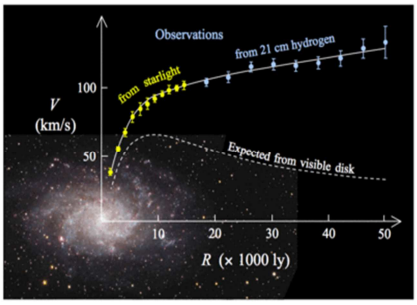
The Spin Linear Mechanism Of Physics

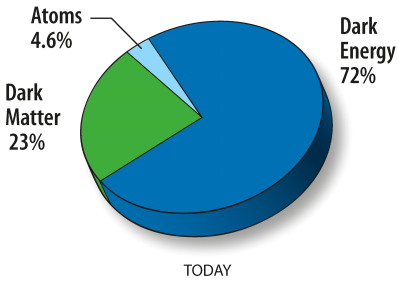
Introduction Paper

A Theory Of Gravity & Matter Proposed By Paul Thurgood

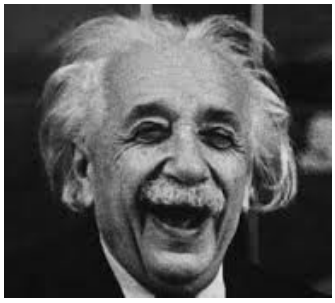
Isaac Newton
(Courtesy of Wikipedia)



Galaxy Rotation Curve
(Courtesy of Stefania.deluca)



Types Of Matter
(Courtesy of NASA/WMAP)



Albert Einstein
(Copyright Ruth Orkin 1955)

The purpose of this paper is to introduce alternative models for the action of gravity and for certain aspects of the nature of matter. The gravity mechanism can be linked to the effects which are currently attributed to Dark Energy and Dark matter. It is also a model that will fit very easily with quantum mechanics.

The mechanism of matter equates Einstein's $E=MC^2$ equation to the kinetic energy equation $E=½\ MV^2$ and in doing so links The "Week Equivalence Principle" to time dilation and length contraction. The mechanism explains why the combined impact speed of light and a moving observer is always the speed of light, regardless of the speed of the observer. It therefore replaces Special Relativity with a logical, intuitive mechanism.

This paper, the first of three and provides the background and introduction for the following two papers.

In a moment we will take a high speed jaunt past a few of the milestones of the history of gravitational physics. Before that though, we are going to take an even quicker look at some of the subjects of research around this area today.

Quantum Gravity is the name for the quest to combine Einstein's theory of gravity, "The General Theory Of Relativity" with Quantum mechanics. Although research in this area started in the 1930's, General Relativity has proved very difficult to quantise and the work is still ongoing today. String theory is one model proposed for quantum gravity. Although this received a lot of initial interest, it appears to have lost ground in recent years due to ongoing hurdles.

Dark Matter is a hypothetical matter that cannot be seen using telescopes but would account for 23% of all of the matter in the universe. It was first proposed in the early 1930s by Jan Oort as the outer stars in the Milky Way galaxy were orbiting faster than Einstein's or Newton's theories predicted. Other physicists believe that Dark Matter may not be the correct explanation and that actually the current theories are wrong. Two well known alternative theories which may partially remove the need for Dark Matter, are MOND (**MO**dified **N**ewtonian **D**ynamics) and TeVeS (**Te**nsor **Ve**ctor **S**calar Gravity). It has also been speculated that a large number of small black holes distributed through galaxies could account for the extra gravitation. No such black holes have been found to date and again this theory seems to be losing ground.

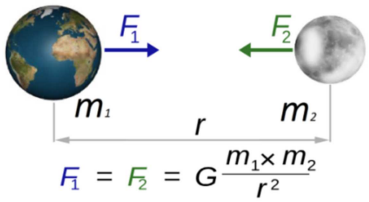
Dark Energy is an energy hypothesized to permeate all of space, tending to accelerate the expansion of the universe. In Einstein's day before the big bang was conceived, the universe was thought to be static, neither expanding nor contracting and that it had probably been like this for ever in the past. In the late 1920's, the light from distant galaxies was found to be shifted to the red end of the spectrum. This meant that the galaxies we viewed in all directions were moving away. The only possible conclusion being that the universe was expanding. Once the expansion was known about, it was thought that it might either continue expanding at an ever decreasing rate, or it might eventually start contracting again. Recently the study of particular Supernovae has shown to much amazement, that the universal expansion is accelerating. For this to happen energy must be put in and so this invisibly energy was named Dark Energy. Dark energy is thought to make up around 72% of the total mass of the universe. This only leaves around 5% for Baryonic matter. This is the stuff all of us and the stars and space dust are made of.

A Very Brief History Of Gravity

Possibly the earliest writings about gravity date back to Aristotle in the 4th century BC. He believed that gravity came from inside objects and directed everything towards the centre of the earth, which was also considered to be the centre of the universe. He also believed that if one object had greater mass than another, it would fall faster. In 1589 Galileo tested this when he famously dropped a large and a small canon ball from the top of the Tower of Pisa. Contrary to Aristotle, they both hit the ground at the same time.

In July 1687 Isaac Newton published three books comprising Philosophiae Naturalis Principia Mathematica. This is widely regarded as the most significant single work ever produced in the history of science.

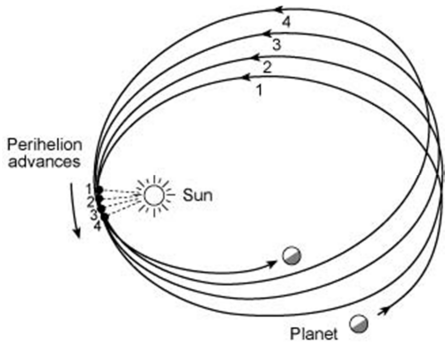
The Principia provided the "Inverse Square Law" equation for the force of gravity as shown. The force diminishes with the square of the distance as it is effectively diluted as the area of the gravitational sphere increases. Newton also introduced the Universal Gravitational Constant 'G' at that time. "G" is the constant 6.674×10^{-11} Nm2/kg2.



The assumption was that the force of gravity travelled at infinite speed and was therefore instantaneous. Newton gave no model for why or how gravity exists, just the mathematics required to predict it's action. It was therefore described as 'Action at a Distance' (which means we don't know why, just how much). In Newton's day the science community expected scientific theories to provide a model to demonstrate why the maths was applicable. The lack of a model was criticised by many of his contemporaries, particularly Leibniz. At around that time a Swiss mathematician, Nicolas Fatio de Duillier who was a very close friend of Newton, came up with a model which was called the 'Shadow Theory'. In his model, tiny gravity particles permeated the whole of space. When two masses (say the sun and a planet) were in close proximity, they would shield each other from the force of the collisions. There would be a net force from the outside pushing the two masses together. A major objection to this, was that in order for the particles to act on the whole of the masses, the particles would need to be able to fully penetrate the masses, but if the particles were able to pass straight through, there would be no shielding effect. What I consider to be a more significant point is that there could equally be an accumulation of particles between the two masses and these would have repulsive rather than attractive affects. Anyway, due to these and other objections, it never caught on.

Despite initial objections from some of Newton's contemporaries, his theory consistently coincided with accurate measurements, and so confidence gradually grew. Over the next 150 years, Newton's law of gravity could do little wrong. In 1846 the French mathematician Urbain Le Verrier using Newton's laws predicted the existence of Neptune to a high degree of precision, due to perturbations observed in the movement of Uranus. Le Verrier contacted the Berlin Observatory who soon announced the discovery. It was a sensational moment for 19th century science and dramatic confirmation of Newton's gravitational theory. In François Arago's apt phrase, Le Verrier had discovered a planet "with the point of his pen". Next Le Verrier focussed his attention on Mercury.

Mercury follows an elliptical path and is the closest planet to the sun. This means that it moves the fastest of all the planets. I should mention here that planets in elliptical orbits move fastest when they are closest to the sun (this location is called the Perihelion of the ellipse) and vice versa. It was already known that the axis of Mercury's ellipse precesses as shown. In 1859, after many years of careful research, Le Verrier presented his paper which concluded that the perihelion was precessing faster than could be explained using Newton's laws by 38 seconds of one minute of one degree every 100 years. It is now known to be 42.9" seconds. The image shows the orbit of Mercury. According to Newton, the orbit should continuously cover the same path, but as can be seen, it is continuously moving forward.



Newton's laws were able to account for 531.6" of the total angle as it was known that the outer planets were able to drag the bulge in the ellipse of Mercury's orbit. One of the ways to explain the remaining angle was to hypothesise the existence of a planet which would lie between Mercury and the Sun. This was a similar fix to the prediction of Neptune to resolve the Uranus anomaly. The proposed planet was named "Vulcan" (one might say a little prematurely) as despite thorough investigation, Vulcan was never found. Another attempt by Asaph Hall (and later by Simon Newcomb) was to change the r^2 in Newton's inverse square law to $r^{2.00000016}$. Whilst this resolved most of the problem with Mercury, it overly predicted the perihelion advance of Venus, Earth and Mars. A large number of physicists of the day, both great and small entered the fray to try to find the solution but all with limited success. The table below shows the total discrepancy of Newton's theory and the improved proposal of Newcomb and the solution from Einstein.

	Mercury	Venus	Earth	Mars
Total observed advance per century	5601".1	5062".9	6185".3	6626".3
Observed advance after removal of general precession	574.7	36.5	1158.9	1599.9
Calculated advance based on Newtonian theory	531.6	28.1	1153.9	1598.5
Discrepancy between observation and Newtonian theory	43.1 ±0.45	8.4 ±4.8	5.0 ±1.2	1.36
Calculated additional advance from general theory of relativity	42.98	8.61	3.84	1.35
Newcomb's attempted correction for perihelion advance	43.37	16.98	10.45	5.55

Perihelia Advances of the Inner Planets:
A "Current" Comparison of Theory and Observation

Between 1861 & 1862 James Clerk Maxwell introduced his theory of Electromagnetism. Until that time electromagnetic theory was based upon 'action at a distance' ie the same as Newton's theory of gravity, however Maxwell's new theory was a field theory where the electromagnetic action propagated at the speed of light. The introduction of a finite speed would now be pursued for gravity.

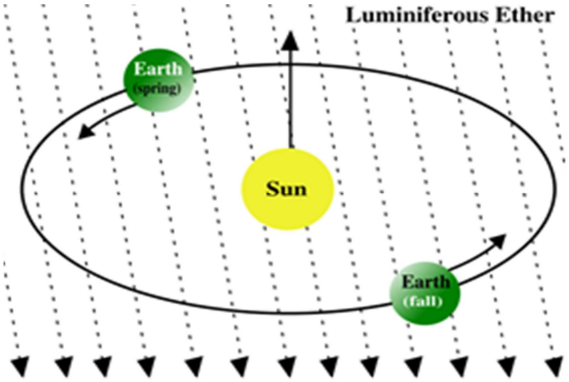
In 1898 Paul Gerber, a German school teacher published a paper which introduced an equation with a velocity

dependant potential which accurately predicted the perihelion advance observed for Mercury. As the Perihelion advance angle was already known, he used his new equation to work out the velocity of the gravitational field which he achieved to a high degree of accuracy. His equation was also Identical to the one that Einstein would provide 17 years later. This caused controversy later for Einstein with accusations of plagiarism which he denied. Einstein pointed out that Gerber hadn't properly derived his equation and that his theory was incomplete. Gerber's gravity also failed to correctly predict the bending of light by gravity.

To look at the next stage in the development of gravitational physics we initially need to side track a little:

In 1887, far away from the world of Gravity research, Albert Michelson and Edward Morley set up an accurate experiment to measure the change in the speed of light as the earth passes through the Aether. This was one of the most significant experiments in the history of physics.

The Aether is a hypothesised medium which was thought to transmit light in a similar way that sound is transmitted through air and other gases and medium.



(Image Courtesy of Creative Commons)

Their experiment is sometimes described as the greatest experimental failure ever as despite the huge effort to perfect the apparatus, it indicated approximately one sixth of the predicted result. This small reading is now attributed to experimental error.
The experiment has been repeated several times but always with similar results. This is a very famous experiment which has been named in almost every book ever written about gravitational physics (and Special Relativity). However, two other similar types of experiment are the Sagnac Experiment and the Michelson Gale Experiment but these are scarcely ever mentioned. In contrast to the Michelson Morley experiment, they both showed the earth's rotational velocity through an Aether with a high level of accuracy. The Sagnac effect is commonly used in aeroplane guidance systems and other similar applications today.

Length contraction which was originally called the Lorentz-Fitzgerald contraction is the prediction that matter is foreshortened in the direction of movement. This effect has since been incorporated into Einstein's Special theory of Relativity. The length contraction that should occur with the forward limb of the Michelson Morley apparatus would exactly account for the apparent failure of the experiment to detect the aether. So by simply applying the rules of Special Relativity, and including length contraction, the experiment could not claim to have proven the non-existence of the Aether. Length contraction would also occur with the Sagnac experiment and the Michelson Gale experiment, however with these experiments, the two light beams take the same route but in opposing directions, so the length correction cancels out. Nevertheless it is now commonly taught that the Aether has been proven not to exist.

As length contraction could be described as conspiring with light, to hide our movement through the Aether, a website has been set up by Doug Marett which is called "The Conspiracy Of Light". It is an excellent website with many articles about this area of physics and it uncovers the lost truth of these various experiments.

In 1905 Albert Einstein published his Special Theory of Relativity (SR) which was a theory in which the concept of the Aether was no longer required. Einstein's two main postulates for Special Relativity were:

1. The laws of physics are identical in all inertial systems and
2. The speed of light in a vacuum is the same for all observers, regardless of the motion of the light source.

It might sound harsh to say it but this was sadly the point where rational thought in this area of physics had to be abandoned. One of the most significant implications of Special Relativity was that if you run towards a light beam at 100 km per second (km/s) and that light beam is travelling towards you at 300000 km/s, you might reasonably expect the combined speed to be 300100 km/s. But no, in SR the combined speed is 300000 km/s. In fact however fast you travel towards or away from the light beam, the combined speed is always 300000 km/s. For anyone who is comfortable with this conclusion, you shouldn't be, it is totally counter intuitive. When I say counter intuitive, what I actually mean is it is not physically possible. For the combined speed to remain the same, the speed of the photon would have to change to accommodate the speed of the person running towards it. Special Relativity proposes that the distance between the runner and photon would actually change. But how could the expanse of space change to suit some distant moving observer and supposing 2 runners were running towards the same photon, could it accommodate both runners at the same time ? What bigger elephant could ever exist in any scientific room.

The speed of sound through air at sea level is approximately 340 m/s. This is because the molecules of air are travelling at this speed, bouncing into one another and therefore any vibration signal passes through the fluid at this speed. The speed changes as the temperature and density of the air change and so it is a very logical concept. Whilst we know how fast light travels, without an Aether or any other matrix in the Universe, why should light travel at a fixed speed ? Einstein stated that the speed was fixed but didn't give a reason why.
From Special Relativity Einstein derived his now iconic equation $E=MC^2$. In addition SR predicts length contraction, time dilation and mass dilation for anything travelling at speed. These three predictions were absorbed into SR however they were originally conceived by Hendrik Lorentz and George Fitzgerald. For Lorentz, length contraction refers to moving objects whereas Einstein has changed this to include space between moving objects.

Whilst many experiments have been carried out which measure the 2 way speed of light (a light signal leaving a source and returning to it in a given time), the one way speed of light in a moving reference frame has never been carried out due to complications of synchronisation. So we don't actually know that light doesn't speed up in one direction and slowdown in the other.

In SR there is no preferred reference frame in the universe. Peter could not claim to be stationary whilst telling Paul he is moving. No one could say who was stationary and who wasn't. This idea is now known to be wrong. We now know of the cosmic microwave background (CMB) which makes it completely clear who is moving and how fast. Many Physicist are currently mapping out the visible universe and deciding how fast each bit is moving. This part or SR is no longer valid. The measured effects of Special Relativity may well result from another mechanism other than SR which I will describe later on.

To further Special Relativity, Einstein started to investigate the implications of acceleration on a reference frame. This led him to what is now referred to as Einstein's Equivalence Principle. He demonstrated this with a thought experiment in which a person in a rising accelerating box in zero gravity would not be able to distinguish the force upon them from someone in a static box in an equal gravitational field. This demonstrated that there is an equivalence between the effect of gravity and the effect of acceleration. They are equivalent but they are not the same. This led Einstein onto the next stage which was to incorporate his Special Theory of Relativity into gravity theory. At a certain point in his work, Einstein's friend Marcel Grossmann (who became a Professor of Mathematics at the Federal Polytechnic Institute in Zurich) pointed Einstein towards the mathematics of non-Euclidean geometry called Riemannian geometry. This enabled him to develop his new gravity theory based on spacetime curvature, which would accord with this type of geometry.

In 1915 Einstein introduced his new theory of Gravity to the world. It was called "The General Theory of Relativity", (GR). This correctly predicted the perihelion advance of Mercury and also predicted the bending of light around the sun. Einstein wasn't the first person to propose that light might be deflected by gravity. In Newton's 1704 treatise on "Opticks " he said: "Do not bodies act upon light at a distance and by their action bend it's Rays and is not this action strongest at the least distance ? " In 1784 Henry Cavendish and later in 1801 Johann Georg von Soldner calculated the curvature of light based upon Newton's principles on the basis of a particle of light travelling at their estimated speed of light. The equation of deflection (in radians) that they derived and the one Einstein derived were:

Newton Angle = $2GM/C^2R$

Einstein's Angle = $4GM/C^2R$.

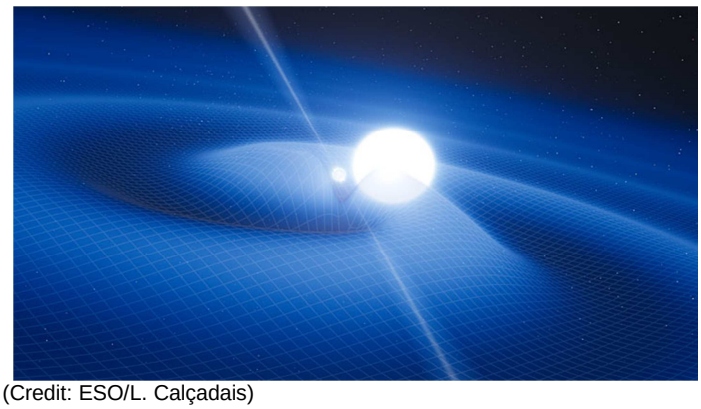
The reason provided for Einstein's equation giving twice the deflection of Newton's, was the additional contribution of Space time curvature. I should mention that when Einstein originally proposed the deflection of light by his gravity theory, he also arrived at the same deflection as Cavendish and Soldner. Adding in spacetime curvature was the reason for him amending his equation thereby doubling the prediction.

The correct prediction for the orbit of Mercury and the bending of light passing the sun are described as the first two classical tests of GR. It is often stated that GR predicts a gravitational change in the frequency of light and this is frequently referred to as the third test of GR. This is not the case. Gravitational Redshift (frequency reduction of light as it moves away from a massive object)) is a consequence of the $E=MC^2$ equation. This is equated to the energy of a photon which is ***h.v***, where ***h*** is Plank's Constant and ***v*** is its frequency. No part of GR is required for this calculation.

The fourth classical test of GR is called the Shapiro time delay. This is the delay of a radar beam passing close to a massive object and being delayed by the longer bent path it would take because of the gravitational field. Whilst the Shapiro time delay is a different experimental test to light deflection, it is testing that same thing.

The two major changes predicted by General Relativity which contrast it with Newton Gravity are therefore the doubling of light deflection by gravity and the perihelion advance of the inner planets, particularly that of Mercury.

In 1919 Arthur Eddington and his collaborators went to Principe, an island off the coast of West Africa to take simultaneous observations of star locations during a solar eclipse. They found the deflection of light to coincide accurately with GR and Einstein rose to a celebrity status overnight.



(Credit: ESO/L. Calçadais)

In GR, spacetime is believed to be curved and a gravitating mass tries to follow the Geodesics of curved spacetime. The image above is an artist's representation of curved spacetime. We see Einstein's **$E = MC^2$** Equation almost everywhere we go these days but the one below was the one he regarded as his greater achievement. It equates mass and energy on the right with the curvature of space on the left.

$$G_{\alpha\beta} = \frac{8\pi G}{c^4} T_{\alpha\beta}$$

The late John Wheeler, (an eminent American theoretical physicist) famously said: "Spacetime tells matter how to move; matter tells spacetime how to curve". Although it is often written the other way around. The reality is though, that it is probably not matter but the gravity associated with it, that curves space time. But whether we use the word 'matter' or the word 'gravity', the same problem exists. How can gravity make curved spacetime make gravity, make curved spacetime etc ? It is circular reasoning and makes no sense. What does it mean to say that matter curves spacetime ? We now know that time runs slower near to a massive object and faster when further away. Highly accurate atomic clocks have been placed at the top of

mountains where gravity is slightly weaker and compared to clocks at sea level. The clocks that have been located at high altitude have run more quickly and gained time over their sea level counterparts. We could easily create a 3 dimensional map with time contour lines showing the differing rates of time movement, but is this the curved spacetime that creates gravity.

If there is to be acceleration, there has to be a force, it is difficult to intuitively equate spacetime curvature to the accelerating force required.

GR is often criticised for being extremely complicated to understand. Leonard Susskind who is the Felix Bloch professor of Theoretical physics at Stanford University said: "few people I know can work with the equations of General Relativity as there is no mechanical visualisation".

As the equations of GR can be very complex, when Einstein was formulating the equation for the advance of the perihelion of Mercury, he resorted to a form of "Post Newtonian Expansion" calculation rather than using full GR. In 1922 Arthur Eddington produced the first "Parameterised Post-Newtonian (PPN) approximations. These equations were extended by Dr Ken Nordvedt in 1968-69 and further by Professor Clifford Will in 1972. These equations provide the same results to those given by GR for most studies to date. They extend Newton's inverse square law to incorporate the finite speed of gravity and the additional effect of relativistic mass and are much simpler to work with than full GR.

The equation below is a version of the PPN equation. The overall effect of velocity in the PPN equation (and therefore in GR) is to reduce the force/acceleration of gravity compared to Newtonian gravity. You cannot express GR in Newtonian language as Newton predicts a force whereas GR predicts movement in the geodesics of curved spacetime. Nevertheless, in loose terms the V^2 term is analogous to the relativistic mass increase of spacetime curvature in GR.

$$\text{Acceleration} = -\frac{GM}{r^2}\vec{n} - \frac{GM}{C^2 r^2}\left\{\left(V^2 - \frac{4GM}{r}\right)\vec{n} - 4\dot{r}\vec{v}\right\} + 0\left(C^{-4}\right)$$

The other components of the PPN equation reduce the overall force/acceleration due to Special Relativistic length contraction and time dilation corrections. The overall effect of the velocity corrections in this PPN equation is to reduce the force/acceleration when compared to Newtonian gravity. The scale of the reduction gets greater, with greater speed. Where two gravitating bodies are completely stationary, General Relativity is identical to Newton gravity.

In "The Feynman Lecture on the Theory of Gravitation" in 1961, Feynman said "So the great laws of mechanics are quantitative mathematical laws for which no machinery is available. Why can we use mathematics to describe nature without any machinery behind it ? Nobody knows, but we just have to keep going, we find out more if we keep going, so we just keep going".

I can only assume from this, that Feynman struggled to see spacetime curvature as the mechanism of gravity. The reality is that modern physicists, in total contrast to 19th century physicists, are generally focussed solely on mathematical models and are seldom interested in the actual mechanisms involved.

Criticisms Of General Relativity

General Relativity predicts the action of gravity with extreme accuracy but is curved spacetime the true mechanism, or does curved spacetime simply follow the shape of the gravitational field and appear to be the mechanism ?

General Relativity predicts infinite space time curvature for black holes. This leads to infinite gravity which is not physically possible. Predicting the impossible would normally be a bit of a show stopper for any scientific theory but as GR has performed so well in other ways, this failing is generally ignored.

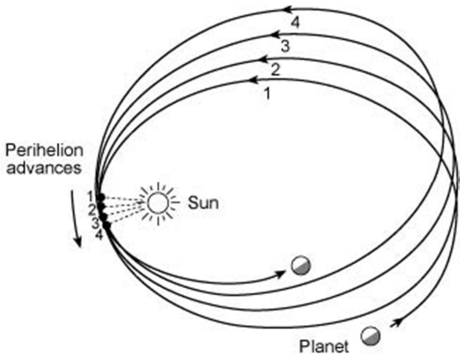
Although GR/SR do not attribute mass to light, they do attribute gravity as photons have energy. If photon are gravitating objects then when huge distances across the universe, they should clumping together and yet this phenomena has never been seen to occur.

General Relativity predicts cosmological redshift due to the expanding Universe. This fails when considering Quasars as they would need to be traveling at 4 times the speed of light to Redshift as much as they do.

If we fail to find Dark Matter in the next few years, this will be a huge failing for GR. Whilst GR is able to get fabulous precision in sometimes obscure areas of gravity, underestimating the force of gravity on galactic scales by several factors, would surely ring alarm bells for even it's most ardent supporters.

Returning To Mercury

Before we leave the introduction paper, I want to return to the Perihelion precession of Mercury and discuss why this occurs. If we ignore the outer planet we know that in Newtonian gravity, no perihelion advance is predicted but in GR it is. GR predicts a slight reduction in gravitational force, with velocity. In Newton gravity, velocity has no effect on the force. If we consider the image below, and we were to add a little extra gravitational force to Mercury when it is closest to the sun, we should pull it in on its orbit and cause the precession to occur. This is similar to the effect of introducing Vulcan. It also aligns with Gerber's velocity increased potential and with Asaph Hall and Newcomb's modification of R^2. GR predicts the exact opposite and yet still obtains the correct precession equation.



I mention this because if General Relativity is later found not to be the true nature of gravity, it's replacement could well be a model in which force increases with velocity whereas GR predicts a force reduction with velocity.