Mystery Solved -- What Causes the Force of Gravity

By Larry Thiele June 1, 2022

Never reject the idea that simple solutions may exist for some of mankind's most difficult problems.

One aspect of science that has continued to defy explanation and has remained a mystery is, what causes the force of gravity. When Newton published his law of gravity in the 1600's describing how gravity works, he provided no answer to what produced the force of gravity. Not even when Einstein published his work on general relativity in 1916 did he address the cause of the force of gravity. Since then there has been no definitive answer to this question. It is quite unimaginable how the truth about this aspect of gravity could have eluded mainstream science for such a long time.

New research has now solved that mystery, with results posted in a paper, "Gravity Revealed as Electromagnetic Force", on the OSF Preprint Server:

https://osf.io/7f2mn/

Some experts in current science question whether gravity is really a force but instead some other phenomenon that produces acceleration of masses. That idea might be promoted due to an inability of these experts to identify a cause for the force of gravity. Since a plausible cause cannot be identified, they seem to be comfortable denying the force exists.

Although Einstein's publication on general relativity addresses gravity, it speaks of gravity as an acceleration and makes no statements about a force of gravity. In 1916 Einstein also published a book, " Relativity -- The Special and The General Theory", for the purpose of explaining relativity to the general public in non-technical terms. Even there he made no statements about the force of gravity. However nowhere in these publications did Einstein deny that gravity is a force as we understand it on earth. Einstein did not end his search into the mysteries of gravity with general relativity. During the latter part of his life he relentlessly pursued a search without success for a link between electricity and gravity, thereby giving us a clue that gravity could very likely be associated with electric charge and the forces produced by electric charges.

More clues came from Richard Feynman in his lectures on gravitation at Caltech in 1963. While not providing an explanation for the force of gravity, Feynman admitted that gravity might be the consequence of something we already know but have not calculated correctly, perhaps having to do with charge.

The work of Einstein and Feynman suggest there is strong reason to not deny gravity being a force and that the solution to the cause of the force of gravity could have just been overlooked and ignored for a long time.

The answer to the mystery turns out to be astonishingly simple but also very compelling. The force of gravity on earth is caused by electric charge elements (protons and electrons) within the earth attracting electric charge elements within objects at and beyond the surface.

Presented here is a description of the process undertaken that produced a logical solution based upon fundamental scientific and mathematical principles we thoroughly know and understand without any need for new theories nor new speculation. The proof is obtained using a mathematical analysis based on commonly taught textbook theory. That proof shows gravity is an electromagnetic force and not a unique force of its own. It also shows why gravity is so comparatively weak, why gravity is only attractive, and how Newton's gravity law can be derived.

Applying Coulomb's Law

Electric charge is a logical choice to investigate given the earth is fundamentally comprised of protons, electrons, and neutrons, and proton and electron charges produce forces. That force relationship is described by Coulomb's law, which says the electric force between any two charges is proportional to the product of the charge quantities and inversely proportional to the square of their separation distance:

$$F = \frac{k\, q_1\, q_2}{R^2}$$

Coulomb's law dates from 1785 and is the unquestioned trusted foundation for all electric theory and the underlying basis for all modern electric, electronic, and communication technology. It describes an instantaneous force, not an average force. Coulomb's law does not preclude the existence of a force between any two charges regardless of their separation distance, location in the universe, and intervening charge or mass. Electric charge forces of protons and electrons do not abruptly cease at atomic boundaries, crystal boundaries, nor boundaries of higher matter. Charge forces are always present between charge elements within any atom, between charge elements among adjacent atoms, and between charge elements among distant atoms. Therefore every charge in the earth exerts a force on every charge in an object at the surface.

Any increment of mass of the earth and objects at its surface contain a count of protons equal to the count of electrons, and since the quantity of charge on any one proton equals the negative of the charge quantity on any one electron, the earth and surface objects are said to be electroneutral, i.e., zero net charge. But here is where a significant misunderstanding may have contributed to perpetuating the mystery of the force of gravity. It appears there has been a belief among some people in mainstream science that zero net charge also means there are zero net charge forces between mass increments and between earth and objects at the surface. A main objective of the analysis herein has been to disprove this belief and show that charge forces and force imbalances still do exist among distant mass elements in spite of zero net charge and that the accumulation of such forces is equivalent to the gravitational force.

The analysis first applies Coulomb's law to demonstrate how a local proton-electron pair having zero net charge can have a nonzero force imbalance with a remote proton-electron pair having zero net charge. Since both local and remote have zero net charge, Coulomb's law shows there is no force imbalance due to charge quantities. However any imbalance in separation distances between charges gives rise to an imbalance in charge forces between local and remote. For any proton-electron pair within an atom, the electron is always separated from and moves in a space around the proton. At any instance of time the proton and electron will normally have different separation distances with respect to any remote charge. Therefore the two Coulomb charge forces with the remote charge will be different.

The differences in local-remote separation distance for a proton-electron pair are quite infinitesimally small so it is hard to imagine such small force imbalances can give rise to a gravitational force. Coulomb's law is additive in that the total force for several local charges acting upon a single remote charge is the sum of the forces of each local charge acting alone. Therefore, every one of the immense number of proton-electron pair in the earth simultaneously incurs a force imbalance with a remote charge making the total force effect significant enough to be reckoned.

There are four individual charge forces between a local proton-electron pair and a remote proton-electron pair. When the sum of the four forces is modeled mathematically, the resulting net instantaneous force is proportional to the square of the charge of a proton or electron and to the square of the separation distance between the proton and electron within an atom and inversely proportional to the fourth power of the local-remote proton-proton separation distance. These conditions are the main contribution to why the gravitational force is so comparatively weak. Because electrons are always moving around their protons, the instantaneous local-remote force imbalance can vary between attractive and repulsive. It is the average of continually changing instantaneous force imbalances over time that is of significance and is in the correct form to compare to a gravitational force. It needs to be proven nonzero and always attractive.

Monte Carlo Analysis

For an electron, its location, movement, and separation from a proton within an atom are not known with absolute certainty. These values must be considered random and continually changing. To handle random values the analysis is based upon probability calculations. The analysis herein uses a Monte Carlo probability simulation. Monte Carlo consists of selecting a set of random values for the random variables and then making a force calculation. This process is repeated for additional sets of random selections with the results accumulated into an average value of force. If enough random sets are calculated, a pattern of the most-probable results emerges. In this analysis the random variables are the locations of the local and remote electrons in a spherical space around their protons. Random selections are made for those locations and then the local-remote force calculation is made. This process requires on the order of one million random calculations to have a consistent repeatable pattern emerge, meaning the process must be computerized. Manual hand calculations provide no meaningful patterns.

Results show that of all possible locations for both local and remote electrons at any instant, there are sufficient occurrences of separation great enough to allow the time-averaged proton-electron attractive forces to always outweigh the combined electron-electron plus proton-proton repulsive forces, making the net residual time-averaged force always attractive. This is the significant pattern discovered, the repulsive forces never entirely cancel the attractive forces and on average a net attractive force always remains. Therein lies the basis for the gravitational force being only attractive.

Gravity on Earth

Because Coulomb's law is additive for multiple charges, the effect of two or more charges can be combined into a single equivalent charge. Therefore, analyzing a single local proton-electron pair versus a single remote proton-electron pair reveals that each pair becomes equivalent to a single new charge giving the same attractive-only force between local and remote as the four original proton-electron charges. The process of calculating gravity from electric charge is to accumulate the sum of the forces for every proton and electron in every atom of the earth acting upon every proton and electron in every atom in an object at the surface. However, accumulating this sum is not a calculation that is possible charge by charge because of the immense number of charges in the entire mass of the earth. Instead, it is possible using a computerized numerical simulation to calculate equivalent charge at the earth center and then use those values to calculate the force effect of the entire earth in the form of the acceleration of gravity at the earth surface.

While the concept of charge pair shows how force imbalances arise, identifying charge pair is not part of the process of calculating a force effect for all charge within a large mass like the earth. Charges must be handled individually. All protons in the earth can be approximated by a uniform charge density. Then the sum of the proton forces of every volume increment of charge with a single remote charge at the surface equals the single force with the remote calculated as if all

protons are concentrated at the earth center. The same can be done for all electrons in the earth. This process is similar to how Newton proved that the sum of the gravitational forces of every small increment of the earth with a mass at the surface equals the same force as if all mass of the earth is concentrated at the earth center. Both of these can be verified by computerized numerical analyses.

With all charge in the earth represented as a single positive charge quantity and a single negative charge quantity at the earth center, the results of analyzing a local proton-electron pair versus a remote proton-electron pair can then be applied by substituting the entire earth charge. The resulting positive and negative charge can be equivalized into a single charge representing the entire earth. Coulomb's law then correctly applies to calculate the entire force of the earth against a remote charge at the surface and represent it as the acceleration of gravity at the earth surface. The acceleration of gravity is the appropriate value to simulate since it can be verified experimentally.

Duplicating the acceleration of gravity via a Coulomb charge force calculation verifies the charge force equals the gravitational force. This confirms the force of gravity on earth is an electric charge phenomenon and therefore an electromagnetic force.

To derive Newton's law of gravity the quantity of charge in the Coulomb force equation needs to be converted to the mass of the earth using the mass per individual proton-electron-neutron combination. This conversion transforms the Coulomb law proportionality constant to the gravitational constant and gives the same force as calculated via Newton's gravity law.

Gravity Observations

A number of observations can be made. It is no coincidence that Newton's law and Coulomb's law look similar as forces inversely proportional to the square of separation distance. For a large mass these are proven to be equivalent equations, one described with respect to mass and the other with respect to charge count.

Gravity on earth is proven to be directly dependent on count of protons and electrons in the earth and in objects at the surface. There does not seem to be any significance to mass in Newton's equation other than as a calculation proxy in place of dealing with count of charge elements.

Since the charge force at the atomic level has been proven to give rise to the gravitational force at the level of the earth, gravity at the atomic level is really the Coulomb force. It is inconsistent to believe there is another separate gravitational force at the atomic level.

Because the source of the force of gravity is now known, that knowledge should also give us the knowledge to finally understand how to create antigravity.

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Interpreting the Force of Gravity

By Larry E. Thiele March 23, 2024

It has been proven that the force of gravity is an electromagnetic force and not a unique fundamental force or fundamental interaction of its own (https://osf.io/7f2mn/). Here is an interpretation to understand what that really means.

Even as an electromagnetic phenomenon, that does not mean gravity or the force of gravity is electricity or magnetism in any sense. It is an electric charge effect of protons and electrons, but it produces no accumulation of like charges nor any current flow so the net charge of any increment of mass of the earth is zero. Therefore, gravity is quantized in the form of individual protons and electrons.

The electric effect of relevance is charge separation, the separation of electrons from protons within atoms. Because that separation has a nonzero average value over time for any proton-electron pair within an atom, there normally exists two different separation distances with any external proton or electron charge and therefore a net nonzero instantaneous force with those charges . The interaction of a local proton-electron pair within any atom of the earth with a remote proton-electron pair within any object at the earth surface results in four nonzero instantaneous charge forces. When those four forces are combined the result can be either attractive or repulsive, but the average value over time is always nonzero and attractive. When all such forces are combined throughout the earth, the result is equivalent to the force of gravity.

It is the immense number of protons and electrons within a large mass the size of the earth that compensates for the infinitesimal distance between a proton and electron within an atom and makes the equivalent net force for the entire earth relevant. We perceive gravity as a single force but in reality it is the composite of many electric charge forces acting simultaneously.

We recognize the force of gravity by the acceleration it produces on mass objects at the earth surface. Since there is no recognizable acceleration produced by surface objects on other surface objects, we don't need to consider these objects as being sources of a mutual gravitational force. There is a mutual force but it is just a weak composite of electric charge forces. Therefore, the force of gravity is primarily a concept associated with celestial-sized objects like the planets, moons, and larger.

At the atomic level gravity is in fact the Coulomb force between protons and electrons. This means at the atomic level gravity satisfies the principles of quantum mechanics.