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The Breaking of Symmetry in Gravitational Attraction and the Random Motion of a Hydrogen Gas Molecule

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

This paper examines symmetry breaking in gravitational attraction between gluons within a proton and shows that the random motion of hydrogen gas molecules might be caused by this breaking of symmetry. Anisotropic gravitational field is applied to a gluon elementary particle. Generally, gravitational force is offset when masses face each other. A progressive concept of gravitational attraction that gravitational force is also offset when gravitational field lines being shielded by each other is presented. The rigidification of vacuum by color-charged mass is introduced to explain the shielding of gravitational field lines. Both the gluon's anisotropic gravitational field and the shielding mechanism demonstrate that the symmetry of gravitational attraction can be broken within a proton. The asymmetric gravitational attraction produced within a proton inevitably accelerates proton. Thus, a hydrogen gas molecule with independent acceleration vectors at the two hydrogen atoms exhibits the combination of vibrating, rotating and translation motions. Atomic vibrations in a solid are also caused by this acceleration.

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1. INTRODUCTION

It is logical to explain the motion of all masses in the universe, from the orbital motion of planets to the motion of electrons, by the four fundamental forces of nature. Of the four fundamental forces of nature, gravitational force is the dominant force acting on massive bodies. It is known that gravitational attractions between two bodies act symmetrically. Surprisingly however, not many studies have explored the gravitational field in relation to elementary particles such as quark and gluon, or the gravitational attraction between them. This is because gravitational attraction force is known to be very weak in the world of subatomic particles.

A gas molecule moves on its own just like a star or a planet propelling itself without consuming any internal energy. Scholars have not yet been able to explain the origins of the motions of gas molecules beyond identifying the motions as the inherent nature of gas. However, the motion of gas molecules should instead be understood in the context of the four fundamental forces of nature. A hydrogen gas molecule can vibrate, rotate and translate with only two covalently bonded protons of the atom, which implies that each proton is moving independently. This in turn indicates that at least one of the fundamental forces interacting with the subatomic particles in a proton is acting asymmetrically.

Asymmetric gravitational field was reported recently at the massive body of planet Jupiter [1-2]. Space probe Juno finds that Jupiter's gravitational field is asymmetrical in 2016. Asymmetry is attributed to differential rotation and deep atmospheric flows [1]. However, it is difficult in finding studies of the asymmetric gravitational field of subatomic particles such as gluons.

In this study, I examine the possibility that the asymmetric force within a proton is gravitational attraction. The first thing to consider in studying the gravitational field of the subatomic particle is the shape of the elementary particle. If we consider a large mass as a set of elementary particles, we can model it as a single solid sphere. However, when we look at each elementary particle, there is no basis to claim that the shape is spherical. Rather, many research studies present the shape as a string-like tube [3-5]. The asphericity of the elementary particles affects the form of the gravitational fields. The next is reconsidering of the principle of superposition of gravitation. In general, the principle of superposition can be applied when there are several nearby masses. The total gravitational field is made by adding all the gravitational force vectors. By the principle of superposition, gravitational force is offset when masses face each other. However, the gravitational force is also offset when gravitational field lines being shielded by each other.

In this theoretical study, on the condition that the mass has an anisotropic gravitational field and the gravitational field lines are shielded by nearby masses, I propose that the symmetry of the gravitational attraction breaks.

This study also investigates the breaking of symmetry in gravitational attraction within a proton. These theoretical conclusions seek to explain the cause of the random motion of a hydrogen gas molecule.

The rest of the paper is organized in the following order. Section 2 proposes a theoretical explanation of the symmetry breaking in gravitational attraction within a proton. I argue that this symmetry breaking exists within a proton, and a proton or a neutron is given to create an arbitrary acceleration vector. Section 3, I apply the proposed theory to explain the random motion of a hydrogen gas molecule. In doing so, I show that my theory explains Charles's Law. Extending the theoretical framework, Section 4 then discusses atomic vibrations associated with symmetry breaking and explains the rotation of planets as evidence for the asymmetry of gravitational attraction in massive bodies. The final section concludes these findings.

2. SYMMETRY BREAKING IN GRAVITATION ATTRACTION WITHIN A PROTON

This section shows how gluon's anisotropic gravitational field and the shielding of gravitational field lines cause symmetry breaking in gravitational attraction within a proton.

2.1 Reality of Mass

Gell-Mann's quark model from the 1960s found that a proton was not an elementary particle and that it actually consisted of an additional particle

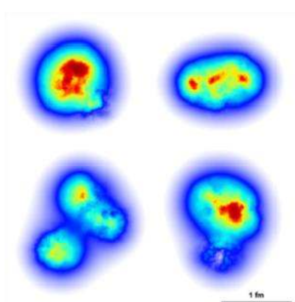
[6-9]. Protons and neutrons, which occupy most of the mass of all matter, are composed of three quark particles. However, the mass of a quark is less than 5% of the mass of a proton. Most of the mass is produced by gluon fields [10-12]. That said, most of mass is energy that comes from color charges. Therefore, the charges within an atom can be proportional to the mass of an atom, which is consistent with Einstein's law of mass-energy equivalence stating that mass is concentrated energy. This indicates that the charge as well as the mass can play an important role in the mechanism of gravity [13-14].

In recent years, many experimental researchers successfully worked on the proton's structure [15]. Experimental and theoretical studies show various non-spherical gluon shapes such as a flux-tube-type gluon connecting a quark and to another quark, as well as a gluon connecting virtual quark and antiquark in a proton [3-6,10]. In addition, studies have found that the distribution of gluon density varies with gluon fluctuations [16]. Mäntysaari H. and Schenke B. show time-varying gluon's density in a proton at Fig. 1(a) [4-5]. The shapes of gluons are no longer spherical. Leinweber DB also shows snapshots of gluon field obtained from 3D simulation of gluon field in a proton at Fig. 1(b) [10]. The shapes of gluons are time-varying and never spherical. The mass was a physical property with energy of strong force occupying a volume in the empty vacuum of space. The volume occupied by a gluon was not a complete sphere. Magi Mageshwaran et al. show that a particle with volume and mass diminishes the energy density of the empty vacuum of space [17]. To summarize findings from the recent studies, mass is an empty vacuum of color charges with strong force fields and non-spherical shapes.

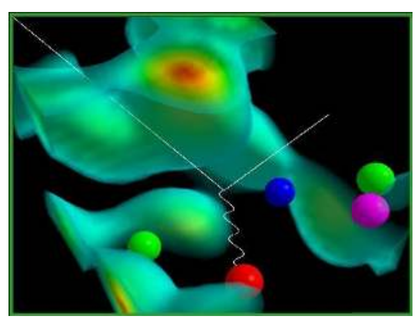
2.2 Shielding of Gravitational Field Lines by Rigidification of Vacuum

In this section, I suggest a shielding mechanism of gravitation. Generally, in the gravitational field model, mass is modeled by a point mass or a homogeneous spherical solid body. Point mass is the assumption that all the mass of an object is at a single point. The force of gravity acts along straight lines through the vacuum. Gravitational field lines come toward a point mass in every direction and never cross each other [18]. The problem concerns how the gravitational field lines pass through the neighboring point masses or the spherical solid body. If the empty vacuum of space occupied by the point mass is not a normal vacuum, then the gravitational field lines which have straight lines going in every direction would have problems passing through this point.

The vacuum polarization of charged mass is the well known phenomenon for the abnormal vacuum state. The dielectric displacement within mass is different from the dielectric displacement outside of mass due to vacuum polarization. In Dirac vacuum, the empty vacuum of space is a vacuum bubbles in which virtual particle-antiparticle pairs are constantly producing and annihilating repeatedly [19-21].



(a)



(b)

Fig. 1. The shapes of gluon density. (a) Gluon density of a proton at high energy and four different times, as modeled by Mäntysaari and Schenke. Red indicates high gluon density, and blue indicates low density [3-5]. (b) 3D visualization of the proton. The red, green and blue spheres are quarks, confined by the gluon field to form a proton. The pair of green and magenta (anti-green) sphere is a quark-antiquark pair, forming a meson. The quarks only make up 3% of the proton's mass, and the gluon field makes up 97% by Einstein's equation $m = E/c^2$. Hence, the majority of all mass originates in gluon interactions [10]

Virtual particles include leptons and hadrons such as electrons, quarks and gluons. If an electrically charged particle exists in the empty vacuum of space, the virtual electron-positron pairs in the vacuum reposition themselves. This reorientation of the short-lived electron-positron pairs is an act of vacuum polarization. The polarized vacuum is no longer a normal vacuum state. It would be slightly distorted or rigidified from the reorientation. Tesla's ether [13] was rigidified by rapidly varying electrostatic forces in his dynamic theory of gravity although the theory was not published. Dirac vacuum [21] makes decoding of Tesla's ether rigidification possible. When quarks or gluons of color charge appear in the empty vacuum of space, the virtual particle-antiparticle pairs in the vacuum reposition themselves with their color charges. This is reinterpretation of Tesla's ether rigidification in a broad sense [22].

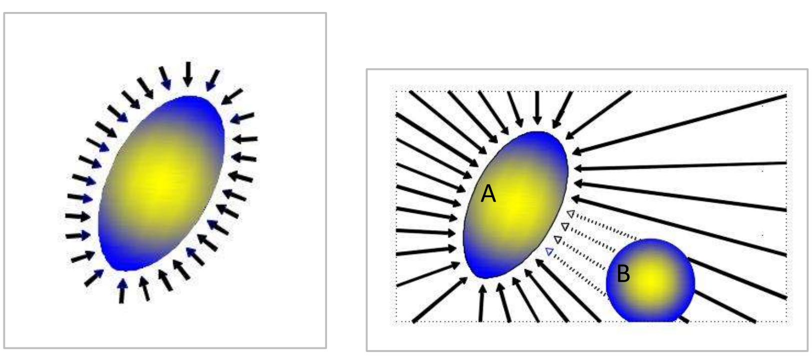
Most of the mass in a nucleus is produced by gluon fields [10-12]. Gluon fields are made by color charges. In word words, mass possesses charges proportional to it, and mass with charges rigidifies the empty vacuum of space. This rigidification can cause problems for the empty vacuum's role as a mediator of gravity transfer. The rigidification of a vacuum could be a wall considering the force of gravity acts along straight lines through the vacuum. For example, consider sound waves reaching a glass window as they are transmitted through the air. In this case, the sound waves are shielded due to the window glass which serves as a kind of rigidification of the air. The molecules in the glass are rigid while the molecules in the air are able to fly around randomly. The gravitational field lines would not pass completely through the mass because of the rigidification. In other word, gravitational field lines are shielded by the charged mass. Future studies could validate these claims through experimentations.

2.3 The Gravitational Field of an Elementary Particle

This section demonstrates how an elementary particle has its own gravitational field like a massive body, but the gravitational field of a gluon is not isotropic because of the tube-like shape. Experiments on the gravitational field of a massive body show that gravitational field lines are heading toward the center of mass from every direction [18].

A massive body is the sum of the masses of many elementary particles, and the gravitational field of the massive body comes from the superposition of the individual gravitational fields of the elementary particles. In this scenario, the elementary particles refer to gluons, which occupy most of the mass of protons and neutrons [9].

It is assumed that the gravitational flux density for the mass of an elementary particle is constant. The shape of gluon is not spherical as shown in the distribution of gluon density in a proton [10-11, 16]. Therefore, the gravitational field made by a gluon is not isotropic. Fig. 2(a) shows the typical anisotropic gravitational field of a gluon in which the field lines are perpendicular to the surface of the gluon.



(a) (b)

Fig. 2. Gravitational field lines of a gluon and the shielding of gravitational field lines. (a) The anisotropic gravitational field of a gluon. (b) The shielding of gravitational field lines by a nearby gluon

2.4 Symmetry Breaking in Gravitational Attraction

Now, I suggest that anisotropic gravitational fields and the shielding mechanism cause symmetry breaking in gravitational attraction. As shown in Fig. 2(b), if particle B is close to particle A, then the gravitational field lines of particle A that pass through the mass of particle B are shielded, because the vacuum occupied by the mass of particle B is rigidified as explained in section 2-2.

Fig. 3 examines the gravitational attractions between elementary particles of spherical or non-spherical shapes. Particle A and particle C have spherical bodies, whereas particle B has a non-spherical body. Particles A and C mutually shield gravitational field lines with the size of the shielded area the same for each.

Applying Gauss's law for gravity [22], the gravitational force acting on the shielded area can be calculated using equations (1) and (2) for particles A and C, respectively. It can be assumed that the gravitational flux density is constant for particles A, B and C. Geometrical analysis shows that the shielded gravitational force vectors of particles A and C are symmetric as shown in equation (3). Particle A and particle C move toward each other symmetrically.

$$f_{AC} = \int_A g \cdot dA \quad \text{at particle A.} \tag{1}$$

$$f_{CA} = \int_A g \cdot dA \quad \text{at particle C.} \tag{2}$$

$$f_{AC} + f_{CA} = 0 \tag{3}$$

g is the gravitational field.

f_{AC} is the gravitational force vector of particle A.

f_{CA} is the gravitational force vector of particle C.

dA is a vector, whose magnitude is the area of an infinitesimal piece of the surface of particle A (or C) shielded by particle C (or A).

By the way (Fig. 3.), if particle A is replaced with the non-spherical body of particle B, particles B and C also would mutually shield their gravitational field lines. However, in this case, we come to know that the shielded area on particle B is different from the shield area on particle C through the geometric analysis.

The shielded gravitational forces can be calculated using equations (4) and (5) for particles B and C, respectively. Note that the calculated force vectors are no longer symmetric for both particles, as shown in equation (6).

$$f_{BC} = \int_A g \cdot dA \quad \text{at particle B.} \tag{4}$$

$$f_{CB} = \int_A g \cdot dA \quad \text{at particle C.} \tag{5}$$

$$f_{BC} + f_{CB} \neq 0 \tag{6}$$

g is the gravitational field.

f_{BC} is the gravitational force vector of particle B.

f_{CB} is the gravitational force vector of particle C.

dA is a vector, whose magnitude is the area of an infinitesimal piece of the surface of particle B (or C) shielded by particle C (or B).

3. RANDOM MOTION OF A HYDROGEN GAS MOLECULE

In this section, I apply the established theory of symmetry breaking to explain the random motion of a hydrogen gas molecule.

3.1 Acceleration Model of a Proton

A hydrogen gas molecule is constantly propelling itself with various types of motion. The molecule itself experiences no energy consumption. According to Newtonian mechanics, this is the result of “unknown external forces” being constantly applied to hydrogen gas atoms. This means that there must be “unknown external forces” transmitted through a vacuum. Where does “unknown external forces” come from?

The hydrogen molecule is covalently bonded to two atoms, and the hydrogen atom has only one proton in the nucleus. Fig. 4(a) shows the distribution of gluon density in a proton, in which the main gluons connect three quarks and there are many gluons between quark-antiquark pairs

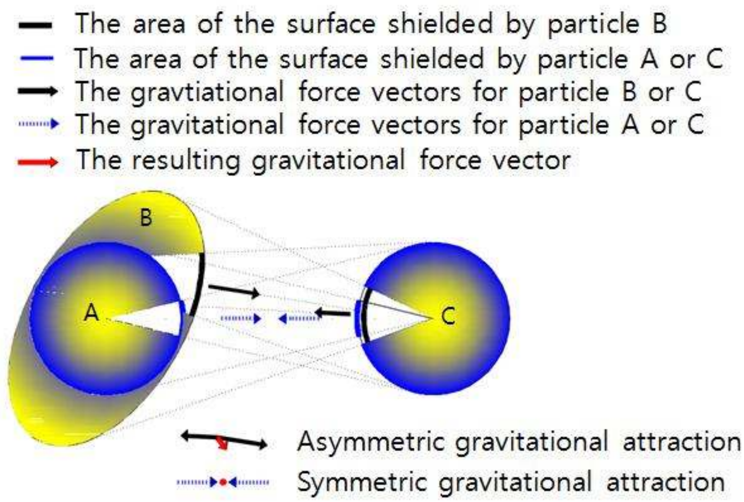


Fig. 3. Symmetric and asymmetric gravitational attractions from the shielding mechanism

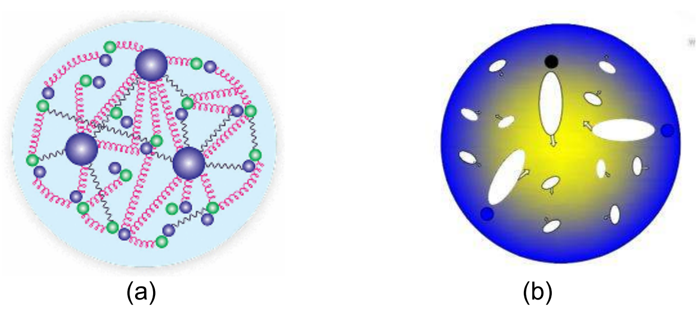


Fig. 4. Gluon's acceleration vectors based on the quark-gluon model. (a) The neutron and proton, in addition to having three valence quarks (larger balls), are filled with a virtual sea of gluons (red springs) and quark (purple)–antiquark (green) pairs [23]. (b) Gluon's acceleration vectors obtained from asymmetric gravitational attraction

[23]. Each gluon makes its own gravitational field and has its gravitational force vector. Fig. 4(b) shows the various gluon gravitational force vectors. As shown in equation (7), the total gravitational force vector of the proton is the sum of the individual gravitational force vectors of all the gluons. The force in equation (7) does not amount to zero because gravitational attractions are made between the non-spherical bodies of gluons, as explained in Section 2-4. In addition, all the gluons are constrained inside the proton. Thus, a proton moves, not with "unknown forces", but with the acceleration vector determined by the equation (8).

$$\mathrm{F} = \sum_{i=1}^{n} - \mathrm{f}_i \quad (i = 1, \ . \ . \ . \ n) \tag{7}$$

$$= m\,\mathrm{a} \tag{8}$$

F is the total gravitational force vector of a proton.
n is the number of gluons within a proton.
f_i is a shielded gravitational force vector for the *i*-th gluon.
m is the mass of a proton.
a is the acceleration vector of a proton.

3.2 Random Motion

Here, I will present a mechanical model illustrating the random motion of a hydrogen gas molecule using the acceleration model of a proton. In Fig. 5, two protons are shown

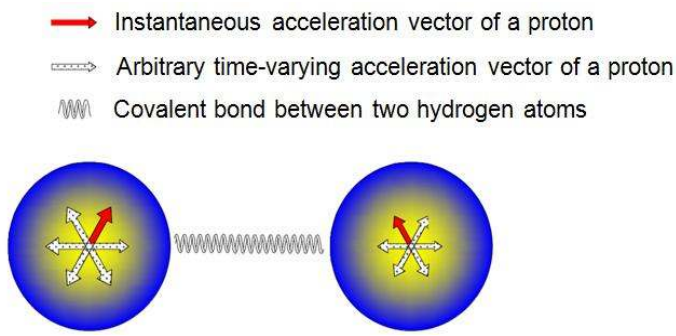


Fig. 5. Mechanical model of a hydrogen gas molecule exhibiting random motion

covalently bonded together like a spring. Each proton possesses the acceleration vector described by equation (8).

The acceleration direction of a proton changes quickly because the quarks, which have asymptotic freedom [24-25], move very quickly and freely, affecting the density distribution of the gluons. Eventually, a hydrogen gas molecule with the arbitrary time-varying acceleration vector of a proton will inevitably display random motion. This is why monoatomic gas molecules, such as helium, also exhibit random motion.

As shown in Fig. 5, a hydrogen gas molecule has two bonded hydrogen atoms. However, the atoms can move independently with the acceleration vector described by equation (8). Therefore, a hydrogen gas molecule can have translational or rotational motions, as well as vibrating motion.

3.3 Charles's Law

This section shows how the gluon's asphericity upholds Charles's law. Charles's law states that the volume of gas increases in proportion to an increase in temperature if the pressure on gas is held constant. It also states that gas reaches zero volume at the absolute zero temperature. When gas reaches zero volume, the proton's acceleration is close to zero. When the proton's acceleration is close to zero, the gravitational attraction between the gluons is close to mutually symmetrical state, as explained in Section 2-4. This means that the gluons expected to be almost spherical shape.

However, as the temperature increases, the distance between the quarks increases and the length of the gluon flux tube also increases, which tends to increase the departure from sphericity of the gluons. The increase of gluon's asphericity would increase the asymmetric gravitational attraction, causing the acceleration of proton to increase. Therefore, the average speed of hydrogen gas molecules increases and the volume of gas increases, as well.

The proton-neutron mass difference is negligible. If there is a constant correlation between temperature and quark movement, the acceleration of one proton or neutron at a given temperature would be the same. Therefore, the increase of atomic mass number and the increase of asymmetric gravitational attracting force occur simultaneously, and according to Newton's acceleration law, the acceleration of gas molecules becomes constant regardless of atomic mass number. This is why Charles's law is applicable regardless of the type of gas.

4. DISCUSSION

Vacuum polarization does not occur in the entire space of the proton because it occurs only in the place where charge is present, in other words, vacuum polarization occurs in the empty vacuum occupied by the gluon, quark, and electrons. Therefore, the gravitational field lines would not be shielded perfectly by nucleus.

If the breaking of symmetry in gravitational attraction does not occur in the proton or neutron, then the vibration of atoms will not occur, and also gas cannot exist.

If gas molecular motion or atomic vibrations serve as evidences of the asymmetry of gravitational attraction in elementary particles, then evidence also exists to support the asymmetry of gravitational attraction in massive bodies. It is the process by which planetary rotation is created. Scientists are still uncertain as to how planets are formed. To explain the Earth's rotation [26], the Earth formed out a spinning disk of dust and gas around the newborn sun. Bits of dust and rock stuck together. As it grew, the surrounding space rocks continued colliding with the nascent planet of Earth via the gravitational attraction, with these collisions giving the Earth an angular momentum. This angular momentum was produced because the collisions did not take place on the centerline of two objects. If asymmetric gravitational attraction occurs, it is not directed to the center of the object. The process by which the planet rotates is an evidence for how asymmetric gravitational attraction works on massive bodies.

5. CONCLUSIONS

This study examines symmetry breaking in gravitational attraction between gluons within the proton and shows that the random motion of hydrogen gas molecules might be caused by this breaking of symmetry. The gravitational field model applied to massive body has been extended to explain the gravitational field of gluons. Two central points are worth noting: (1) an anisotropic gravitational field is possible in gluons and (2) gravitational attraction can be explained by the shielding mechanism. This study introduced rigidified vacuum of color-charged mass to explain shielding of gravitational field lines. Both the gluon's anisotropic gravitational field and the shielding mechanism demonstrate that the symmetry of gravitational attraction is broken within the proton. This paper also presents the acceleration model of a proton from the breaking of symmetry. At the temperature above absolute zero, it is inevitable for protons or neutrons accelerate. Thus, a hydrogen gas molecule with the independent acceleration vectors at the two atoms exhibits the combination of vibrating, rotating and translation motions. Atomic vibrations in a solid are also caused by the acceleration of a proton from the breaking of symmetry.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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