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RESEARCH ARTICLE

Gravity - Viewed as Not One of the Several Forces of Nature but Rather as a Result of Atomic Structure

Donald C. Aucamp, ScD

Professor (Emeritus), Southern Illinois University at Edwardsville, USA.

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Corresponding Author: Donald C. Aucamp, ScD, Professor (Emeritus), Southern Illinois University at Edwardsville, USA.

Abstract

The primary objective in this work is to show that gravity is a result of the structure of the atom, so that it is not a force of nature. To do this a theory is worked out intuitively and then validated by a simple thought experiment which shows that the standard laws of electromagnetic theory are incorrect. In turn, this finding leads to the central thesis that gravitational force is actually an electrical force which is shown to be too weak to be measured by standard antennas.

1. Introduction

In Part 2 of this work an intuitive argument will be made which explains how atomic structure causes the electron orbits of other atoms to be slightly compressed. It will be further explained why this compression induces a mutual attraction which is called gravity. Then, in Part 3 a thought experiment will be given which lends mathematical credence to the intuitive arguments of Part 2. The results of this experiment are found by a computer program which is discussed in Part 4. Finally, conclusions are drawn in Part 5.

2. Intuitive Arguments

The central idea of this work is that the atomic structure of atoms leads them to be electrically attracted to all other atoms, where it will be shown the electric fields exerted to do this are too small to be measured by standard lab equipment. In this part it will be intuitively shown that this notion has merit. Then in Part 3 it will be proved the theory has mathematical validity.

2.1 An Intuitive Argument Involving Two Atoms

Consider two atoms, say A and B, which are initially far apart, and assume their electron orbits are in stable equilibrium, so that they exert no outside force on each other. Then suppose these two atoms are moved very close together. It is argued that the nearness to each other of the outer electron shells of A and B causes a repellent force which wasn't in evidence when they were far apart. It is also argued the net effect of this force is to squeeze both A and B into slightly smaller shapes. This repellent force causes the distances between the outer electron orbits of A and B to be increased. The net result is that the individual repellent forces between the outer electrons of A and B are thereby reduced. As this repellent force was zero before the squeezing, it is argued that the two atoms will be attracted to each other after the squeezing. This attraction is currently called the force of gravity.

It is further argued that atoms A and B consist of free moving electrons and are therefore not solid objects. As result, if an outer electron in one of the atoms, say B, pushes against an outer electron in the other atom, say A, this action does not cause the entire A atom to be accelerated. This would not be the case if atoms were solid objects.

2.2 Attractive Forces Inside a Mass of Many Atoms

Suppose a mass of atoms is closely packed together, where the atoms may or may not be identical. Then the net effect of the repelling forces just described

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results in the shrinkage of all the outer electron shells between all the atoms in m. As a result, all the distances between these outer electrons are increased. Thus, there is an overall gravitational attraction between them. Accordingly, taken as a whole, all the atoms in a given mass undergo shrinkage and therefore there is mutual attraction.

2.3 Attraction Between Two Masses m1 and m2

Based on the previous discussion, it is argued that the outer electrons in all the atoms of mass m_1 are attracted to the outer electrons of mass m_2. As a result, it is concluded that two masses will be attracted to each other.

2.4 Attraction of a Free Outside Atom to a Mass

It is argued that the outer electrons of atom A will be attracted to any given mass. This argument is based on the same reasoning as was given in the prior sections.

2.5 Difficulty in Measuring Gravitational Electric Fields

It is surprising that the gravitational force outside of the earth is measurable, whereas the electric field causing this force is virtually unmeasurable. This strange result is explained as follows: Assume, for example, a linear antenna consists of a wire having a radius of r and a length of L. The small cross section area of the wire is $A = \pi r^2$. It is argued that the electric field E flowing through the wire is principally due to the emanation from the earth in a cylinder of cross-sectional area A between the antenna and the earth. As this area is negligible compared to the earth's area which contributes to the gravitational force, call it A_E, then E is approximately proportional A/A_E, which is virtually equal to zero. It is therefore concluded that such an experiment will not detect the electric field which induces a "gravitational" attraction.

2.6 Wrapup

Based on the above intuitive discussion it is argued that "gravitational" forces are the result of the structure of the atom, and that these forces are electrical rather than natural. It is further argued the electric fields created by this structure are too small to be measured with standard lab equipment.

Of the several forces of nature, it is interesting that two of them, gravity and magnetism, have been shown by this author to be electrical. In particular, in Aucamp[1] magnetic forces are shown to be the result of electric fields which travel at the speed of light with respect to the instantaneous inertial frame of reference of the moving source charge. While this result is in conflict with Einstein's [5] special theory of relativity (STR), it is noted in Aucamp[2] that Einstein's STR is proved to be in error, and an alternate theory is given in Aucamp[3].

3. A Simple Thought Experiment

A simple thought experiment will now be offered which will provide important corroborating evidence concerning the intuitive analysis just given, an analysis which was based on the squeezing effects caused by atomic structure. It is argued the overall gist of the model offered here is close enough to the reality of the outer atomic electrons to establish the validity of the intuitive conclusions. In the analysis certain simplifications concerning the constants, r_0, q and k, will be made which do not affect the conclusions which will be drawn. Specifically, it will be assumed that $r_0=1$, $q=1$, and $k=1$. Then, if vector $\boldsymbol{F}$ is the derived force using these constants, the actual force vector $\boldsymbol{F^*}$ is given as $\boldsymbol{F^*} = \boldsymbol{F}\ q^* k^* / r_0^{*2}$. Thus, the true force can be found by multiplying the computer program output by a constant.

Now consider two spheres, each with radius of $r_0=1$, and assume there is a nuclear charge of $q=1$ in the center of each. Further assume there is a total electrical charge of $q= -1$ spread equally on the surface of each sphere. Thus, each sphere is electrically neutral. Also, the differential surface charge dq on any given differential area dA is as follows:

$$(3.1)\quad dq = dA / (4\pi r_0^2) = dA/(4\pi)$$

The problem studied here in this thought experiment is to determine the electric force $\boldsymbol{F}$ exerted by each sphere on the other when the separation distance between them is H. According to standard electromagnetic theory this vector force is found to be $\boldsymbol{F=0}$, a result which will be shown in this work to be in error. Concerning the outer electron layers, it is argued that this thought experiment is close enough reality to be useful in the theory developed in this work.

Next, assume that the two spheres will be referred to as left (L) and right (R), and they are situated in such a way that a straight line through the centers runs along the x *axis*. It is further assumed the left sphere has its nucleus at $(x,y,z)=(-1-H/2,0,0)$ and the right sphere has its nucleus at $(x,y,z)=(1+H/2,0,0)$. Further, consider two differential areas, dA_L and $\boldsymbol{dA_R}$, on the L and R sphere surfaces, respectively, and let dq_L and $\boldsymbol{dq_R}$ be the charges covered by these areas. Since it is assumed that the surface charges are spread out evenly on the spheres, then:

$$(3.2)\ \ dq_L = dA_L / (4\pi r_0^{\ 2}) = dA_L / (4\pi)$$

$$(3.3)\ \ dq_R = dA_R / (4\pi r_0^{\ 2}) = dA_R / (4\pi)$$

In this work the unit vector $\boldsymbol{u}$ will be defined as the vector running from any given charge in the left sphere to a given charge in the right sphere, where the given charges are either differential or nuclear. If vector $\boldsymbol{F}$ is a force exerted by the right sphere on the left sphere, and if this force is given by $\boldsymbol{F}=\alpha\boldsymbol{u}$, then $\alpha>0$ if the force is attractive and $\alpha<1$ if it is repellent.

Now let δ_L be a given charge in the left sphere, where either $\delta_L = dA_L/(4\pi)$ if the given charge is on the surface with area dA_L , or $\delta_L=1$ if the charge is the nucleus. Similarly, let $\boldsymbol{\delta_R}$ be defined in the same way. Then, according to an assumed differential version of Coulomb's Law (see Aucamp[4]) the force vector $\boldsymbol{\delta F}$ exerted by $\boldsymbol{\delta_R}$ on δ_L is as follows (assuming Coulomb's constant is $k=1$) :

$$(3.4)\ \ \boldsymbol{\delta F} = S\ (\delta_L)\ (\boldsymbol{\delta_R})\ \boldsymbol{u} / D^{\ 2}$$

In (3.4) $S=1$ if the force is attractive and $S= -1$ if it is repellent. Also, D is the distance between δ_L and $\boldsymbol{\delta_R}$, which is determined from the following expression:

$$(3.5)\ \ D^{\ 2} = (\boldsymbol{x_R}\text{-}x_L+H)^2 + (y_R\text{-}y_L)^2 + (z_R\text{-}z_L)^2$$

In this equation the positions of the left and right charges with respect to their sphere centers are (x_L,y_L,z_L) and $(\boldsymbol{x_R},y_R,z_R)$. If both δ_L and $\boldsymbol{\delta_R}$ stem from differential areas or if they both are nuclear, then in these cases the exerted force is repellent, and $S=-1$. Otherwise, if just one of these charges is nuclear, then the force is attractive and $S=1$.

In this thought experiment the objective is to find the total force vector exerted by the various charges in the right sphere on the charges in the left sphere. From symmetry it is noted this force is directed in the plus or minus u_0 direction, so that it is only necessary to find the scalar values, and it consists of the sum of four contributions, which are defined as follows:

(a) $\boldsymbol{F1}$ = the force exerted by the nucleus of R on the nucleus of L.

(b) $\boldsymbol{F2}$ = the force exerted by all the $\boldsymbol{dA_R}$*'s* on all the dA_L*'s*.

(c) $\boldsymbol{F3}$ = the force exerted by all the $\boldsymbol{dA_R}$*'s* on the nucleus of L.

(d) $\boldsymbol{F4}$ = the force exerted by nucleus of R on all the dA_L*'s*.

From these scalar definitions the total force scalar F is given as:

$$(3.6)\ \ \boldsymbol{F} = \boldsymbol{F_1} + \boldsymbol{F_2} + \boldsymbol{F_3} + \boldsymbol{F_4}$$

From Coulomb's Law $\boldsymbol{F_1}$ as defined in (a) above is found by noting that the nuclear charges are $\delta_L=\boldsymbol{\delta_R}=1$ and the distance between the two nuclei is $2+H$. Also, this force is repellent and directed along the x *axis*, so $S= -1$ in (3.4). Thus, vector $\boldsymbol{F_1}$ is given as follows:

$$(3.7)\ \ \boldsymbol{F_1} = -\boldsymbol{u}_0 / (2+H)^{\ 2}$$

Next, vector $\boldsymbol{F_2}$ will be determined as defined in (b) above. This force is given as follows:

$$(3.8)\ \ \boldsymbol{F_2} = -\iint \boldsymbol{u}\ dq_L\ dq_R / D_2^{\ 2}$$

In (3.8) unit vector u is a function of the (x,y,z) positions of dq_L and $\boldsymbol{dq_R}$. Since the force exerted by $\boldsymbol{dq_R}$ on dq_L is repellent and therefore in the $\boldsymbol{-u}$ direction, a negative sign is used in the formula. Also in this formula, D_2 is the distance between the differential charges, so that from (3.5):

$$(3.9)\ \ D_2^{\ 2} = (\boldsymbol{x_R}\text{-}x_L+H)^2 + (y_R\text{-}y_L)^2 + (z_R\text{-}z_L)^2$$

Next, from the above arguments and its definition in (c), vector $\boldsymbol{F_3}$ is found by noting that the force is attractive, so $S=1$ and therefore:

$$(3.10)\ \ \boldsymbol{F_3} = \int \boldsymbol{u}\ dq_L / D_1^{\ 2}$$

From (3.10) $D_1^{\ 2}$ is found given by noting that $X_L=1$, $Y_L=Z_L=0$. Then:

$$(3.11)\ \ D_1^{\ 2} = (\boldsymbol{x_R}\text{-}1+H)^2 + (y_R)^2 + (z_R)^2$$

Concerning scalar F_3 and F_4 as defined by (c) and (d) above, it is clear that symmetry implies the following:

$$(3.12)\ \ F_4 = F_3$$

It is argued that the above integral equations for vectors $\boldsymbol{F_2}$ and $\boldsymbol{F_3}$ are very difficult to solve analytically, especially in the case of $\boldsymbol{F_2}$. However, these solutions can all be found from a relatively straightforward computer program which will be discussed next in Part 4. The results of the program in the case when $H=0$ and $N=100$ are given below, where N will be defined in the in computer program discussion and the scalars have been converted to vectors.

$$(3.13)\ \ \boldsymbol{F} = F\,\boldsymbol{u_0} = -.83106\ \boldsymbol{u_0}$$

$$(3.14)\ \ \boldsymbol{F_1} = F_1\,\boldsymbol{u_0} = -.25\ \boldsymbol{u_0}$$

$$(3.15)\ \ \boldsymbol{F_2} = F_2\,\boldsymbol{u_0} = -1.081073\ \boldsymbol{u_0}$$

$$(3.16)\ \ \boldsymbol{F_3} = F_3\,\boldsymbol{u_0} = .250074\ \boldsymbol{u_0}$$

$$(3.17)\ \ \boldsymbol{F_4} = F_4\,\boldsymbol{u_0} = .250074\ \boldsymbol{u_0}$$

Several interesting properties concerning the scalar values in the above equations are as follows: First, scalar F in (3.13) is negative and not zero, which is the result predicted by standard electromagnetic theory. Second, the negative value in this equation indicates a repellent force is in play, which is in agreement with the intuitive analysis in Part 2. Third, it is seen that the scalar magnitudes of F_1, F_3, and F_4 are all approximately equal. From symmetry, it is clear that $F_3=F_4$. It is further argued that F_1 should approximately equal F_3 because the *D* distances involved in the integral equations are all relatively large when compared to some of the distances in the F_2 analysis.

On the assumption that this thought experiment roughly mirrors the overall gist of the outer structure of atoms, it is concluded from the results of this program that (a) the current laws of electromagnetic theory are not totally correct and (b) there is a certain degree of compression which causes outer electron atomic attractions.

4. A Computer Program Solution for *F*

The computer program, which is written in C, calculates the scalar values of the forces in (3.13-3.16). In this program it is convenient to use polar coordinates, (r, φ, θ), to locate any given (x,y,z) point on the surface of the sphere, where each sphere is identically sliced by *N* parallel and equidistant planes to form a set of latitudes in much the same way as how the earth is divided. If φ is the latitude angle, then :

$$(4.1)\quad -\pi/2 \le \varphi \le \pi/2$$

In (4.1) $\varphi=0$ along the equator. It is noted that any given latitude has a fixed value of *z*, where $-1 \le z \le 1$. Also, each such latitude forms a circle on the sphere which is parallel to the *xy* plane.

Moreover, each of the two spheres is further divided into a set of *N* longitudes, where the longitude angles (θ) are equally spaced. Then:

$$(4.2)\quad 0 \le \theta \le 2\pi$$

Thus, each spherical surface is divided into N^2 sub-areas.

Based on the thought experiment discussed in Part 3, the centers of the two spheres (called L and R) are assumed to be on the *x axis* of the *xy* plane and equidistant from the origin. Assuming $r_0=1$ the left nucleus is therefore at $(x,y)=(-1-H,0)$ and the right nucleus is at $(x,y)=(1+H,0)$. It is reiterated that the unit vector which runs from the left nucleus toward the right nucleus is defined as u_0, which is on the x axis.

Based on the differential version of Coulomb's Law (see Aucamp[4]) as applied to the differential charges, the value of vector $\boldsymbol{dF}$ exerted by any differential charge $\boldsymbol{dq_R}$ in the right sphere on a differential charge dq_L in the left sphere is given as follows:

$$(4.3)\quad \boldsymbol{dF} = S\, dQ_L\, dq_R\, \boldsymbol{u_0} / D^2 = S\, dA_L\, dA_R\, \boldsymbol{u_0} / [16\pi^2 D^2]$$

For mathematical convenience the above notations are used even if one or both of the charges are nuclear. In (4.3) *S* is either *+1* or *-1*. If $S=+1$ the force is attractive, and if S= -1 it is repellent. It is therefore concluded that the scalars F, F_1, F_2, F_3, and F_4 can be determined by a computer program which sums all the vector $\boldsymbol{dF}$*'s* in (4.3) if the dA_L and $\boldsymbol{dA_R}$ values on the two spheres can be determined, and if the position points (x,y,z) can be found for the differential areas. It is noted that the *D* distance in (4.3) can be readily found once the positions of dA_L and $\boldsymbol{dA_R}$ are known.

Based on this polar coordinate system, it is seen a latitude plane parallel to the *xy* plane slices the sphere so that the intersection is a circle of radius *R*, where φ is the constant angle which governs this latitude. From elementary geometry *R* is given as follows, where the radius of each sphere is $r_0=1$:

$$(4.4)\quad R = r_0 \cos(\varphi) = \cos(\varphi)$$

Then the total surface area, $\boldsymbol{\delta A_B}$, of the belt between two adjacent latitudes is given as the product of the strip width, which is $r_0 d\varphi = d\varphi$, and the circumference, which is $2\pi R$. Thus, δA_B is as follows:

$$(4.5)\quad \delta A_R = [r_0\, d\varphi]\, [2\pi\, R] = 2\pi \cos(\varphi)\, d\varphi$$

In (4.5) $[r_0 d\varphi]$ is the strip width distance and $2\pi R$ is the strip circumference. Upon setting $d\varphi=\pi/N$ then:

$$(4.6)\quad \delta A_R = 2\pi^2 \cos(\varphi) / N$$

If $\boldsymbol{\delta A_B}$ is further divided into *N* equal parts to form the individual *dA* values, then the following obtains:

$$(4.7)\quad dA = 2\pi^2 \cos(\varphi) / N^2$$

Thus, *dq* can be found as follows:

$$(4.8)\quad dq = dA / (4\pi) = \pi \cos(\varphi) / (2N^2)$$

From these results all the differential charges and their positions can be calculated. Also, from the known geometry, all the *D* distances can likewise be found, so that all the force vectors can be determined. As a result, the computer program problem is solved.

Finally, it is noted that setting $r_0=1$, surface charge $q=1$, and $k=1$ do not change the direction of the true force. Also, it is easy to show that the true scalar *F* (call it F^*) becomes, when the actual r_0, *q,* and *k* are used:

$$(4.9)\quad F^* = (q^2\, k / r_0^{\,2})\, F$$

5. Conclusion

Two central theses are proved in this work. The first is that current electromagnetic theory is erroneous in calculating electric field forces. In support of this thesis an intuitive argument is made, and a thought experiment involving two electrically neutral spheres is conducted which shows them to be mutually repellent. The reason for this strange outcome is due to the large forces atomic outer shell electrons have on the outer electron shells of other atoms. By way of note, electromagnetic theory has also been shown (see Aucamp[1]) to be incorrect in calculating magnetic forces, which are actually due to electric fields travelling at the speed of light with respect to the source.

The second thesis is that gravitational forces are due to the structure of atoms, so that gravity is not a force of nature. The nearness of outer atomic electron shells to the outer atomic electron shells of other atoms causes all these electrons to be squeezed a little toward their individual nuclei. As a result, it is shown this squeezing causes the atoms to be a little attracted to each other. It is also shown that the electric fields which do the attracting are essentially non-measurable.

It is interesting that gravitational forces behave in a way which is similar to electric field forces. Based on the results of this work, this is not accidental.

More research is needed concerning the fine points of this proposed theory to extend the results portrayed herein.

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