Physics of Gravity

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Abstract. This article considers electromagnetic origin of gravity and describes techniques to generate gravitational field that has the opposite sign to that of Earth.

Introduction

Define "spin current" $I_s = q\omega$, where ω is the angular velocity of spin of a charge q. Spin current $q\omega$, measured in Amperes [A] , does not flow through a conductor, but "exists" when a charge q spins.

Spin currents are present in every atom and most components of the Universe, but they seem omitted in the current theory of electromagnetism.

The remainder of this article demonstrates that spin current $q\omega$ may be responsible for existence of the force that we now call "gravity" and that we should be able to engineer practical gravity control devices.

Hypothesis

Let's consider that the average value of the "gravitational" force $\hat{\mathbf{F}}_\mathrm{s}$ between two objects as a cumulative result of average spin currents $\widehat{I_{s1}}$ and $\widehat{I_{s2}}$ in each object as follows:

$$\hat{\mathbf{F}}_\mathrm{s} = -A_0^2 \frac{\widehat{I_{s1}}\widehat{I_{s2}}}{r^2}\frac{\mathbf{r}}{\mathrm{r}} \qquad (1)$$

where r is the distance between objects, $\frac{\mathbf{r}}{\mathrm{r}}$ is a unit vector that defines direction, and A_0^2 is a positive constant that we shall try to estimate later on in this article.

This equation is as elementary as the definition of Ampere that links mechanical forces to electromagnetism.

In line with tradition we can represent the force $\mathbf{F}_\mathrm{s}$ using average spin current fields $\hat{S}_1$and $\hat{S}_2$ as follows:

$$\hat{\mathbf{F}}_\mathrm{s} = -A_0^2\left(\frac{\widehat{I_{s1}}}{\mathrm{r}}\right)\left(\frac{\widehat{I_{s2}}}{\mathrm{r}}\right)\frac{\mathbf{r}}{\mathrm{r}} \stackrel{\text{def}}{=} -A_0^2\hat{S}_1\hat{S}_2\frac{\mathbf{r}}{\mathrm{r}} \qquad (2)$$

Force $\hat{\mathbf{F}}_\mathrm{s}$ exists when both $\hat{S}_1$and $\hat{S}_2$ exist and interact.

Spin current field potential

Consider a field potential S due to spin current $q\omega$ of an elementary charge, say an electron. Electrical field potential around a charge is known to be isotropic, i.e. identical in all directions. In contrast, field potential S should be expected to be anisotropic.

On the basis of astronomic observations of spinning systems, specifically a presence of collimated symmetric jets observed during star formation process along axes of spin [2], it is reasonable to expect that the spin current field S is restricted to a symmetric cone defined by a solid angle γ_0 around the spin axis.

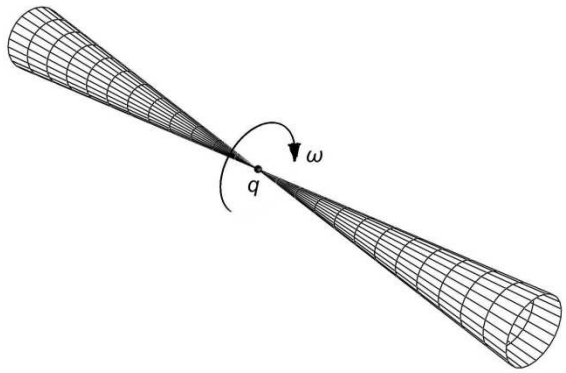

Fig 1

Inside the cone the field potential S is likely to be an inverse function of a distance away from spinning charge q :

$$S = \frac{1}{4\pi}\frac{q\omega}{r} \qquad (3)$$

and outside the cone S=0.

S field potential of a hydrogen atom

Let's consider a model of hydrogen (protium) atom in ground-zero state. Without loss of generality we can assume that in an atom of protium negatively charged electron e moves in the vicinity of positively charged proton nucleus.

Let's assume that proton spins with angular velocity ω_{sp} and electron spins with angular velocity ω_{se}.

The axes of spin of proton and electron are not constant, but change in time.

Observer at point O, at distance *r* away from the atom, will perceive "impulses" of spin-current induced field S whenever the cone described in Fig 1 aligns itself in the direction of observer.

The sequence of these impulses would most likely appear random and generate impulse forces causing observable oscillations of atoms and molecules.

The "average" spin-current induced field $\hat{S}$ that the observer at O will perceive is:

$$\hat{S} = \frac{1}{T}\int_0^T S dt = \frac{2\gamma_0}{4\pi}\frac{1}{4\pi}\frac{e\omega_s}{r} \qquad (4)$$

where 2 in the numerator is due to the symmetric nature of the cone, $\omega_{se} - \omega_{sp} = \omega_s$, the charge of proton is p=-e and the integral averaging time T is sufficiently long.

The factor $\frac{2\gamma_0}{4\pi}$ may also be considered a *probability* of the field S of an atom being perceived by a distant observer at O.

Force between two atoms of hydrogen

The force between two distant atoms of hydrogen due to field $\hat{S}$ according to the result from the previous section is:

$$\hat{\mathbf{F}}_{\mathrm{S}} = -\frac{A_0^2\gamma_0^2}{64\pi^4}\frac{e^2\omega_s^2}{r^2}\frac{\mathbf{r}}{\mathrm{r}} \qquad (5)$$

The expression for $\hat{\mathbf{F}}_{\mathrm{S}}$ contains a constant $A_0^2\gamma_0^2$. We can estimate this constant using the experimentally obtained value of the gravity coefficient *G* for objects composed of atoms.

Newton gravity between 2 hydrogen atoms

If Newton's law of gravitation is valid for 2 distant atoms of hydrogen the force $\mathbf{F}_{\mathrm{N}}$ is:

$$\mathbf{F}_{\mathrm{N}} = -G\frac{m_H m_H}{r^2}\frac{\mathbf{r}}{\mathrm{r}} \qquad (6)$$

Comparing $\hat{\mathbf{F}}_{\mathrm{S}} = \mathbf{F}_{\mathrm{N}}$ we have

$$A_0^2\gamma_0^2 = G\frac{64\pi^4 {m_H}^2}{e^2\omega_s^2} \qquad (7)$$

Practical constant

Respectable accuracy of the Newton's law of gravitation implies that the average cumulative spin current $\widehat{I_s}$ in a body composed form atoms should be proportional to mass of this body: $\widehat{I_s} = C_0 m$. Comparing Newton's law of gravitation to our hypothesis (1) yields

$$C_0 = \sqrt{G}/A_0 \quad , \quad [\mathrm{A/kg}]. \qquad (8)$$

C_0, expressed in [Amperes/kg], is a better gravity parameter to use than G for objects composed of neutral atoms, because it has a clearly defined physical meaning. C_0 [A/kg] simply states the average cumulative total spin current generated by all spinning charges in mass m. C_0 also indicates what spin current is needed to make a body of mass *m* "weightless".

Experimental determination of C_0 should be quite straightforward using one of a collimated sources of *S*-field described later on in this article.

Since C_0 is likely to be similar for all objects composed from atoms, it should also be the same for a single atom of hydrogen (protium) that we considered earlier, so

$$C_{0H} = \frac{\gamma_0}{8\pi^2}\frac{e\omega_s}{m_H} = 10^3\frac{\gamma_0}{8\pi^2}\frac{e\omega_s}{1.00794}N_A \quad , \qquad (9)$$

where mass of hydrogen was expressed by its atomic mass using the Avogadro constant N_A: $m_H = 1.00794 * 10^{-3}/N_A$.

Calculation of C_0 for other atoms and for bodies composed from atoms indicates that the Newton's law of gravitation is an approximation of reality, parameter G appearing slightly different for different elements and isotopes. See Appendix 1 for details.

Since ω_s and γ_0 seem related to all objects composed from atoms, they are good candidates for fundamental constants and may have a quantum foundation.

Attractive and repulsive gravity

The necessary condition for gravitation force to exist between two objects is existence of spinning charges *in each object*.

Each object may contain both positively and negatively charged spinning components. In such a case the resultant spin current $q\omega$ in each object is an integral (sum) of all contributing spin currents.

Spinning objects with similar charge polarity (the same sign of $q\omega$) would attract themselves gravitationally. For example, spinning electron would *gravitationally* attract another spinning electron.

Spinning objects with opposite charge polarity (the opposite sign of $q\omega$) would repel one another gravitationally. For example a spinning electron would be *gravitationally* repelled by a spinning proton.

Matter and antimatter should repel one another gravitationally.

Spinning atoms or objects composed of atoms (not ions) in their neutral state should not alter the *S* field or associates forces, because the increment in angular velocity of spin is identical for electrons and protons in atomic nuclei so that the cumulative spin current for such object remains unchanged.

Repulsive gravity in our neighbourhood

Solar wind

Our Sun is known to emit so-called "solar wind" composed of protons. "Clouds" of such protons of varying size and intensity reach Earth everyday. On approach they are redirected by the Earth's magnetic field towards magnetic poles.

When the flux and/or kinetic energy of "solar wind" protons increases due to increased solar activity they cause "magnetic storms" and other electromagnetic disruptions at locations quite distant from the magnetic poles of Earth.

Why do protons travel *away* from the Sun at great speeds? And why don't they orbit the Sun as every other object does but instead travel along a straight line away from Sun? *Because they spin*. According to the discussion presented earlier in this article, spinning protons generate repulsive gravity force with atoms and *accelerate away* from Sun, as long as they spin.

Why don't "solar wind" protons attract electrons and become hydrogen? *Because these protons spin*. Spinning protons repel spinning electrons with gravity force impulses as explained earlier in this article.

Since electron inertia is small, these force impulses accelerate electrons away from spinning protons thereby preventing the domination of hydrogen-forming electrostatic forces.

Why do "solar wind" protons stay close together in a "cloud", instead of being dispersed by their repulsive electrostatic forces? *Because they spin*. Spinning protons attract one another *gravitationally* via impulses of *S* field.

Gravitational attraction and electrostatic repulsion create a situation of "dynamic equilibrium" enabling spinning protons to coalesce and form stable "clouds" that travel over large distances away from stars that emit them – into interstellar space.

When "solar wind" protons eventually stop spinning fast enough, they can acquire electrons and form hydrogen.

Polar satellites

Decades of trying failed to achieve a stable satellite trajectory above Earth's poles.

When spinning protons that comprise "solar wind" arrive near Earth, they locally modify Earth's gravitational field before they collide with Earth's atmosphere.

A satellite passing near a cloud of "solar wind" photons will perceive modifications to Earth's gravitational force and alter its trajectory accordingly, *always to a higher orbit*, because spinning protons generate gravity field *S* that has the opposite sign to that of Earth.

Since the flux of "solar wind" changes continuously in time, the associated gravitational anomalies appear "unpredictable".

Earth gravitational minimum

According to considerations above, the gravity field of Earth should be the smallest at the location of the maximum flux of "solar wind" spinning protons, which should be near Earth's magnetic poles and above the atmosphere.

Leaving Earth's gravity field at these locations should be the easiest in the sense that it would need the least possible amount of energy to be accomplished.

Gravity field anomalies due to presence of "solar wind" protons should be observable on Earth's surface, their magnitude reducing with a distance away from the spinning proton cloud.

Cosmic jets

Axial jets resembling Fig. 1 seem to be quite common in the Universe. Their presence during a star formation process [2] provided inspiration for the mathematical model of the elementary *S* field adopted earlier in this article.

We should also be able to find *galaxies* in our neighbourhood that eject matter along their axes of spin. Such galaxies should be expected to have a significant amount of positively charged spinning objects at or near their centres, generating large spin currents.

Generating repulsive gravity field *S*

Reduction of gravity field intensity and associated gravity force on Earth needs to involve spinning of positively charged objects.

Spinning positively charged objects, just like spinning protons in "solar wind" do everyday above Earth's poles, can locally reduce or eliminate gravity on Earth to assist us with transport and construction activities.

Capacitors with spinning electrodes

Capacitor is a device that separates charges using an electric potential applied between electrodes.

An obvious way of reducing/eliminating Earth's gravity seems to spin the electrode that attracts protons.

Significant spin currents can potentially be achieved by spinning large number of protons at moderate angular velocities.

Spinning both electrodes whether in similar or opposite directions is counterproductive from the point of view of *S* field generation.

Design of *S* field generating capacitors needs to compromise between various constraints imposed by size, spin rate, voltage, insulation, capacitance and application.

Capacitors with spinning proton-attracting electrodes seem the most convenient devices to determine constants A_0 and γ_0 with accuracy required for engineering applications.

Spinning sources of positive ions

Spinning alpha-emitting isotopes such as Polonium 210 will generate continuous streams of spinning alpha particles.

Spinning alpha particles should travel in a vacuum chamber to extend the time they spin before colliding with surroundings.

The generated *S*-field should increase proportionally to the length of travel of spinning alpha particles.

Cyclotron

A cyclotron is a device that uses magnetic field to force charged particles to move along a curved trajectory. If the magnetic field intensity is constant, the charged particle trajectory is a helix with a fixed radius.

In a cyclotron, the spin current field S is generated by spinning charges in directions parallel to the axis of the cyclotron, forming a cylindrical "curtain" that can be observed during certain stages of the star formation process.

The most convenient positively charged particles to use in cyclotrons are alpha particles, because alpha-decaying isotopes, such as Polonium 210, eject them with a significant (and constant) speed of $0.05c$ so that they do not need to be accelerated to be used in a cyclotron.

Cyclotrons designed to *entrap* a beam of alpha particles using magnetic field can potentially operate in a self-sustained way at their natural orbiting frequencies with minimal external energy input requirements.

On the basis of half-life of the isotope, a craft using Polonium 210 powered cyclotron would be limited to about 4 weeks of autonomous functioning. While Americium 241 can potentially offer a few hundred years of autonomous flight capacity, the mass required to provide sufficient flux of alpha particles may disqualify this isotope from vehicle applications.

Broken cyclotron

A "fragment" of a cyclotron will also force moving charged particles to move along a curved path, but only along a finite arc.

Imagine a permanent magnet circuit producing a strong magnetic field in a vacuum "gap". Imagine that alpha-emitting isotopes inject alpha particles to this gap from all directions.

Alpha particles would spend some finite time spinning in the gap and generate *S*-field opposite to that of Earth.

If alpha particles are supplied at sufficient rate, determined by the type and the amount of the alpha-emitting isotope, the device may become a useful *S*-field source.

While not as efficient as full cyclotrons, "broken cyclotrons" should offer a distributed *S*-field generation over the entire area of the magnetic gap.

Spinning superconductors

In superconductors the association between electrons and atomic nuclei appears modified. Some electrons appear to become "free" from their bind with atomic nuclei.

Spinning superconductors can potentially achieve higher spin rates for positively charged nuclei than for free-to-move electrons and therefore provide a mechanism for *S*-field generation that opposes that of Earth, providing that the spinning method does not induce spin to free electrons.

Remarks and implications

1. *S*-field (gravity) seems to be an impulse field. While *average* gravity forces appear very small, force *impulses* that contribute to that average are large (γ_0 is likely to be small) and due to their magnitude can have a large range in the Universe. For this reason, gravity is a dominating long-range force in the Universe.
2. We did not directly detect *S*-field impulses due to aliasing errors in our measurements. We only observed the average effects of *S*-field impulses.
3. Gravity field *S* can be collimated, much like light in a laser, the best collimation being limited to γ_0. This is accomplished by maintaining a fixed axis of rotation of charged objects that generate *S* field. Collimation significantly increases gravity forces above the average value. The increase factor seems to be $4\pi^2/{\gamma_0}^2$, when the axes of spin of *S*-field generating charges overlap.
4. Models of atoms: multiple electrons spinning around atomic nuclei with multiple protons will interact with one another with Coulomb force *and gravitationally* via the *S*-field, *because they spin*. Introduction of gravity interactions between atom components should improve modelling of atoms and our understanding of their structure.
5. The so-called "uncertainty principle" (a foundation of quantum mechanics) may need revision, because apparently nondeterministic movement of charged elementary particles such as electrons, that is currently proclaimed "unexplorable", can be attributed to deterministic *S* field force impulses and interaction with other objects that generate *S* field. The uncertainty principle actually "masks" the origin and the impulse nature of gravity forces and *prohibits* them from being discovered
6. Impulse nature o*f S* field may provide foundation for explaining a "quantum entanglement" phenomenon. A single electron that spins experiences impulse *S* field interaction with *some* of spinning electrons and protons in the Universe at any given instant of time. In a finite time interval, each electron can potentially experience *S* field interaction with a large number, if not all, charged particles in the Universe that spin. For this reason the *S* field (now called gravity) should be considered as one of the best carriers of information in the Universe.
7. Good "receptors" for *S*-field forces should be arrays of free spinning electrons, due to their low individual inertia. Spinning electrons will tend to coalesce together much like spinning protons do. Unlike clouds of spinning protons however, clouds of spinning electrons are *attracted to matter* and will surround it. This phenomenon may explain a concept of so-called "astral body" of living organisms that can contain and process quantum-encoded information and facilitate a *natural interface of every living organism directly to the Universe* without proxies.
8. Static electricity: rubbing surfaces assists in *increasing the spin* of surface electrons, which in turn attract more electrons to join the "cloud" because their rate of spin increases. Large charges can be accumulated and the associated large electrical potential differences (Voltages) can also be very large. This phenomenon is known since ancient times.
9. The average distance between spinning protons or electrons in their respective "clouds" should be inversely proportional to their average angular spin velocity $\hat{\omega}$. The *density* of spinning particles in such a cloud should be proportional to $\hat{\omega}^3$.
10. Nuclear synthesis: *S*-field and the associated forces can assist in the process of synthesis of atomic nuclei. When two protons spin about the same axis, and their spin rate is large enough, the gravity field attraction force between them can be stronger than the electrostatic repulsion and assist in (if not induce) the process of nuclear fusion (into deuterium). Is this how gravity assists in nuclear fusion in the early Universe? If so, the concentration of deuterium in hydrogen *today*, in places unlikely to alter deuterium concentration, is likely to be related to the probability $(\gamma_0/2\pi)^2$ of proton pairs aligning their spin axes in the early Universe.

11. Can we take an example from Nature and design spinning fusion reactors? Achieving nano-scale safe and reliable fusion of helium nuclei using *S*-field would solve the energy problem and eliminate the need for fossil fuels until the end of intelligent human presence on Earth.
12. Synthesis of heavy atomic nuclei, whether or not naturally occurring on Earth, should also be possible. The process of such synthesis would involve selecting suitable atomic nuclei to be combined, stripping these nuclei of electrons and spinning them about a common axis of rotation. A kitchen blender will not quite work, but the analogy is quite amusing. Nuclear synthesis technology can potentially reduce or eliminate the need for environmentally destructive mining of minerals.
13. Construction of spacecraft travelling with speeds approaching the speed of light should be possible. The greatest challenge for such craft would be avoiding/preventing collisions with interplanetary/interstellar space debris and particles.
14. Neutrons are known to be gravitationally attracted to one another and are known to form neutron stars. According to the hypothesis presented in this article this means that a neutron *must* contain spinning charges with their average total spin current negative, just like protium. This would occur if neutron was an oscillator structure composed from proton and electron spinning with different rates of spin, where electrostatic attraction is resisted by *S*-field repulsion. Experiments confirm that a free neutron indeed decays naturally into proton and electron (accompanied by antineutrino), but the concept of neutron being *composed* from proton and electron, first proposed by Rutherford in 1920, has been dismissed on the grounds that it was impossible to justify proton-electron equilibrium resembling neutron. Admitting for consideration the *S*-field and the associated forces is likely to help in finding this equilibrium and its quantum stability.
15. Repulsive gravity is as common as the attractive gravity in the Universe, including right in front of our noses. It occurs *in every neutron* and is generated by *every proton that spins*.
16. If antimatter exists naturally in the Universe, there should be antimatter stars and galaxies somewhere that are repelled gravitationally from galaxies composed of matter.
17. There is a need to distinguish between "orbital angular velocity" and "angular velocity of spin" of charged objects that move. Only angular velocity of spin generates spin current and the *S*-field.
18. Spinning protons of stellar origin present in the inter-stellar space can modify gravitational attraction forces between stars. Presence of spinning protons in the intergalactic space may potentially modify forces between galaxies or galaxy clusters
19. *S*-field is likely to retard/modify speed of light and cause optical aberrations when light passes through it.
20. "Stellar wind" clouds of spinning protons that exist in the intergalactic space are likely to *diffract/refract light and also attenuate the intensity* of light that travels through. Without taking the attenuation phenomenon into account, distances measured on the basis of supernovae light intensity will carry errors that grow exponentially with distance being measured [3].
21. Gravity force is not generated by mass. Mass is simply a scalar integral measure of total energy embedded in electromagnetic oscillations and motion of an object. However, the average cumulative spin current $\hat{I}_s$ generated in all atoms of an object seems approximately proportional to this energy, which implies that some proportion of the energy embedded in atoms is "allocated" to spinning charges.
22. Restricting the context of considerations in any way can only lead to wrong conclusions.
23. Since theories that "prove" repulsive gravity to be impossible seem to contradict the Observable Reality, it might be a good idea to begin searching for the Centre of the Universe
24. If you insist that only crawling is possible – you may never fly...

Acknowledgments

If Galileo (Galileo Galilei) or Copernicus (Mikolaj Kopernik) needed to rely on their peers for support or recognition, they would have never made any discovery.

I dedicate the work reported in this brief article to them and to all intelligent people in history of humanity who endured untold misery, hardship and suffering in their quest of seeking a better explanation for Observable Reality, especially those who never saw their work appreciated.

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Appendix 1

Estimating constant C_0 for atoms

An atom with mass number A' (we use A' to distinguish it from the symbol for Ampere used in this article) can be considered to have A' of protons p and A' electrons e, because each neutron can be considered a composition of proton and electron for reasons described in the Remark 14 above.

Hence, for one atom of atomic number A' and due to $C_0 \stackrel{\text{def}}{=} \hat{I}_s/m$ we have:

$$C_{0A'} = \frac{10^3 \gamma_0 \sum_{k=1}^{A'} (e_k \omega_{se} + p_k \omega_{sp})}{8\pi^2 m_{A'}} N_A \qquad (10)$$

Where 10^{-3} is a molar mass constant in SI system of units, $m_{A'}$ is atomic mass of the atom of mass number A' expressed in atomic units u, N_A is the Avogadro constant and ω_{se}, ω_{sp} are natural rates of spin of electrons and protons in atoms.

The expression (10) will become identical for all atoms only when

$$\omega_{se} - \omega_{sp} = \omega_s \qquad (11)$$

When spin rates of protons and electrons satisfy (11), we can write for any atom with mass number A' :

$$C_{0A'} = 10^3 \frac{\gamma_0 e \omega_s}{8\pi^2} \frac{A'}{m_{A'}} N_A \ . \qquad (12)$$

Condition (11) for all atoms is imposed by the requirement that the hypothesis (1) does not immediately contradict the experimentally verified Newton's law of gravity.

Condition (11) predicts that protons and the associated electrons inside atoms should have their corresponding natural rates of spin related, so that the difference between the natural spin of proton and the natural spin of the associated electron is ω_s .

The coefficient $C_{0A'}$ appears very similar, but not quite identical for all atoms.

If the hypothesis (1) is correct, this would imply that there are some inconsistencies in the Newton's law of gravitation, related to the fact that "mass" is not really a source of "gravity" force.

The gravity force parameter G proposed by Newton seems different for every atom and every isotope and cannot be considered "constant".

The ratio of G parameters for two different isotopes having mass numbers A'_1 and A'_2 is:

$$\frac{G_{A'_2}}{G_{A'_1}} = \left(\frac{A'_2}{A'_1} \frac{m_{A'_1}}{m_{A'_2}} \right)^2 \qquad (13)$$

For example, using the well-established experimentally determined atomic masses for H-1 and Au-197 we have

$$\frac{G_{Au-197}}{G_{H-1}} = \left(\frac{197}{1} * \frac{1.007947}{196.9665569} \right)^2 = 1.016$$

Similarly, G parameters for carbon, copper, silver and gold based on their typical isotope

ratios and standard atomic masses, compared to G measured for lead are

$$\frac{G_C}{G_{Pb}} = 0.9996043645$$
$$\frac{G_{Cu}}{G_{Pb}} = 1.00183933$$
$$\frac{G_{Ag}}{G_{Pb}} = 1.000865061$$
$$\frac{G_{Ag}}{G_{Pb}} = 0.9999438405$$

Objects composed from atoms

Since the mass number A' and the atomic mass of an atom $m_{A'}$ are quite similar, for some applications we can *accept* that

$$\frac{A'}{m_N} \cong 1 \ . \qquad (14)$$

In other words, if the accuracy of the expression (14) is acceptable for our application, we can *accept* the coefficient C_0 to be *approximately constant* for all atoms:

$$C_0 \cong 10^3 \frac{\gamma_0 e \omega_s}{8\pi^2} N_A \ . \qquad (15)$$

If we accept the limited accuracy of the expression (15), then for each atom we can estimate its spin current to be $\hat{I}_s = C_0 m$ and the Newton's law of gravitation for any pair of atoms (or any objects composed from atoms) becomes equivalent to the hypothesis (1), with the accuracy limited by the accuracy of the expression (14).