M_u}{{R_u}^2 c^2} \quad (18)$$

From Equation (18), we see that

$$M_u = (\frac{r_p}{R_U})^2 M_p = 10^{78} M_p, \quad (18.1)$$

which is very close to what we observed .

Equation (1), (17) and (18.1) interpreted the Dirac large number hypothesis from a physics point of view.

Planck mass is defined as [13]

$$m_{pk} = \sqrt{\frac{\hbar c}{G}} = \sqrt{\frac{G_s mm}{G}} = \sqrt{\frac{G_s}{G}} m_p = 10^{20} m_p \tag{19}$$

Where from Equation (6) $\hbar c = G_s mm$ is used. Because the proton strong self-interaction constant is 10^{39} of gravitation constant, the Planck mass is 10^{20} times of proton mass. Is Planck Mass meaningful or it is just a wrong scale matching? If we replace the gravitational constant G by the proton self-interaction constant G_s in Equation (19) we get $m_{pk} = m_p$.

By the same token, Planck length is defined as

$$r_{pk} = \sqrt{\frac{\hbar G}{c^3}} = \sqrt{\frac{G_s mmG r_p{}^2}{c^4 r_p{}^2}} = \sqrt{\frac{G}{G_s}} \sqrt{\frac{G_s mmG_s}{c^4 r_p{}^2}}\, r_p = \sqrt{\frac{G}{G_s}} r_p = 10^{-20} r_p \tag{20}$$

Where $\hbar c = G_s mm$ and $\frac{G_S M}{rc^2} = 1$ is used. Because the proton strong self-interaction constant is 10^{39} of gravitation constant, the Planck length is 10^{-20} times of proton radius. Is Planck length meaningful or it is just also another wrong scale matching. If we replace the gravitational constant G by the proton self-interaction constant G_s in Equation (20) we get $r_{pk} = r_p$. Planck time is defined as the Planck length divided by c. Thus, if G is replaced by the strong self-interaction constant G_s, we get the strong interaction time scale of 10^{-23} sec instead of 10^{-43} second which is so far from any time scale we can think of. In summary, we treat the proton as the "blackhole" of strong self-interaction. We are able to explain the origin of Dirac Large Number Hypothesis. Also, that the Plack time, Plack mass and Plack length may be due to the mis-match of the constants. The original Planck unit may not have any meaning because gravitation changes amplitude when the matter is forming a new closed and field trapped matter. The correct Planck units shall be the nucleon radius, the strong interaction time, and the nucleon mass.

6. Discussion

From section 2 and 3, we see that assuming the field being self-interacting is very interesting. If the interaction radius (the outer event horizon) is much bigger than the inner radius event horizon, The interaction between the strong self-interaction "Blackholes" has very unique property of interacting from the equator. The other angles of interacting will only cause the object to flip. That means the force is only tangential when interacting from a non-zero altitude angle and the force is perpendicular when interacting from the equator. If the interaction radius is not so much bigger than the inner event horizon radius, there are some interactions from the non-zero angle, the "Blackhole" must be in contact with each other. The photon escapes from the electron or nucleon with 2 times of their spin. Using this new self-interaction theory to study the photon emission pattern can be interesting.

From Section 3, we see that quantum mechanics can be well explained in a physics way using this new theory. This SSI field theory is different from quantum mechanics philosophically. The quantum entanglement is due to the exchange of fields in a different "universe". The physics may be different, and the exchange speed is not infinite like in quantum mechanics. Based on the next part of this series of papers, the entanglement may have a strength depending on the speed of the particle. Entanglement can be built and the exchange speed between entangled quantum states can be measured so that we understand the physics within the boundary which may be different from our physics. Through modeling of the movement of the SSI-Blackhole, we can estimate the virtual particle emitting pattern and the inside structure of all elemental particles without seen.

Section 4 is about the strong interaction interpretation using the SSI field theory. It gets the order of magnitude right for mass and interaction time scale. The Nucleons may have composite particles, but this simple Hawking radiation model for the pion decay may not be appropriate. Due to the variation of G_s, this simple constant G_s model of Nuclei using Hawking theory is just an initial attempt. More modeling needs to be done using the Self-interacting general relativity.

Section 5 reveals the meaning of the fine structure constant. The current Planck units are not so useful unless we change the gravitational constant to the SSI constant. The SSI for electron and proton is different.

A complete self-interaction field theory will be presented in Part III.

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