American Journal of Modern Physics
2015; 5(1-1): 8-17
Published online June 29, 2015 (http://www.sciencepublishinggroup.com/j/ajmp)
doi: 10.11648/j.ajmp.s.2016050101.12
ISSN: 2326-8867 (Print); ISSN: 2326-8891 (Online)

The Causes of Gravity and the Strong Force

Albert C. McDowell

Retired, Raleigh, USA

Email address:
almcd999@earthlink.net

To cite this article:
Albert C. McDowell. The Causes of Gravity and the Strong Force. *American Journal of Modern Physics*. Special Issue: Physics Without Higgs and Without Supersymmetry. Vol. 5, No. 1-1, 2015, pp. 8-17. doi: 10.11648/j.ajmp.s.2016050101.12

Abstract: The physical causes of gravity and the related strong force are developed quantitatively with major improvements in the "pushing gravity" concepts of Le Sage and others. Large particles and objects are shown able to coast through a gas of subatomic particles without loss of velocity or energy. The strong force declines with the 4th power of distance, and the strong force of a small particle on a large one is greater than the strong force of the large one on the small one, making small particles very suitable for retaining nuclear components.

Keywords: Gravity, Strong Force, Aether, Gravitons

1. Introduction

Isaac Newton explained the effects of gravity. This article explains the causes of gravity. Although Georges-Louis Le Sage proposed a thermodynamic theory of gravity over 200 years ago, Einstein's Relativity sidelined the concept of "aether" to transmit gravity or electromagnetic forces. The Cosmic Microwave Background Radiation experiments reverse the "null" results of the Michelson-Morley and other light-speed experiments [1], allowing revival of the prospect that light and gravity are conducted by gaseous aether.

Visible matter consists of atoms constructed of small particles separated by relatively very wide expanses without matter. Gravity is an attractive force among the subatomic particles of matter. The net gravity force on one matter particle is the sum of the gravity force from all other particles of matter. To understand the cause of gravity, one need only discover the cause of gravity between two subatomic particles, which are assumed spherical for analytical convenience.

The conductor of gravity in this model is a gas of tiny invisible fast particles, commonly called "gravitons," that move in straight lines until striking a particle of matter, from which their path changes and their velocity is decreased. These slower gravitons are the physical embodiment of the "field" of gravity. When these slower gravitons strike a second matter particle, they impart less force than the gravitons hitting the opposite side without having been slowed to conduct gravity. The incrementally lower force from the slower gravitons creates a net attractive force directly toward the matter particle that slowed the gravitons. The gravitons that conduct force from particle A to particle B are not the gravitons that conduct force from particle B to particle A.

Although this pushing gravity theory is over a century old, it has developed little over time. Introductions to this theory can be found in [2, 3, 4, 5, & 6]. The various earlier concepts of this process have two serious problems regarding energy flows, and both problems are resolved in this article. Logical analysis of this process within the conventional Newtonian laws of mechanics reveals that the strong force is the form that the gravity process takes at very close ranges.

2. The Speed of Gravity

Observations of binary pulsars and other experimental data have shown that gravity propagates at least 20 billion times the speed of light [5 &7].

For example, two stars in a binary orbit emit gravity that takes time to reach the star on the opposite side of their mutual orbit. When the emitted gravity reaches the other side, the star on that side has moved forward along the orbit. The gravity force vector is mostly toward the center of the orbit, but a small force vector component will point in the direction that the receiving star is moving. This small perpetual force will steadily and eventually accelerate the stars out of their orbits.

However, binary stars are very common throughout the universe, meaning that they very seldom spiral apart. Gravity clearly propagates far faster than the speed of light.

Nevertheless, gravity speed is not infinite. The gravitons are particles with mass that simply travel extremely fast. In the world of Newtonian mechanics, nothing travels infinitely fast.

3. Gravity Flows Through Objects

Since gravity force is proportional to all of the atomic mass in objects, gravity must be conducted throughout objects. The gravitons carrying the lower-velocity signature of the field of gravity must flow into solid objects to apply gravity to the interior atoms. Moreover, gravity must flow straight through solid objects to apply gravity to further objects in line with that gravity vector.

Yet when a graviton applies gravity to an atom, the graviton rebounds in a different direction with the reduced velocity related to its most recent contact with atomic matter. Consequently, most of the gravitons entering an object must flow straight through the object without contacting atomic matter, while only a small proportion of the gravitons collide with atoms to deposit gravity force.

This process is illustrated by the Wang eclipse [8] and Allais pendulum [9] experiments in which the Moon appears to attenuate the flow of gravity from the Sun to Earth during its eclipse of the Sun. Even though a significant proportion of Sun gravity appears to be attenuated by the Moon, the vast majority of Sun gravity flows through the Moon without interruption to apply gravity force to Earth.

Although it may seem intuitively unlikely that there are straight paths through Earth that do not intersect subatomic particles, there is a lot of space between atoms, atomic nuclei are tiny relative to the sizes of atoms, and quarks and gluons may be made of much smaller particles.

At a much smaller scale, the neutrons and protons in the nuclei of atoms with high atomic numbers can only contribute to total atomic gravity force if the gravitons penetrate the full depth of the nuclei. Thus gravitons need to be able to fly straight through nuclei as well as planets and Suns.

Nevertheless, the relatively few gravitons that strike the nucleons toward the outside of the nuclei of atoms with large atomic numbers deflect to reduce the graviton collisions with nucleons toward the interior of nuclei. If the inertial force of accelerating nucleons is due to the more frequent and more forceful collisions with gravitons approaching from the direction in which the nucleon is accelerating, then the total inertial force and thus the mass spectrometer measurements of nuclear mass of large nuclei would be slightly less that the sum of the masses of the individual nucleons when measured outside nuclei. This could account for the "mass defect" of atoms with increasing atomic numbers.

4. The Range of Gravity

Gravitons have to travel in straight lines without contacting other objects or other gravitons in order to transmit the force of gravity from each object to others at great distances. Nevertheless, regardless of how far gravitons travel in straight lines, each graviton will eventually collide with an atom, another graviton, or the likely other aether components that transmit electromagnetism [1]. These ultimate collisions limit the range of gravity, for they alter the direction of flight.

The gravity range limits answer the cosmological question of whether a non-expanding universe would collapse due to gravity without limits. This prospect forced Einstein to add an arbitrary cosmological constant to his Relativity equations, and it adds motivation for scientists to assume a mysterious Dark Energy to explain the presumed universe expansion.

With the present view of universe structure, it seems likely that gravity does not extend effectively beyond the typical distances between galaxies. Even the clustering seen among galaxies may be random or perhaps caused by common origins of groups of galaxies.

5. Derivation of Newton's Law

In this model of gravity, atomic particles are presumed composed of subparticles substantially smaller than nucleons, and gravitons are far smaller (estimated to be about 10-37 meters in diameter and moving 1016 km/sec with a mass of 10-57 grams in [1]. These quantities are not critical. It is only necessary that gravitons be substantially smaller and lighter than atomic particles.)

The subatomic particles of atomic matter, called "atomitons," may move in orbits within atoms, but the atoms remain relatively in place. Gravitons are constantly in motion as a gas that permeates the universe. Atomitons are presumed spherical for analytical convenience. When gravitons strike atomitons, they rebound according to the laws of conservation of energy and momentum. The collisions are inelastic in that there is no friction to absorb energy. Otherwise, the energy of matter would be steadily increasing due to graviton collisions, and gravitons would slow to reduce gravity force.

Gravitons provide a physical "field" that enables mass to feel gravitational force from other mass. Each atomiton in the atoms of one object reflects gravitons carrying gravitational force toward atomitons in other objects. The total gravitational force of one object toward another is simply the sum of the gravitational forces of every atomiton in one object toward each atomiton in the other. Denoting the number of atomitons in one object by M and the number in another object by N, there are M x N individual gravitational forces to be summed to obtain the total gravity between the two objects. These counts of the numbers of atomitons are surrogates for the mass factors in Newton's Law of Gravity, which says that the gravitational force between two objects is proportional to the product of their masses. Thus, the mysterious cause of gravity reduces to the cause of gravity between any two atomitons.

The two most obvious models for these collisions have obvious problems. In the absorption model, each colliding graviton stops and merges with the larger atomiton, adding to the mass and heat energy of the atomiton. In the scattering model, each graviton bounds away with slightly less speed, leaving the atomiton with heat energy but no additional mass. Adding mass and/or energy to all matter continuously requires a replenishment mechanism if the world is not to run down. Such replenishment is impractical and will be shown unnecessary. In this model, gravity is caused by the reduction in velocity of gravitons that collide with atomitons, but there is no exchange of energy, as explained in the next section.

There are two different mechanisms by which gravitons generate force between objects. The primary mechanism explains the force of gravity. The second mechanism, not previously identified, appears to describe the "strong force" that binds protons and neutrons in the nuclei of atoms.

In this model, gravitons not carrying gravity bounce away from atomitons at lower speeds in all directions as if from a spherical surface. The number and rate of gravitons entering an object is equal to the number leaving, regardless of the number of collisions in the object, and the directions of entering and leaving gravitons are randomly distributed. Gravity is initiated by the small fraction of gravitons that collide in the object and leave it with less speed than when they entered. The slower outgoing gravitons spread apart laterally as they travel in inverse proportion to the distance squared from the object, a geometric feature of the way things expand outward from a point source. The reduced speed of this small proportion of the outgoing gravitons may be considered a gravitational field that exists independently from other objects.

A person standing on the Earth is bombarded by equal numbers of gravitons from all directions, but a few of the gravitons rebounding from collisions within the Earth travel upward at slightly slower velocities than those bombarding the person from above. The weight of the person is produced by the lower push upward from the departing gravitons than downward from an equal number of gravitons from space. Earth gravity is not a pull downward from below, but a push downward from above.

Since the total gravitational force between any two objects is the sum of the gravity between each atomiton in one object and each atomiton in the other, the cause of gravity can be explained by the relationship of the gravitons to the mass and/or size of any two atomitons. Fig. 1 shows two atomitons, A and B, separated by distance D. The gravitational force of atomiton A on atomiton B is caused entirely by the gravitons that bounce off the right hemisphere of A and collide with the left hemisphere of B. These gravitons have relatively lower speeds, for a reason described in the next section, depending on the angles at which they strike A. These slower gravitons will impart a slightly lower momentum to the left side of atomiton B than the momentum from the equal number of gravitons colliding with the right side of B. This momentum difference translates to the gravity of atomiton A on atomiton B.

The momentum that gravitons transfer by impact to larger atomitons is converted to force over the time of the collision impulses, creating small increments of the force of gravity. With a continual bombardment of gravitons on each atomiton, their forces are summed over their impulse times. The impulse time profile does not matter. If the force is twice as great over half the impulse time, the force sum will include half as many graviton impulse forces, each twice as large, in any period of time, for the same summed force from all graviton collisions.

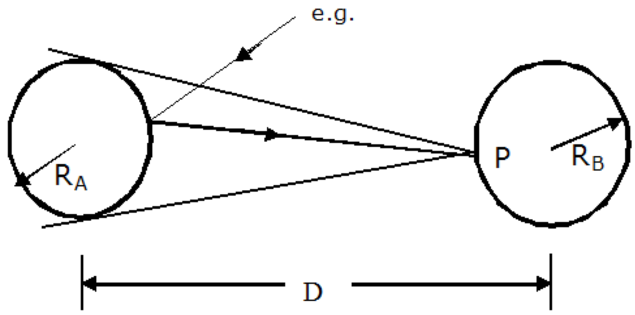

Figure 1. *Gravity of particle A on particle B*

At any point P on the left hemisphere of B, shown in Fig. 1, the incoming gravitons include a cone of speed-reduced gravitons rebounding from a circular area of πRA2 at distance D. The reduced graviton momentum, and the resulting re duced force, striking point P is thus proportional to RA2/D2. Integrating the reduced force at a point over the entire area of the left hemisphere of B provides the total gravity force of atomiton A on B, which is thereby also proportional to the profile area of atomiton B. Thus, the gravitational force, between atomitons A and B is equal to k (RARB/D)2, where k is a constant, RA and RB are the radii of the atomitons, and D is the distance between them.

Denoting Dij as the distance between an atomiton of radius Ri in one object and an atomiton of radius Rj in a second object, the total gravitational force between the objects is k ∑ (RiRj/Dij)2. If the objects are so far apart that the distances between all pairs of atomitons are essentially the same, if all atomitons have the same radius, and if the two objects have M and N atomitons respectively, then the total gravitational force is kR4MN/D2. Relative to Newton's Law of Gravity, k is proportional to the gravitational constant, MR2 represents the mass of one object, NR2 represents the mass of the other, and 1/D2 is identical to the distance parameter in Newton's Law of Gravity. If the objects have more than one size of atomiton, the R2, M, and N terms are replaced with sums reflecting the total surface area of all atomitons.

It is remarkable that mass only shows up in this formula for gravity in terms of the numbers of atomitons and their frontal area, not their volume, nor their mass!!! Instead, the mass of each atomiton is directly proportional to the surface area of the atomiton, implying that its mass is entirely in a thin shell at its surface. This suggests that the atomitons that produce gravity are very tough, very small, hollow spheres.

To see further why the mass of atomitons does not affect gravity, consider the basic Newtonian formula for the momentum transfer from a graviton to an atomiton. Let m denote the mass of a graviton, M denote the mass of an atomiton, v0 denote the incoming velocity of the graviton, v1 denote the post-collision velocity of the graviton, and V denote the velocity given to the atomiton by the graviton strike. For simplicity, consider the case of a direct hit in the center of the atomiton. The conservation of momentum and energy require that $mv0 = mv1+MV$ and $mv02 = mv12+MV2$. From these equations, it follows that the momentum transferred to the atomiton is $MV = 2mMv0/(m+M)$ in direct hits.

As discussed earlier in this chapter, v0 is at least 20 billion times faster than the speed of light, making v0 even faster relative to V, which is likely to be at most a fraction of the speed of light. With $v0 >> V$, and m very much smaller than M, leaving m+M virtually equal to M, the equation for atomiton momentum received from a graviton direct hit reduces to 2mv0.

The atomiton mass M does not affect the amount of momentum transfer. The graviton momentum transferred to the atomiton is directly proportional to the momentum and velocity of the graviton, but is not dependent of the mass of the atomiton at all. Therefore, the force over time resulting from graviton hits is therefore not dependent on atomiton mass, meaning that gravity is not directly affected by atomiton mass. The mass of an object that appears in the Law of Gravity is due to the number of its atomitons, not the mass of each atomiton directly.

Furthermore, it is conceivable that gravitons and atomitons do not even have the property we call mass. Gravitational force is instilled by the difference in force from gravitons of different speeds, which may be due to the deformation and rebound rate of the surface of atomitons and not to their mass. In this model, mass would be only a secondary effect of the fundamental way atomitons act when colliding, and the 2mv0 factor in the momentum calculations above may be only a surrogate for the impulse received in the atomiton to create force over a short time period.

This impulse or the formula for momentum transfer to create gravity simply say that the atomiton first absorbs the entire forward momentum/impulse of the graviton, mv0, and then gains another equal amount of momentum/impulse by pushing the graviton away in the direction it came at virtually the same speed. The atomiton gains double the amount of momentum/impulse contained in the graviton, without reducing the absolute value of graviton momentum, by reversing its direction. Thus gravity is powered simply by changing the directions of gravitons. A graviton gives up no kinetic energy when reflected to a new direction at the same speed.

Nevertheless, this process of producing gravity does require that the speed of reflected gravitons hitting atomiton B be lower than the speed of gravitons striking B from the opposing direction. Slower gravitons have less linear momentum and kinetic energy. This raises the question of where this lost energy goes, whether it is replenished, and if so, how?

6. Gravity Expends No Energy

The source of energy to fuel the graviton process for generating gravity has been the major problem with the theory. The momentum transferred from gravitons to matter has been previously assumed to generate heat continuously in all matter. This presents the problem of how this heat is dissipated, and the much larger problem of how graviton energy can be replenished to prevent the universe from running out of gravity.

Victor Slabinski has argued that the heat energy produced in the generation of gravity may be consistent with the heat radiated by planetary bodies [2]. By this means, the heat now presumed to generate from nuclear radioactivity deep inside planets would derive instead from the constant absorption of energy to produce gravity.

Tom Van Flandern and Matthew Edwards have discussed the possibility that the graviton energy lost to heat in the generation of gravity is replenished by the flow of heat energy into light and from light back into gravitons [5 & 10]. This would require that photons of light interact with gravitons in a way that rebuilds their extremely high velocities. With most of the energy of starlight flowing out into space, perhaps these photons renew gravitons either slowly by creating tired light or more directly by graviton termination of photons to absorb their energy. However, there is no known mechanism for tiny particles to increase their extremely high speed by stealing energy from much slower photons going randomly in all directions at the same speed. Moreover, photons do not even appear to have mass to create momentum for transfer to gravitons.

Fortunately, there is a more fundamental solution to this problem, suggested some time ago by Lord Kelvin [3, 11, & 12]. While it is necessary for gravitons to reduce their speed when colliding with atomitons to establish the gravity field of slower gravitons leaving the atomiton, the graviton's energy may remain constant if it acquires a spin in its impact with the atomiton. A small graviton flying at 20 billion times the speed of light colliding with a relatively stationary and much larger atomiton anywhere outside the center of the atomiton will surely initiate a spin of the graviton during its glancing frictionless impact. Even though the impulse time of contact is very short, a frictionless collision will produce angular acceleration of the graviton. The rotational energy gained by the graviton will reduce its linear energy and linear speed.

Not only can some of the energy of the linear velocity of gravitons convert to graviton spin energy, the impacted atomitons do not need to absorb energy to create the force of gravity. It is assumed that the gravitons and atomitons are spherical particles that deform upon impact and reform to their spherical shape without absorbing energy internally. The momentum acquired by an impacted atomiton is minimal, because it is being bombarded by gravitons from all directions, with many of them in contact with the atomiton during the impulse time of a graviton impact. The atomiton is largely only an intermediary object between all of the graviton hits. Each graviton is essentially encountering the collective incoming momentum of lots of other gravitons. The small mechanical jitter of the atomiton as the gravitons hit is offset by hits from opposing directions without the atomiton acquiring net energy from the gravitons that reflect continually from the atomiton.

Consequently, the energy of an incoming graviton leaves with the reflected graviton, partially in spin velocity and mostly in linear velocity. This enables gravitons to transmit a gravitational field of somewhat slower gravitons without sacrificing graviton energy. Gravity is maintained without energy loss or the need to recycle lost energy back into gravitons. However, this process results in all gravitons having varying degrees of spin, depending on the angles at which they rebounded from their last atomiton collision. To cause gravity, the gravitons reflected from the gravity-causing atomitons must spin faster, and thus travel slower, on average than those approaching the target atomiton from the other direction.

This process of producing gravity by converting graviton speed to spin in collisions with the atomitons of mass requires another process for later reducing graviton spin and thereby returning their speeds to high levels to create gravitational force on the sides of atomitons away from the other atomitons that "attract" them. This is accomplished in collisions between gravitons themselves. While collisions with atomitons convert graviton speed to spin, collisions with other gravitons convert spin back to speed.

The conversion from linear to rotational energy in graviton collisions with atomitons requires that atomitons be far larger and more massive than gravitons. In a frictionless non-skidding collision outside the center of an atomiton, a graviton leaves the glancing blow with spin induced by the surface of the more massive atomiton. However, when a spinning graviton collides with another graviton, someone its own (tiny) size, a frictionless impact of the two particles will decelerate the spin of each, stretching their surfaces tangentially. The tangential surface stretch will accelerate each graviton in a tangential direction while the spin of each graviton equalizes in opposite directions. While the spins equalize, the linear incoming velocity of each graviton depresses the other graviton surface toward its center. Our experience with balloons tells us that they depress radially with much less force than their surfaces stretch tangentially. Therefore, we can presume that the spins of colliding gravitons will equalize in opposite directions before the linear depression impact rebounds for the gravitons to separate. While they are in contact, the flattened area between them will resist any remaining spin in equal and opposite directions, further forcing spin energy to convert to tangential linear velocity. Thus, graviton collisions with other gravitons tend to decrease their spins and increase their average velocities. This replenishes linear velocities for the continued generation of gravity.

While gravitons reduce their speeds to produce gravity without losing energy to the atomitons they strike, the continual bombardment by gravitons can cause a low-amplitude mechanical jitter in atomitons. During the small impulse time of each graviton strike, there are likely other gravitons striking the atomiton during overlapping impulse windows. Whether one at a time in tiny impulse windows or several at a time in overlapping impulse windows, the bombardment may cause a miniscule high-frequency jitter in the positions and velocities of the atomitons. However, energy from a graviton that accelerates it in a direction away from the graviton produces an atomiton velocity that returns a corresponding amount of energy to gravitons striking the atomiton from the other direction. As long as the net effect of graviton hits from all directions leaves an atomiton at the same location in space, gravitons collectively transfer no net energy to the atomiton.

Since gravity is force, not energy, it is natural that energy should not be needed to create it. Most of the gravitational force produced by gravitons is not used to do work. When an apple falls, gravity is working. When gravity simply applies force downward to apples hanging on a tree, no work is being done. Over time, the total material inside and on the Earth remains at about the same distance from the center of the Earth, and the earth's gravity is doing little mechanical work. It should not be necessary to constantly expend energy only to provide a force on matter that has little or no net movement over time in response to the force.

7. Matter Coasts Without Drag Force

Another critical issue with the transfer of energy between gravitons and atomitons is the "drag force" due to the movement of matter through the gaseous aether [13]. Galaxies revolve; planets orbit suns; electrons orbit nuclei. All matter in motion must plough through the gas of gravitons, whose mass would seem to erode the velocity and energy of the moving matter.

The velocity reduction from the drag of gravitons on larger moving atomitons can be calculated by Newtonian mechanics and is proportional to the velocity of the atomitons through the graviton sea. As a gas, gravitons at any given location have a single frame of reference in which the average velocity of gravitons is the same in all directions. If an atomiton moves relative to the graviton frame of reference, then the rate of graviton hits is larger on the side of the atomiton moving into the graviton wind and smaller on the other side. Moreover, gravitons hit with more force on the upwind side and with less force on the downwind side. The higher rate of hits, and the higher force of hits, on the upwind side increase the average speeds of gravitons. This energy gain by gravitons is energy loss to the atomitons, causing the atomiton velocities to decline.

If the Cosmic Microwave Background Radiation anisotropy of 370 km/s reflects the graviton frame of reference, our solar system is moving through the graviton gas at roughly 0.001 times the speed of light, and it would be slowly decelerating in its motion toward the CMB apex as energy is transferred to gravitons. Cosmic explosions such as supernovas or the infernos of stars and quasars produce huge quantities of particles moving at high fractions of the speed of light. The problem of drag force demands a solution.

To prevent all moving objects from decelerating continuously from their loss of velocity to drag as they travel through gravitons, a process is needed for the objects to regain the velocity they lose to gravitons in drag force. There is one unique way for this to occur, and this amazing process reveals a great deal of the fundamental nature of atomitons.

In the above derivation of the cause of gravity, the subatomic components of matter are spherical, or at least act collectively on average as if they were spherical. In the following solution to the graviton drag problem, it is shown that the surfaces of these atomitons must be elastic and tough enough to withstand graviton bombardment and to reflect the gravitons without loss of energy from the gravitons. For clarity, this discussion will assume the case of gravitons impacting a spherical atomiton. The same mechanisms and formulas apply to collisions of gravitons with particles of different sizes (which might conduct electromagnetism [1 & 5]).

This concept is that a graviton striking an atomiton will penetrate the elastic surface, decelerate until the component of its velocity radial to the atomiton reverses, and then accelerate until it exits the atomiton surface. Gravitons striking directly the front or back of a moving atomiton will exit at the same position on the surface that they entered. In contrast, gravitons striking directly on the sides of a moving atomiton will exit only after the atomiton has moved forward. As the elastic wall of the atomiton moves forward, the side-impacting gravitons roll rearward along the stretched atomiton surface to exit at a slightly rearward angle to convey a net forward force to accelerate the moving atomiton. This effect applies over the entire surface of the atomitons, from front to back. Essentially, the gravitons striking a moving atomiton from the front and back slow the atomiton by positive drag, while the gravitons striking the atomiton from the sides roll backward to accelerate the atomiton, creating negative drag. The magnitude of both the accelerating and decelerating forces are directly proportional to the velocity of the atomiton moving through the graviton aether in the aether frame of reference.

If the positive and negative drag forces are equal, the net drag is zero, enabling atomitons to coast through the sea of gravitons at any constant velocity without loss of energy. This phenomenon follows from the spherical shape and reflective nature of atomitons. The fore, aft, and side collisions of gravitons create a toroidal flow around the moving atomiton that exists only as it passes without net energy exchange with the gravitons.

To quantify this remarkable phenomenon, consider six gravitons striking an atomiton at equally spaced quadrants around its surface, one directly in front, one in the rear, and four at 90° intervals around the sides. The effects of these six represent the effects of strikes from all other directions. From the laws of conservation of momentum and energy, the net atomiton momentum reduction due to the front and rear gravitons (the positive drag effect) is 8mV, where m is the graviton mass, which is much smaller than the atomiton mass, V is the atomiton velocity, and graviton speed v is the same in all directions. One-half of this atomiton momentum reduction is due to the higher speed at which gravitons strike the front of the atomiton, and one-half of this positive drag effect is due to the higher frequency at which gravitons strike the front of the atomiton.

This formula for positive drag for each two graviton hits can be derived from the laws of conservation of momentum and energy, or they can be understood intuitively by considering simultaneous hits from front and rear in the atomiton frame of reference. In this frame, the velocity of the atomiton is zero, the velocity of the front graviton is v + V, and the velocity of the rear graviton is v – V in the opposite direction for a total mass of 2m striking and rebounding with a net velocity of V, yielding momentum of 4mV. The same logic can be applied to calculate the same amount of momentum per pair of gravitons due to the frequency of hits in a continuous flow of hits, providing total momentum of 8mV for each pair of fore and aft graviton hits.

This positive drag momentum needs to be offset by equal negative drag momentum from the four gravitons striking the sides of the atomiton.

A large elastic sphere will undoubtedly resist the force of a fast, tiny graviton with a counter-force that builds with the depth of graviton penetration like a spring, whose force is a spring constant k times the distance penetrated $x = v\sqrt{(m/k)} \cdot \sin[t\sqrt{(k/m)}]$, where v and m are the velocity and mass of the graviton and t is time from the initial contact. The maximum depth of graviton penetration D occurs when the sine function is at π/2, meaning that the time to reach maximum penetration $T = \pi/2 \cdot \sqrt{(m/k)}$, and the total time from initial contact to last contact is twice this amount.

A graviton penetrating an atomiton will pull along with it a tunnel of the stretching material of the atomiton. The incoming velocity of the graviton of at least 20 billion times the speed of light makes the momentum of the graviton and the tunnel material pulled with it so large relative to the original momentum of the atomiton tunnel material due to the atomiton motion that the graviton will continue straight on its path as it enters the atomiton and pulls along the atomiton tunnel.

When a graviton strikes a glancing blow, the mouth of the tunnel is pulled along the surface, attempting to minimize its length by pointing radially toward the center of the atomiton. When the radial component of the graviton momentum falls to zero, the tangential momentum of the graviton will continue to move the tunnel and its mouth along the atomiton surface until the graviton exits. The movement of the tunnel will spin the graviton at the bottom of the tunnel, whose one side rises while the other falls. Consequently, the graviton reflects from the atomiton with spin and thus lower linear velocity, as specified in this gravity theory.

In the case of side-impacting gravitons to produce negative drag, as illustrated in Fig. 2, the incoming graviton heads straight for the position of the atomiton center at the time of impact. At its maximum depth, which is shown here to be only partway to the atomiton center, the atomiton center will have moved upward by the distance TV, and the tunnel will extend from the graviton radially to the atomiton surface a distance of TVD/(R-D) below the graviton entrance point, where D is the distance of maximum penetration. Without its momentum at its turnaround point, the graviton will change course and follow the tunnel. As the graviton accelerates, its momentum builds quickly to lock it on its course toward the exit TVD/(R-D) below its entry point.

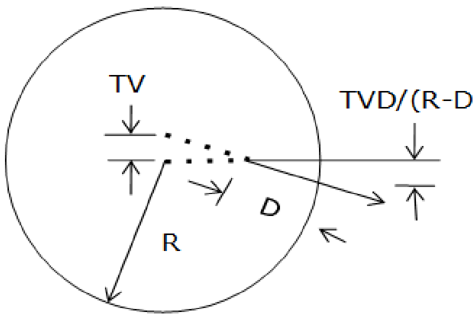

Figure 1. *Particle collision geometry*

Since each of the four side-impacting gravitons changes its momentum by 2mv and the proportion of this momentum that is converted to forward momentum of the atomiton is the distance TVD/(R-D) divided by D, the forward momentum imparted to the atomiton by the four side-impacting gravitons is 8mv • TV/(R-D). Replacing T with π/2 • √(m/k), the forward momentum becomes 8mV • πv√(m/k)/2(R-D).

Since 8mV is the momentum loss from the drag of the forward and aft gravitons, the negative drag of the side gravitons needs to be this same amount for continuous atomiton motion at constant velocity. This requires that πv√(m/k)/2(R-D) = 1.

The spring force formula says that D = v√(m/k) at maximum penetration of the graviton, and thus the zero net drag condition requires that D = R/(1+π/2). Since graviton energy is mv2/2 and the maximum potential energy of the spring force at maximum depth is kD2/2, k is simply 2/D2 times the kinetic energy of a graviton.

It is particularly remarkable that the maximum (head-on hit) depth of penetration of a graviton to eliminate net drag is a reasonable R/(1+π/2), or about 19% of the diameter of the atomiton. The penetration depth percentage is unaffected by the size, mass, or velocity of gravitons. The time to penetrate to maximum depth reduces to simply πR/(2+π)v = πD/2v, which is 61% of the time that a graviton would require to travel the distance R at its full normal speed. The total time of contact, denoted 2T, is 2πR/(2+π)v = πD/v.

It is vitally important that the penetration depth of gravitons into atomitons is self-regulating. Total drag momentum is calculated as positive drag of 8mV minus negative drag of 8mV • πv√(m/k)/2(R-D). If graviton velocity v declines, their penetrations of atomitons fall below the optimum depth for zero net drag, reducing negative drag, slowing atomitons, transferring kinetic energy from atomitons to gravitons, increasing graviton velocities and therefore increasing graviton penetration depths. On the other hand, if gravitons penetrate beyond the optimum depth, atomitons gain velocity, and energy is transferred from gravitons to atomitons, reducing graviton velocities and penetration depths back toward the optimum level. Without this self-regulation, the universe would either collapse into black holes or disintegrate into isolated atomitons with no atomic structures.

A more thorough calculation integrating all of the directions from which gravitons approach a larger atomiton may yield slightly different results, but the six directions used here represent all angles of approach, since all approaches are vector combinations of these six directions. For purposes of understanding how atomitons work, this six-direction calculation certainly suffices to illustrate the concepts. No matter how painstaking the calculations, there is a graviton penetration depth that will enable the atomiton universe to operate without collapsing into black holes as gravity pulls energy from atoms or disintegrating as atoms pull energy from the source of gravity.

8. The Strong Force

As mentioned above, there are two different mechanisms whereby gravitons cause force between objects. One is gravity, described above. The other works in addition to gravity at only very short ranges. Unlike gravity, this relatively local force does not require a field of lower speed gravitons to instill force. Instead, each atomiton creates its own attractive force toward a nearby atomiton by casting a graviton shadow on the other atomiton, which then “reflects” this shadow of missing gravitons back to the originator of the shadow to create the force of attraction. A missing graviton reduces net graviton force far more than only a slow graviton. Thus, this force is much larger than gravity at short range and may be the nuclear “strong force” that holds neutrons and protons tightly together in atomic nuclei.

Fig. 3 illustrates two atomitons with radii, RA and RB, separated by distance D. The atomitons are spherical reflectors of gravitons just as a mirror reflects light rays. If each atomiton were alone, the equal force from graviton hits from all directions would leave no net force on the atomiton. Likewise, the number and direction of gravitons leaving the surface of each atomiton is the same as if the atomiton were not there. In other words, the gravitons that the atomiton blocks and reflects on each side of the atomiton are replaced exactly by the gravitons reflected on the opposite side, as if the atomiton were transparent. At each point on a lone atomiton, gravitons strike from all directions throughout a hemisphere that is tangential to the atomiton at that point.

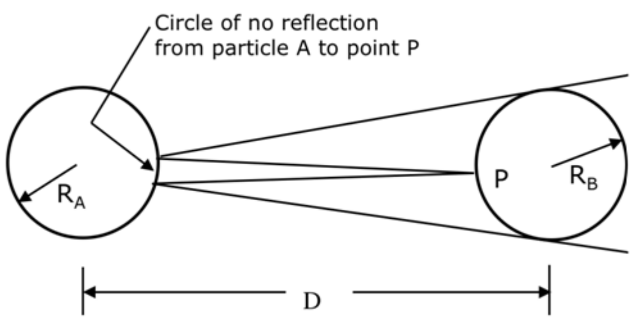

Figure 3. *The strong force*

Consider the effect of atomiton A on the gravitons striking atomiton B. While gravity is caused by the slightly reduced velocity of gravitons reflected from A to B, the strong force is caused by the elimination of gravitons that strike B from the direction of A. As just observed, the flow of reflected gravitons from most of the right surface of A replaces the gravitons that approach A from the left and are blocked by A from reaching B. However, there is a small circular area in the center of atomiton A in which atomiton B blocks the flow of any gravitons that would otherwise reflect back to atomiton B. This graviton shadow of B on A eliminates the flow of reflected gravitons back to B from this circle in the center of A. For example, the gravitons approaching the center of B from the right are blocked and reflected. Consequently, they are not available to strike the center of A and reflect back to B. Thereby B is forced toward A.

As shown in Fig. 4, this reflected shadow occurs at point P on atomiton B over an area on the surface of A with a radius of RARB/2D, which is the ratio RB/D times RA divided by 2 to obtain the radius of the area on atomiton A that reflects no gravitons to atomiton B. This means that every hemisphere of graviton flow arriving at point P on atomiton B, as illustrated, has a hole in the direction of atomiton A without gravitons the size of an area π(RARB/2D)2 at a distance D. Each point on the left side hemisphere of B sees this small hole without gravitons in the hemisphere of incoming gravitons to the surface of B at that point.

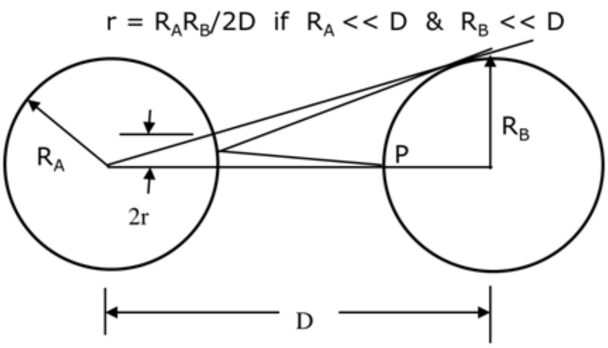

Figure 4. *Shadow of particle B on particle A*

The graviton flow density per unit area at a point from a cone ending at that point is geometrically proportional to the square of the ratio of the radius R of the cone to the distance D at which its radius is measured. Thus the force density per area that gravitons convey to a atomiton can be formulated as (R/D)2f, where f is a constant of the graviton gas. The areal force density at a point P on atomiton B from the graviton blackout area on A is RA2RB2f/4D4. Integrating this force density over the left hemisphere of atomiton B, taking into account the reduced vector component of the force in the direction from A at points away from the center of B, the lost force from the shadowed gravitons from A is πRA2RB4f/8D4. This is calculated by formulating the lost graviton force on a ring on atomiton B as shown in Fig. 5 and integrating the distance x from zero to RB. The factor x/RB repeats three times in this integral to reflect the slant of the ring relative to perpendicular to the incoming cone of missing gravitons, the vector component of graviton force toward the center of atomiton B during the reflection of the graviton, and the vector component of this radial force in the horizontal direction.

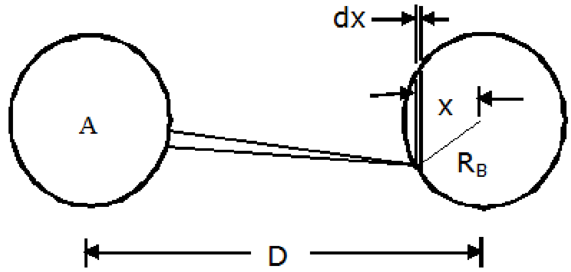

Figure 5. *Graviton shadow lost force integration*

In this strong force formula, the gravitons that are missing in the shadow circle would have reflected virtually radially from atomiton A. Therefore they would have reflected with virtually no spin. All of their kinetic energy would be linear velocity. Therefore the graviton force density constant f for this strong force formula applies only to gravitons at their maximum velocity. This constant is lower for gravitons with spin, as in the case of gravitons carrying the force of gravity. In the following formulation of gravity force, the average areal force density of all reflected gravitons from an atomiton to a point on another atomiton is denoted g.

The graviton force density f is higher, and the graviton force density g is lower, than the average graviton force density existing in the environment. Denoting the environmental background graviton force density k, the net strong force on atomiton B due to atomiton A is πRA2RB4(f-k)/8D4.

Using the same approach to formulating the gravity force, the areal density of the gravity force of atomiton A on atomiton B from the cone of incoming gravitons from atomiton A is defined by the profile area of atomiton A and can be denoted (k-g)RA2/D2, where k-g is the difference between the average areal graviton force density seen in the environment and the lower average graviton force density caused by graviton spin acquired in reflecting from atomiton A toward atomiton B. This force reduction, conveyed in graviton velocity reduction, is the basis for gravity. The factor g accounts for the increasing velocity reduction from the center toward the circumference of atomiton A as seen by atomiton B. The velocities of gravitons reflected toward B from near the circumference of A are reduced relatively greatest because their contacts with A are at glancing blows at shallow angles.

Integrating the reduction in areal force density from atomiton B over the hemisphere of B, accounting for the reduced force component in the direction from A toward the outside of B, the force of gravity on B is πRA2RB2(k-g)/2D2. This is the form of Newton's Law of Gravity, where the mass of the two atomitons is replaced by the square of their radii. As noted before, the square of a atomiton radius is proportional to its mass, which probably exists entirely in the atomiton surface.

The ratio of gravitational force to the strong force caused by atomiton A on atomiton B is 4(k-g)D2/(f-k)RB2. This means that gravity is larger than the strong force when RB2/D2 is less than 4(k-g)/(f-k). From the distance where the two forces are equal, gravity exceeds the strong force with increasing distance squared, and the strong force exceeds gravity with decreasing distance squared. This is consistent with the strong force only being effective at distances in the realm of an atomic nucleon, and with the exceptional power of the strong force at that short range.

The relative sizes of the graviton force density constants f, g, and k can be sized roughly. When a graviton reflects from an atomiton, its spin, and thus its velocity and momentum, persist until removed by a collision with another graviton. A graviton, being much smaller than an atomiton, may collide with many atomitons before colliding with a graviton. As a spinning graviton collides with these larger atomitons, its spin changes continually to the level determined by the last atomiton it hits. Many gravitons in the environment are spinning, and their average spin is certainly less than the maximum spin that they could acquire in a glancing contact with an atomiton.

The areal graviton force density factor f applies to gravitons blocked from reflecting from direct hits in the center of atomitons. These gravitons will have virtually no spin, causing f to represent the maximum areal force density. The maximum graviton spin occurs when contacting a larger atomiton tangentially to acquire surface spin velocity equal to its linear velocity. When a hollow non-spinning graviton contacts an atomiton with little change in direction, acquiring the maximum amount of spin possible, it rotates at a surface velocity equal to its new slower linear velocity without change in total energy, its linear energy reduces by 4/7, and its linear velocity reduces by about 1/3. Since graviton force or momentum is proportional to velocity, the average force density from the gravity effect of spinning gravitons is on the order of 0.8 times the force density of non-spinning gravitons, reflecting the proportionate difference between g and f. If we normalize f at 1.0, g is 0.8, meaning that an f = 1.0 graviton is not spinning and a graviton with a g = 0.8 has converted 20% of its velocity to spin.

The ratio RB2/D2 at which the gravity and strong forces are equal can be estimated roughly from the fact that the strong force, as known currently in science, is effective only within atomic nuclei. If we assume that the distances between subparticles of nucleons are about 10 times the subparticle radius, RB/D may be on the order of 0.1, equivalent to RB2/D2 = 0.01. Now we can solve the formula RB2/D2 = 4(k-g)/(f-k) to find that k = .8005.

The gravitons in the environment have either previously contacted an atomiton to be carrying a spin of g = 0.8 or have previously contacted a graviton to remove most of their spin to leave an average spin of perhaps 0.9. For the average spin in the environment to be .8005, 0.5 % of gravitons would have previously struck another graviton and 99.5% of gravitons would have previously struck an atomiton.

Although these numbers are rough estimates at best, they illustrate the concept of how these formulas may help quantify the origins of gravity and the strong force to provide huge binding forces within nucleons.

The strong force formula differs from the gravity formula by RB and D being raised to the fourth power instead of the second power. The causes for these differences between the gravity and strong force formulas can be understood intuitively. The radius squared of an atomiton is proportional to its area, either surface area or profile area. In the gravity force generation, the rate of gravitons hitting atomiton A is proportional to its profile area, represented by RA2. The rate of these reflected gravitons hitting atomiton B is proportional to RB2. The density reduction of the reflected gravitons over their travel from A to B is proportional to the inverse square of distance D.

In the generation of the strong force, the size of the reflection shadow area on atomiton A is proportional to both the profile areas of A and B, and the area of B appears a second time in the formula as the area over which the eliminated graviton areal force density reduces force on B from A. Thus the area of B shows up twice in the strong force formulas as RB4, and the area of A shows up once as RA2. The inverse square distance factor D2 shows up once for the missing flow of gravitons from atomiton B to A, and once again for the flow of the reflection of these shadowed gravitons back to atomiton B.

While gravity may be considered a field, the strong force is essentially the reflection of a graviton shadow, which is extremely strong at close range and which fades rapidly outside atomic nuclei. Gravity is due to minute differences in the velocities of a small proportion of the gravitons striking the side of an atomiton facing the cause of the gravity field. The strong force is due to the complete lack of gravitons at any speed over a portion of its side facing the reflection of its graviton shadow. The lack of a graviton hit will create far more force than a hit from a slightly slower graviton.

9. Strong Force Asymmetry

There is another major factor that affects the magnitude of the strong force. The formula for the strong force is not symmetrical with regard to the radii of the two atomitons, A and B. The ratio of the force attracting A toward B to the force of B toward A is RA2/RB2, showing that the forces between atomitons can be substantially different if their radii differ. With atomiton surface area proportional to atomiton mass, the strong force attraction between two atomitons differs in proportion to the ratio of their masses.

For example, if there are atomitons in the nucleus that are 1,000 times less in diameter than the atomitons in protons and neutrons, then the atomitons would be attracted to these smaller atomitons with one million times more strong force than the strong force attracting the smaller atomitons toward the larger atomitons. Nevertheless, the accelerations of an atomiton and a smaller atomiton toward each other would be the same for each, since acceleration is proportional to force and inversely proportional to the mass of the accelerating atomiton.

10. Conclusions

Gravity can be explained by a gas of exceptionally small and fast particles called gravitons that carry force from one object to another object in the form of reduced velocity. The frictionless collisions among gravitons and the much larger particles of atomic matter do not transfer energy, because their reduced velocities are offset by increased graviton spin.

Atomic particles coast through the graviton gas without losing velocity or energy, because positive drag from fore and aft graviton collisions is offset by negative drag from side-impacting gravitons whose paths are deflected rearward during their time in contact with the moving atomic particles.

When two particles of atomic matter are near each other, each blocks the flow of gravitons to the other particle, creating a much stronger force of attraction than gravity that is caused by only a small change in graviton velocity. This is apparently the strong force, and it declines with the 4th power of distance.

The strong force of a graviton or another small particle on a larger atomic particle is much stronger than the force of the large particle on the small particle. The strong force of very small particles may act as glue to hold subatomic particles within atomic nuclei; and much of internal nuclear motion is likely governed by the strong force, rather than gravity or electrical force.

References

[1] A. McDowell, Uncommon Knowledge: New Science of Gravity, Light, the Origin of Life, and the Mind of Man. Bloomington, IN: AuthorHouse, 2014.

[2] H. Arp, The Observational Impetus for “Le Sage” Gravity. http://www.haltonarp.com.

[3] M. R. Edwards, Pushing Gravity: New Perspectives on Le Sages’s Theory of Gravitation. Montreal, Quebec: C. Roy Keys, 2002.

[4] H. Poincare, “The Theory of Lesage” The foundations of science (Science and Method). New York: Science Press, 1913, pp. 517-522.

[5] T. Van Flandern, Dark Matter, Missing Planets & New Comets: Paradoxes Resolved, Origins Illuminated. Berkeley, CA: North Atlantic, 1993.

[6] T. Van Flandern, Possible New Properties of Gravity. Astrophysics & Space Science. vol. 244, 1996, pp. 249-261.

[7] T. Van Flandern, The Speed of Gravity: What Experiments Say. Physics Letters vol. A250, 1998, pp. 1-11.

[8] Q. Wang, X. Yang, C. Wu, H. Gua, H. Liu, C. Hua, “Precise Measurement of Gravity Variations during a Total Solar Eclipse.” Physical Review D, vol. 62, 041101, 2000.

[9] M. Chaitelain, Our Ancestors Came from Outer Space. Garden City, NY: Doubleday, 1978, p. 192.

[10] M. R. Edwards, Photon-Graviton Recycling as Cause of Gravitation. Apeiron, vol. 14, 2007, pp. 214-233.

[11] W. Thompson (Lord Kelvin), On the Ultramundane Corpuscles of Le Sage. Philosophy Magazine, vol. 45, 1873, pp. 321-332.

[12] P. G. Tait, Lecture on Some Recent Advances in Physical Science with a Special Lecture on Force. London: Macmillan, 1876.

[13] R. P. Feynman, The Character of Physical Law, The 1964 Messenger Lectures. Cambridge, MA: Massachusetts Institute of Technology, 1967, pp. 37-39.