Gravity

The Effective Mass Theory of Gravity

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Introduction

Gravity has been theorised most famously by Isaac Newton and Albert Einstein. Newton's theory was accepted for more than 200 years until Einstein 'reinvented the wheel' and used his spacetime concept to explain gravity. But still many physicists aren't satisfied and want a new theory of gravity or at least a modified theory of gravity. One reason for that is because many seek to unify General Relativity and Quantum Mechanics to produce a Theory of Everything. I'm not sure why we need a theory of everything but there's still something not quite right with current theories of gravity, that is they don't explain why there appears to be more gravity in the universe than there is mass to produce it. The temporary solution was the introduction of hypothetical dark matter to make up the missing mass.

This is just the introduction to my paper but I bring you the conclusion now and then explain after. I have produced a new theory of gravity a theory based on effective mass. It dispenses with Newton's theory, Einstein's theory and with dark matter and introduces new formulas for making accurate calculations of gravitational force and mass.

First we must calculate the effective mass:

$$Mss1 = \frac{2\pi R1^3/3(1-cos(sin^{-1}(R2/D)))}{\pi R1^3/3\cdot 4}M1 \quad Mss2 = \frac{2\pi R2^3/3(1-cos(sin^{-1}(R1/D)))}{\pi R2^3/3\cdot 4}M2$$

Then to calculate the force of gravity:

$$\mathbf{F} = (\mathbf{G}\cdot\mathbf{Mss1})\cdot(\mathbf{G}\cdot\mathbf{Mss2})$$

Where:

$$\mathrm{G} = 1.13832865\mathrm{e}^{-9}$$

$$\mathrm{F} = \text{Gravitational force (N)}$$

$$\mathrm{M1} = \text{Mass of body 1 (kg)}$$

$$\mathrm{M2} = \text{Mass of body 2 (kg)}$$

$$\mathrm{Mss1} = \text{Effective mass of body 1 (kg)}$$

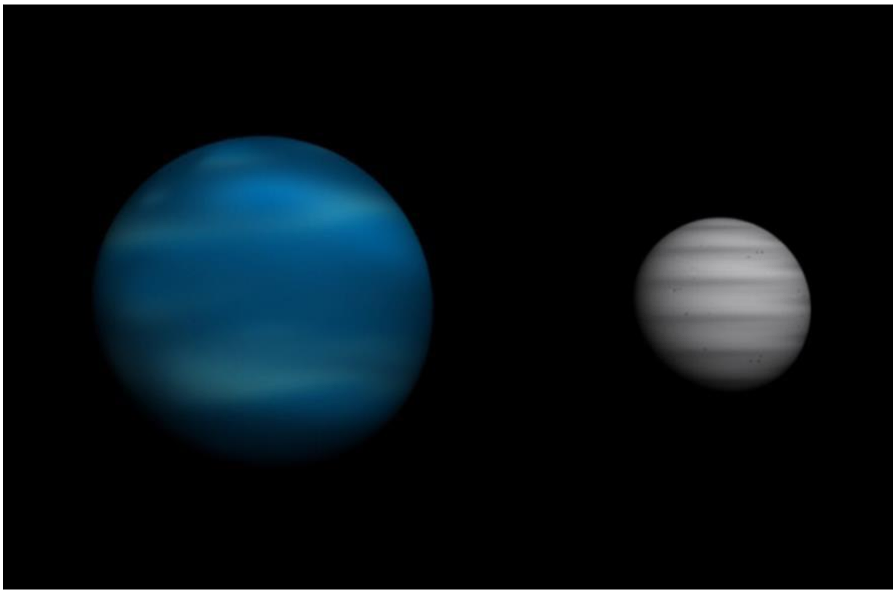
$$\mathrm{Mss2} = \text{Effective mass of body 2 (kg)}$$

$$\mathrm{D} = \text{Distance between bodies (m)}$$

$$\mathrm{R1} = \text{Radius of body 1 (m)}$$

$$\mathrm{R2} = \text{Radius of body 2 (m)}$$

The above gravitational formulas are for use only between celestial bodies because that is where mass and gravity are significant enough to force the bodies in to spherical shapes and so in order to cover everything, there is a section in this paper about surface gravity.



It should be noted early on also that gravitational formulas aren't actually used to calculate gravitational force. They are used in transposed form and used to calculate mass where gravitational force is a given. Even here on Earth we use gravitational force to calculate mass such as when we 'weigh' something or ourselves. We step on to the scales and use gravitational force (weight) to measure our mass.

As you might have guessed from my formulas, Mss1 and Mss2 are fractions of M1 and M2 and represent the 'effective mass' of M1 and M2. What this new theory proves is that not the whole mass of two celestial bodies is responsible for the gravitational force between them. The same is true also for surface gravity. When teachers of science impress a class by demonstrating that a small magnet can lift a paperclip against the gravity of the whole Earth well that is very misconceived. If I stood in London and held my arm out in front of me, would the gravity of the whole Earth be pulling down on my arm? No. In fact, the gravity in Sydney, Australia would be pulling in the opposite direction.

Mss1 and Mss2, at a fraction of M1 and M2, account for the total mass responsible for the gravitational force between M1 and M2. Therefore, we no longer require dark matter to fill in for the apparent missing mass. The dark matter problem is solved.

This paper also covers the inverse square law on gravity, explains why gravitational force appears to follow the inverse square and explains mathematically why it doesn't follow the inverse square exactly, hence its absence from my formulas.

This theory is classical in nature and so relies on the fact that gravity is a force and is a natural phenomenon where the cause of gravity isn't explained but rather is accepted as a property of mass.

Because this theory of gravity is novel and is a standalone replacement theory, this paper seeks to cover everything including gravitational waves, gravitational shielding, general relativity and dark matter we've already touched upon in this introduction. Because of the nature and extent of this paper, it is written in 'text book' form.

The Force of Gravity

What is gravitational force anyway? Mass determines the strength of a gravitational field. The more mass, the stronger the gravitational field. On its own, a gravitational field doesn't do anything. But if two gravitational fields interact their masses each produce a gravitational force. And so gravitational force is always measured between two masses. To compare fields and forces, the Moon's gravitational field is just 1.2% that of the Earth's, given that their masses are in that proportion. However, the surface gravity of the Moon is 17% that of the Earth's, the difference being due to the shorter distance between the surface and the core. Surface gravity relates to potential gravitational force generated between a celestial body and a relatively small object on or near its surface.

Newton gave us this formula for calculating the force of gravity (both interpretations produce the same result):

$$F = G\frac{M1 \cdot M2}{R^2} \quad F = \frac{G \cdot M1 \cdot M2}{R^2}$$

See the formula for centrifugal force below and note the similarities with Newton's formula for gravitational force. It is widely assumed that planets in orbit are subject to two forces: Gravity and a reactivate centrifugal force and that they must be approximately equal in order for a planet to maintain its orbit.

$$F = \frac{MV^2}{R}$$

Let us be absolutely clear, planets are not subject to any orbital centrifugal force. In a thought experiment where gravity is absent and a cable is secured between the Sun and Jupiter and then the Sun 'swings' Jupiter around it at its current speed, there will be a centrifugal force measuring around $9x10^{22}$N. Take the cable away then the Sun and Jupiter no longer have any relationship. But back to reality, Jupiter and the Sun are falling towards one another due to gravity but are not getting noticeably closer due to their 'sideways' motion along their orbital path causing the other's surface to fall away at an even rate. There is no outward centrifugal force. In the absence of gravity, the Sun and Jupiter wouldn't be subject to any kind of orbital centrifugal force they would simply be unrelated to one another. The mechanics of a planetary orbit are not similar to a centrifugal force like in our thought experiment.

Newton's gravitational constant functions only to scale the result in to desired units (N) and was tailored (not by him) to produce the same results as for the centrifugal force, the formula for the centrifugal force initially being used to calculate celestial mass using gravitational force (distances and gravitational forces are measured or estimated observationally and mass calculated from those givens).

Surface Gravity

The quantity of the Earth's mass that causes the gravitational force responsible for keeping our feet on the ground is proportional to the area of our footprint relative to the surface area of the whole Earth. The Earth's surface is 510.1 million Sq. Km. If we had very large feet, then perhaps our footprint is just one quarter of a square meter. And so $2.5x10^{-7} \div 510.1x10^{6} \cdot 100$ means we are standing on just $4.9x10^{-14}$% of the Earth's surface. This also means that just $4.9x10^{-14}$% of the Earth's mass is generating the gravity that keeps our feet on the ground. Not the gravity of the whole Earth as was the assumption. The Earth's mass is $5.972x10^{24}kg$ but just $2.927x10^{9}kg$ of the Earth's mass and gravitational field interacts with each of us. So 3 billion tonnes of Earth and our 70 kg bodies mutually attract gravitationally to produce around 687 Newtons of force. So what does this tell us? Well it tells us that gravity is a lot stronger than previously thought. Two quadrillion times stronger in this example. This error of a factor of 2 quadrillion doesn't apply universally and is much less when making corrections to interstellar calculations.

The formula for calculating the proportion of a celestial body's mass interacting gravitationally with an object on its surface is:

$$Mss = \frac{a}{A} \cdot 100 \cdot M$$

Where 'a' is the surface area occupied by the object, 'A' is the surface area of the celestial body and 'M' is the mass of the celestial body.

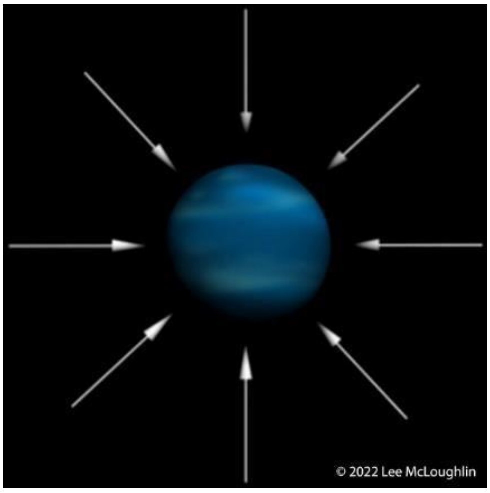
By my reckoning, one might assume that an object would weigh more lying down than if it were standing up. Let me explain. Take a rectangular box, a monolith, measuring 1m x 1m x 2m. We stand it upright so that it occupies 1 sq. m of the Earth's surface. The mass of the Earth beneath that foot print interacts gravitationally with the whole monolith producing 1000 N.

Now lay the monolith down. The same footprint of the Earth and associated mass now interacts gravitationally with just half the monolith, producing 500 N. An identical adjacent portion of the Earth's mass now interacts gravitationally with the other half of the monolith, also producing 500 N. So the net gravitational force remains at 1000 N.

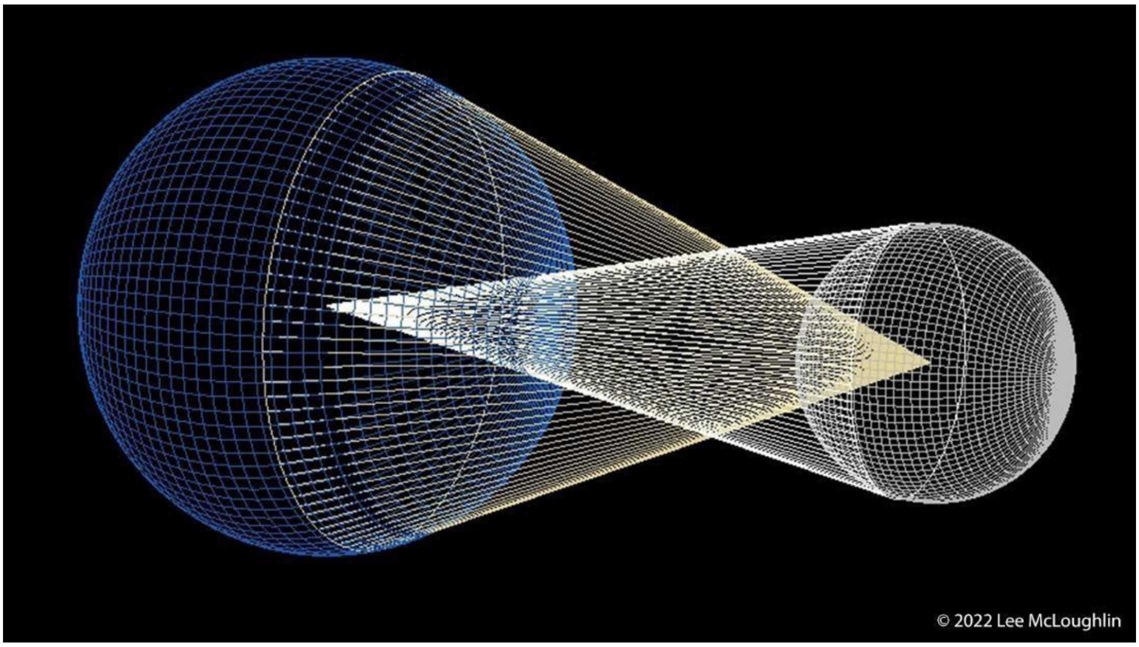
Gravitational Direction

Isaac Newton proposed that the strength of the gravitational force between two objects is determined by mass and distance. He found (thanks to Kepler) that to double the distance between two objects, the gravitational force between them would reduce to a quarter. The famous inverse square law. Perhaps what Newton didn't consider (I don't know) is that the inverse square law is inherent of spheres and not of gravity and so only applies if at least the larger of the two objects is a sphere. Anything that radiates from a sphere equally in all directions is subject (approximately) to the inverse square over distance: light, charge and gravity.

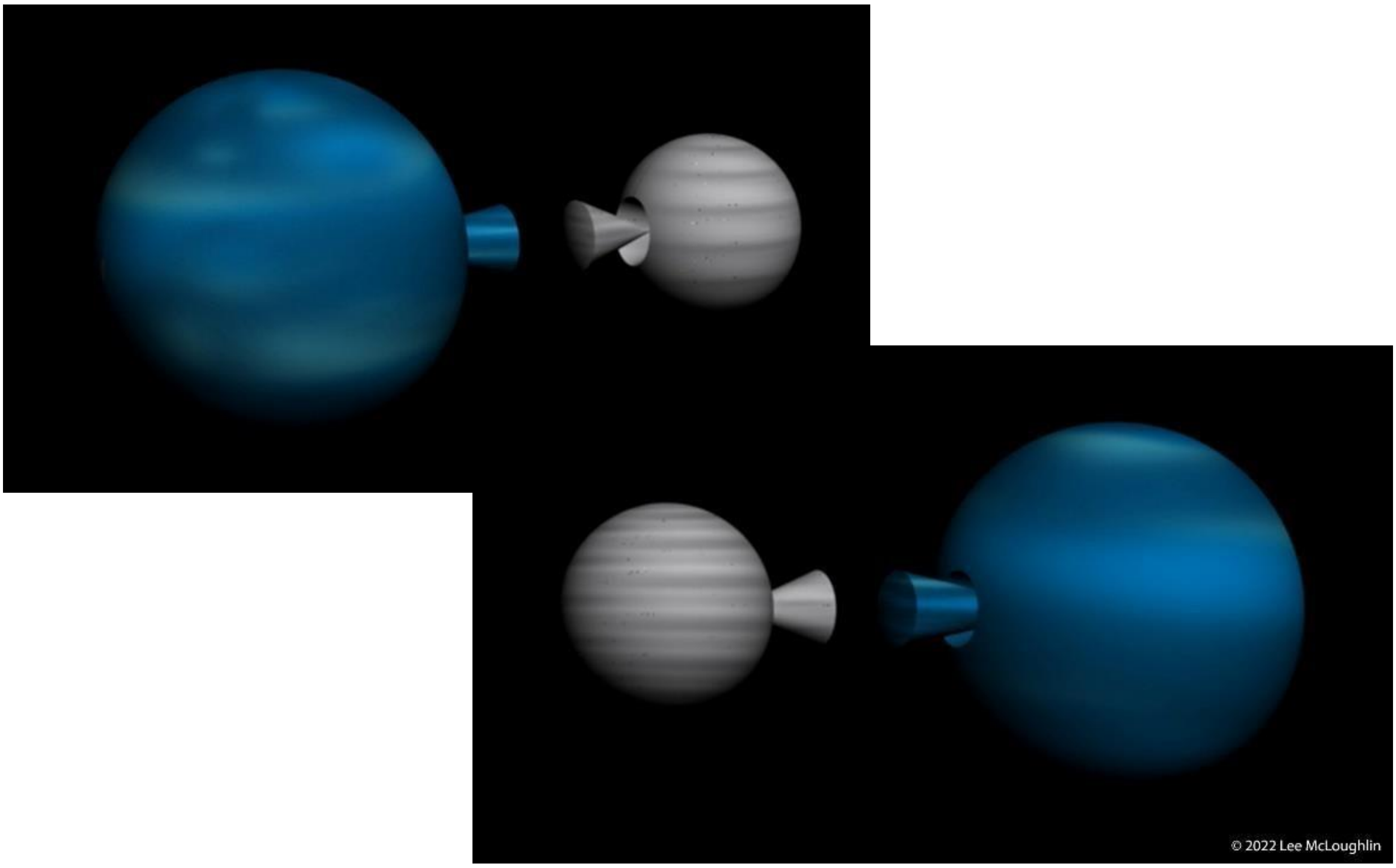
So what does the gravitational force obeying the inverse square law on distance tell us? Well it confirms that the Earth is a sphere for one but what else? Does it tell us that gravity decays over distance? Not quite. Gravity has infinite range and does not decay over distance. Gravity, like light, radiates away from its source equally in all directions. And so, if we position ourselves further from the source of gravity (Earth in our case), the gravity does not get weaker, rather we just get less of it. It would mean less of the Earth's mass is acting upon us gravitationally. It also tells us that gravity 'travels' in straight lines.



Consider my wireframe illustration of the two large bodies. You will see that the gravitational attraction between the two is in straight lines. This gravitational reach carves out the portion of each body responsible for the gravitational attraction of the other.



The portion of each body responsible for the gravitational attraction of the other is in the shape of a spherical sector. The following illustrations show the spherical sectors isolated in order to visualise the scale of the margin of error in previous theories of gravity. It is not an error of 2 quadrillion times like with man on Earth but the margin of error is significant enough to dispense with dark matter.



Gravitational Moments

More about gravity travelling in straight lines: We are all familiar with magnets and probably most of us are aware that magnets can be made only from iron and steel (nickel too) and of course there are also electromagnets. But actually, all atoms are magnetic, not just iron. Every atom has a magnetic moment but usually these all point in random directions within a material and cancel. Magnetic moments are quite stiff, they don't easily change direction but are less stiff in iron and nickel (due to unpaired electrons) and can be made to all face the same way (semi) permanently.

When one enters an MRI scanner, the strong electromagnet aligns all of our magnetic moments. Once the electromagnet is turned off, all of our magnetic moments spring back to their original direction. The speed at which they return is slightly different for different tissue types, giving the radiologist a readable image.

So what about gravitational moments? Gravity is directional and the gravity of the Earth is always directed towards its centre. Gravitational moments are not stiff like magnetic moments but swing freely, like the needle of a compass. We could lift a large boulder, with all of its gravitational moments directed toward the centre of the Earth, and flip that boulder over. The gravitational moments within the boulder, despite the boulder's rotational orientation, will always be directed toward the centre of the Earth.

So what about a large asteroid? With its very small but present gravity. All of its gravitational moments are aligned toward its centre. Should the asteroid ever collide with Earth, I can be certain that that all of its gravitational moments will realign to point toward the centre of the (much larger) Earth, contributing to the Earth's overall mass and gravitational field.

Gravitational Shielding

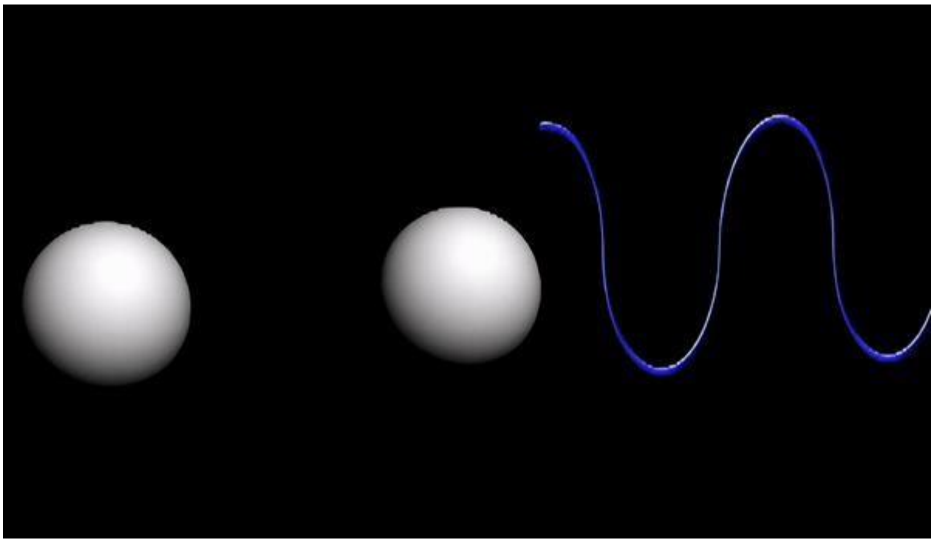
So I discussed above the necessity of gravitational moments, without which gravity wouldn't follow (approximately) the inverse square law over distance. Each end of a magnetic moment is labelled North and South. Do gravitational moments have a 'head' and 'tail' or just two heads? Well if they do indeed have a head and tail and that heads are only attracted to tails then gravitational shielding may be a possibility. That would mean that for some celestial bodies, gravitational moments' heads would all point towards the core but in others, their tails would all point towards the core. That would mean that at the cores of celestial bodies, there may be a repulsion. I draw no conclusions on this.

But consider this. Three celestial bodies all in a line. All are similar in mass and physical size and we call them 'A', 'B' and 'C'. B is in the middle. Naturally, all of their gravitational moments point toward their respective cores. I propose that A and C are gravitationally shielded from one another by B. Experimental physicists I'm sure would confirm or rule out this hypothesis by observation.

Gravitational Waves, Speed and Propagation of Gravity

Gravity travels at the speed of light, relative to the mass that produces it. Contrary to wide belief, linear speed and motion can never be attributed to just one object. Linear speed is always a measurement of the rate of change of distance between two objects.

What about how gravity propagates? Gravitational waves have been detected right? It depends on your definition of a gravitational wave. The detection of gravitational waves was announced on 11 February 2016. Those and subsequent such gravitational waves are detected only as coming from binary star systems at a frequency of two times the orbital frequency of the binary system. See 'OBSERVATION OF GRAVITATIONAL WAVES FROM A BINARY BLACK HOLE MERGER' by LIGO Scientific Collaboration.



As the binary stars orbit one another, fluctuations in distance between each of the two stars of the binary system and Earth causes corresponding changes of the force of gravity at a frequency generated by the orbital frequency. In fact, each body of the binary system would experience the same 'gravitational waves' as if they were emitted from Earth.

'Gravitational waves' aside, does gravity propagate as waves? Light, for example, propagates as an alternating charge of both negative and positive. To an observer, these alternating charges would create corresponding electromagnetic fields that trace out a sine wave as they pass. The frequency of the alternating charges determines the light's energy or colour. Both the frequency and the phase of the electromagnetic field at the time a photon interacts with matter determines what matter does with it, giving it wave like properties and predictions.

Gravity is gravity. It doesn't have opposite properties as with light and so it doesn't have anything to alternate between at frequencies. In fact, if gravity was available at different frequencies, it wouldn't make any sense at all because then gravity would be available in different energies.

New Formulas (Inter-Celestial)

$$Mss1 = \frac{2\pi R1^3/3(1-cos(sin^{-1}(R2/D)))}{\pi R1^3/3\cdot 4}M1 \qquad Mss2 = \frac{2\pi R2^3/3(1-cos(sin^{-1}(R1/D)))}{\pi R2^3/3\cdot 4}M2$$

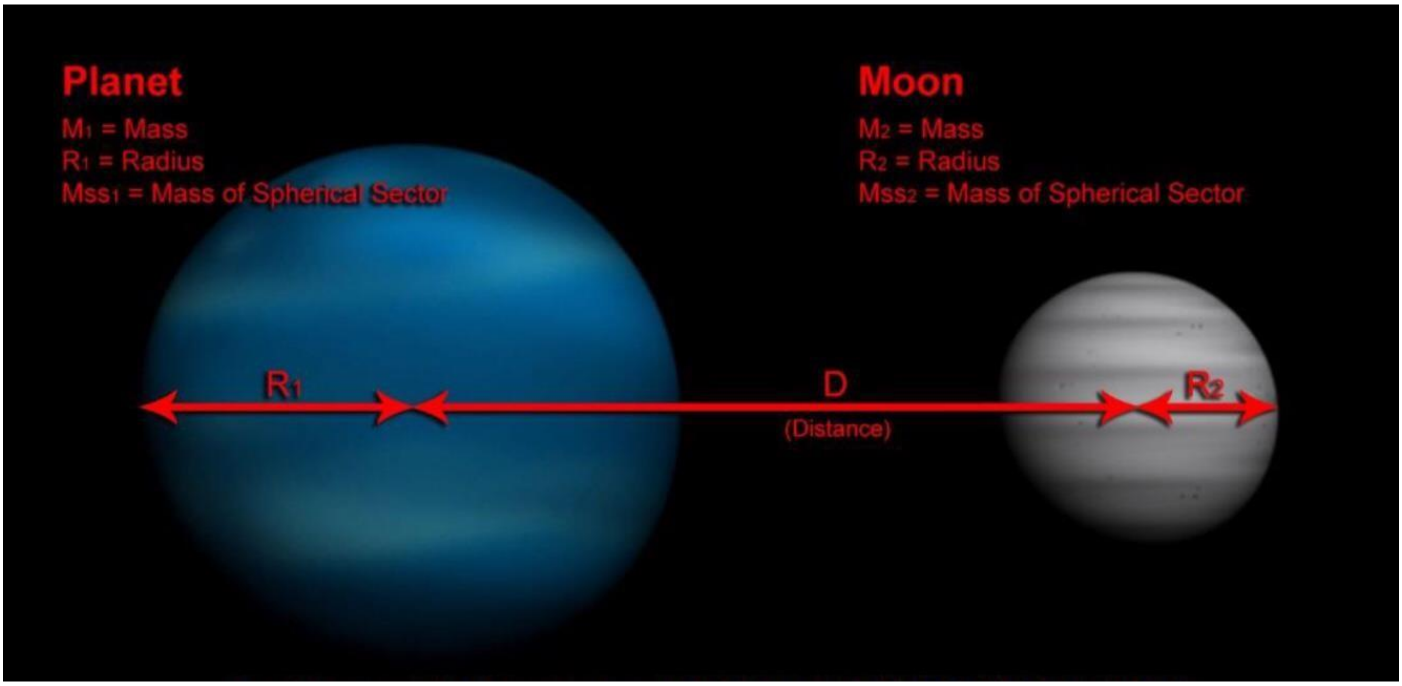
Or for online calculators: https://www.mathsisfun.com/scientific-calculator.html

(for example)

Copy and paste in turn to the online calculator exchanging the variables in bold for values:

Mss1=2pi***R1***^3/3(1-cos(asin(**R2**/**D**)))/(pi***R1***^3/3*4)***M1**

Mss2=2pi***R2***^3/3(1-cos(asin(**R1**/**D**)))/(pi***R2***^3/3*4)***M2**



Experimenting with these formulas (calculator set to degrees not radians), one will notice that when the distance between the two bodies is doubled, the mass of the spherical sectors is reduced to approximately a quarter. This is as expected given that the gravitational force between the two bodies is also reduced to approximately a quarter, the inverse square law.

Yes we used distance to work out the mass of the spherical sectors but we don't require distance to work out the force of gravity when using this method. One can use the formula below where the new gravitational constant will be G = 1.13832865e-9

$$\boldsymbol{F = (G \cdot Mss1) \cdot (G \cdot Mss2)}$$

You will see from my formula that gravitational force is actually made up of two gravitational forces generated by each body and exerted upon the other. Recall earlier when I said that gravity is used to determine mass and not the other way around. This does mean unfortunately that masses for the planets and moons within our solar system have been miscalculated. To determine mass from gravity, we must transpose my formula:

$$M2 = \frac{\pi R2^3/3 \cdot 4}{(2\pi R2^3/3(1 - cos(sin^{-1}(R1/D)))) \cdot (F/Mss1 \cdot G)/G)}$$

Or for online calculators:

M2 = pi*$\mathbf{R2}$^3/3*4/(2pi*$\mathbf{R2}$^3/3(1-cos(asin($\mathbf{R1}$/$\mathbf{D}$))))*($\mathbf{F}$/($\mathbf{Mss1}$*$\mathbf{G}$)/$\mathbf{G}$)

We don't require a formula to find M1 because we require M1 for calculating M2. Known masses like that of the Earth and the Sun can be used as M1 for calculating unknown masses such as Jupiter or the Moon as M2.

Using my formula to determine the mass of Jupiter, for example, produces this result:

$$Jupiter\ Mass\ (new) = 4.04208^{26} kg$$

This is a much more realistic mass for a gas planet than the mass calculated for Jupiter using classical formulas:

$$Jupiter\ Mass\ (previous) = 1.898^{27} kg$$

So if my calculations are correct then Jupiter is 4.7 times less massive and 4.7 times less dense than previously thought. This is somewhat of a relief because now we have no need to explain why a planet made primarily of hydrogen is more dense than water! So how does this revelation affect our understanding? Well, Jupiter's presence is represented primarily by its gravitational field and physical size. What my calculations prove is that Jupiter, at a fifth of the mass previously thought, still produces the same gravitational field, again, as above, meaning that gravity is much stronger than first thought.

Inverse Square Law on Gravity

If every atom of the Earth contributed to the gravitational force upon the moon or a man (and vice versa) and then we double the distance, the gravitational force would remain unchanged. But gravitational forces follow (approximately) the inverse square on distance. The inverse square isn't inherent of gravity but is inherent of spheres. It means less of what is being emitted is observed as distance increases, whether that be charge, gravity or light. The inverse square proves that the whole mass of celestial bodies isn't responsible for the gravitational attraction of another.

So gravity emitted from spheres is bound by the inverse square on force and distance correct? Not quite. Newton's formula compels the use of the inverse square thus producing inaccurate results. It's a close approximation. Halve the distance between two sources of gravity then the gravitational force will increase by four. The problem is, it never does. The increase of gravitational force when the distance is halved is always less than a factor of four, it is more like 3.9999999 and here's why:

As I have demonstrated, the gravitational force between two large bodies, two spheres such as stars for example, is generated by representative spherical segments of each and I have given the formulas above to calculate the mass of each segment.

A spherical sector can be thought of as two parts: a cone and a spherical cap or dome. A cone is usually described by its height and its radius but also by its slant height and acute angle. The radius of the cone represents the widest part of the cone (and the base of the spherical cap).

If we use a binary star system as an example then according to traditional formulas for gravity, to halve the distance between the two stars would see the gravitational force increase by 4. This would be represented by a doubling of the radius of the cone of a spherical sector and a doubling of its acute angle. This is where the slight error occurs. To double the radius and angle of a cone within a sphere, the cone no longer fits. The cone must be slightly shorter in order to fit. With acute angles of less than 5 degrees, this error isn't very noticeable but when the acute angle of the cone is, for example, 45 degrees and a halving of the distance between two stars takes the acute angle to 90 degrees, there is an increase of gravitational force by a factor of just 3.8478.

Here is a short comparison table of the halving of the distance between two stars expressed as the acute angle of the spherical sector or cone (the acute angle directly represents the mass and volume of the spherical sector and in turn the force of gravity):

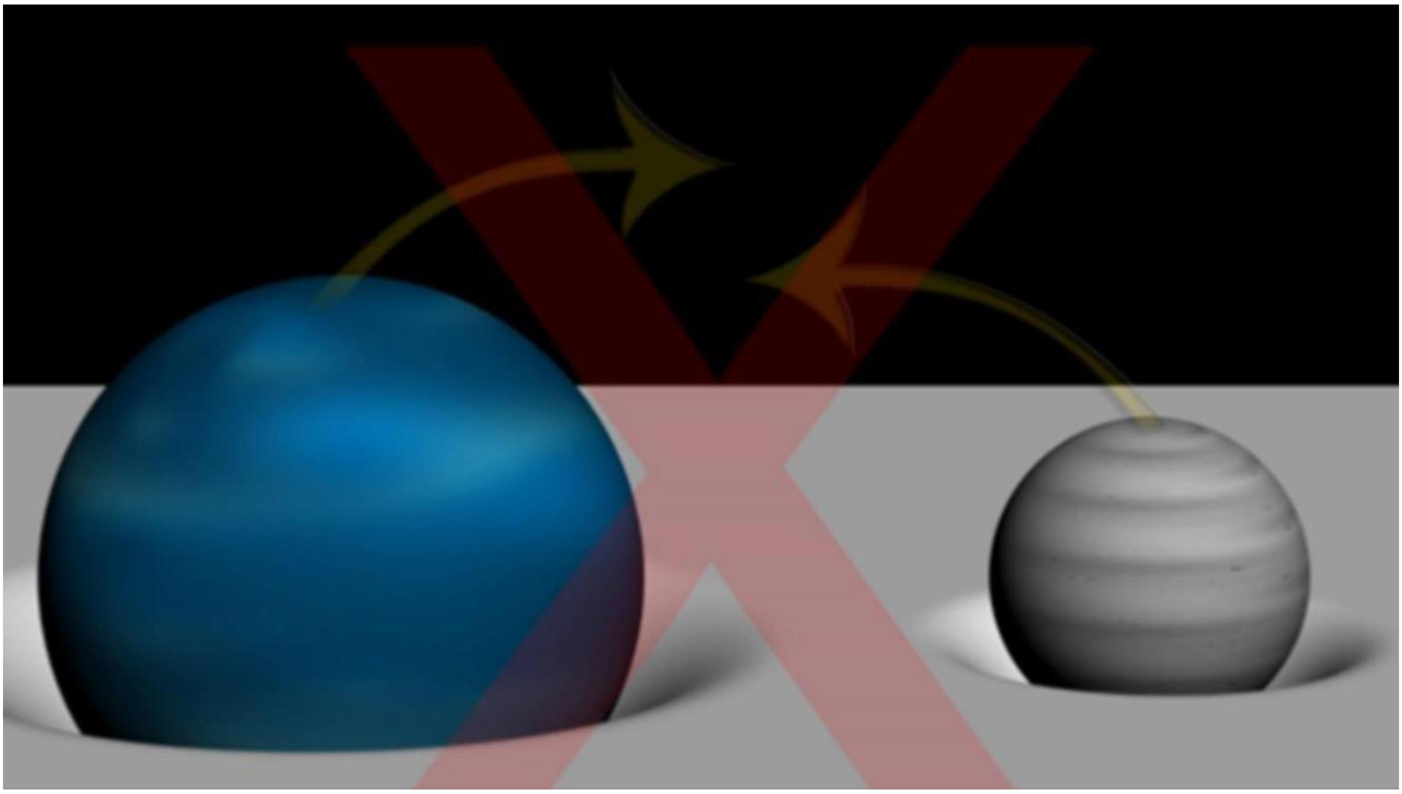
Difference in Acute Angle on Halving Distance	Gravitation Force Increase Factor
5.625 – 11.25 Degrees (Doubled)	3.997590912410325
11.25-22.5 Degrees (Doubled)	3.9903694533443814
22.5-45 Degrees (Doubled)	3.961570560806442
45-90 Degrees (Doubled)	3.847759065022573

The spherical sectors of stars, planets and moons representing gravitational force of another are usually very small in relation to their total mass. Take the Earth and the Moon for example: Just 0.0005% of the Earth's mass is responsible for its gravitational attraction of the Moon and by mutual attraction, just 0.007% of the Moon's mass makes up their respective spherical sectors.
My new formulas do not use the inverse square and so produce accurate results and are not bound by the errors caused by using the inverse square on distance.

General Theory on Relativity

So how does this new theory of gravity fit in with Einstein's General Theory of Relativity? Well, it doesn't. General relativity proposes that the force of gravity doesn't exist and that masses warp spacetime causing masses to fall towards one another. The popular way we visualise Einstein's warped spacetime is in two dimensions. The trampoline analogy seems to be quite popular. The canvas of the trampoline with a cannon ball in the middle causing a dip and causing everything else to fall towards (or under) it. Well this just uses gravity to explain gravity. Further, it is impossible to transpose this two dimensional warpage in to real life three dimensions without losing the gravity to explain gravity. So then we have to invent tensors (gravitational force in disguise). General relativity has stood the test of time due to its predictions (for example, gravitational lensing and gravitational waves) and its field equations. The predictions can be explained classically and the field equations were formulated to fit with observations. Field equations compromised (with the exception of pi) of man made, unnatural units devised with confirmation bias.

Further more, general relativity, when taught, often doesn't take in to account the fact that gravity is a mutual attraction. If we take the Sun and the Earth as an example and the Sun has caused a warpage of spacetime (a dip in the canvas) then General Relativity says that Earth is falling towards (or 'under') the Sun as a consequence of the warpage of spacetime. But by the same theory, the Earth has also caused a warpage in spacetime. The Earth is in its own dip. How can the Earth and the Sun fall in to each other's warpage of spacetime? How can they hop out of their own 'dip' to fall in to the other's?



So why did Einstein propose the concept of spacetime anyway? It originated in General Relativity's older cousin, Special Relativity and was proposed to explain the results of the Michelson-Morley experiments. Einstein sometimes denied any knowledge of these experiments but often cited them as an influence but always maintained that he based Special Relativity upon Maxwell's equations.

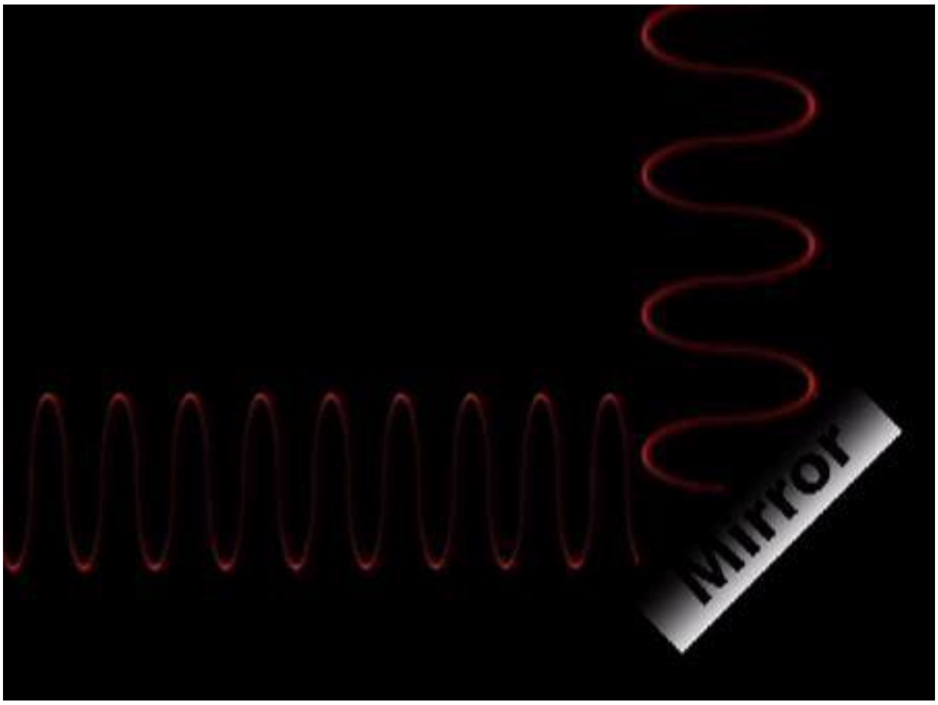
Derived from Maxwell's equations is $c = 1/\sqrt{\varepsilon_0\mu_0}$. But ε_0 and μ_0 were assigned values and units to suit the known speed of light. Further, the equation more suggest that photons are emitted at c and not that photons must travel at c for all observers. Don't be fooled by synthetic proof, discover the evolution of some of these standard constants and units here.

The Michelson-Morley experiments concluded inadvertently that the speed of light was absolute for all observers, even when travelling towards or away from the light source. This left Michelson, Morley, Lorentz, Einstein and just about every other astronomer and physicist scratching their heads.

Einstein's solution was to accept that the speed of light is invariant and propose a concept of spacetime where both space and time are variant in order to accommodate the fact that the speed of light is fixed.

What nobody realised was that the speed of light being invariant was an illusion created by interferometers of the Michelson-Morley experiments. Michelson and Morley were not measuring the speed of the subject light, they were measuring the speed of the reflection emitted by the mirrors of the interferometers.

A mirror (and all matter) will emit light always at c regardless of the speed of the incoming source light. A mirror will absorb all visible light and use that light's energy to send out a replica as a reflection (as per quantum electrodynamics). But a mirror can only replicate frequency (colour) and not wavelength or speed; a mirror can't detect or measure wavelength or speed in order to replicate those properties.



See the illustration above of slow red shifted blue light strike the mirror (left to right), the light is absorbed by the mirror and almost instantaneously, new light is emitted at the same frequency (colour) but at c, thus completing the illusion. See Optical Redshift Explained.