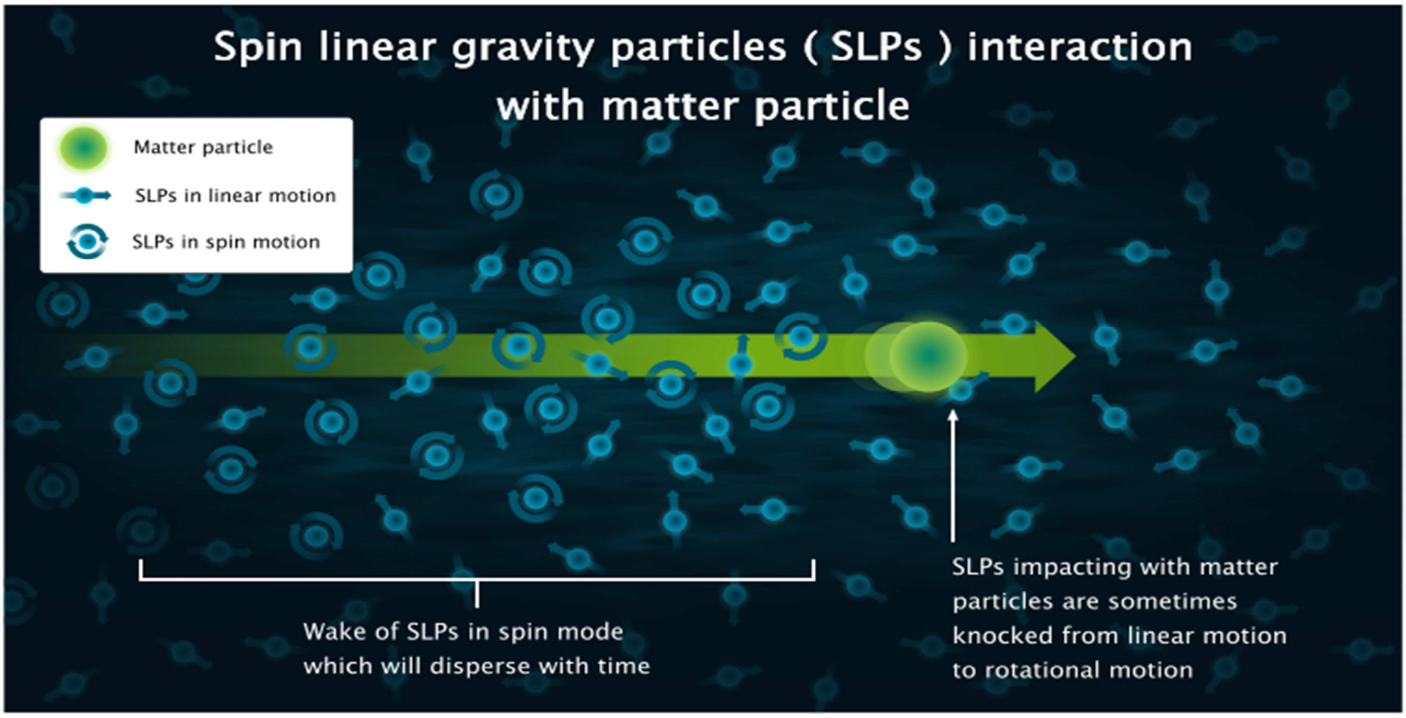
The Spin Linear Mechanism Of Gravity

A New Theory Of Gravity Presented By Paul Thurgood



Abstract
The Spin Linear Mechanism of Gravity is an intuitive model in which the force of gravity generally accords with Newton's inverse square law. Due to certain properties, the force of gravity will increase very slightly with velocity. This velocity dependant potential will allow it to predict the precession of the axes of elliptical orbits including that of Mercury. Due to the nature of the model, the force of gravity becomes much greater for very non-dense matter such as Interstellar hot gas in galaxies. This substantially reduces the need for Dark Matter. In addition, because Dark Matter is itself, very non-dense matter, the gravitational effect of Dark Matter is much greater than for general stellar matter. So the model can preclude the need for DM in certain situations and substantially reduce the quantity required in others. Where the density of matter drops below a critical level in inter-galactic space, the action of the SLP gravity particles becomes repulsive rather than attractive and so by adjusting the free parameters of the model, it can give an intuitive mechanism for the accelerating expansion of the Universe.

Introduction
Newton's theory of Gravity was effectively overtaken by Einstein's in 1915 when he introduced his new theory of gravity to the world, The General theory of Relativity. This was able to provide a mathematical explanation for the precession of Mercury's perihelion. Predicting the precession of Mercury came to be known as one of the 4 classical tests of General Relativity.

The other 3 classical tests were the bending of light by the sun, gravitational redshift and the Shapiro time delay. The Shapiro time delay is the delay of a radar beam passing the sun caused by the beam being curved by gravity. The curved path being longer than a straight path causes the delay. Whilst this is a different test to the curvature of light, it is effectively testing the same thing. Gravitational Redshift was also described as a classical test of GR but is generally no longer included as a test, as no part of GR is needed to predict it. So the 4 classic tests reduce down to two phenomena: The precession of elliptical orbits and the curvature of light by gravity. Newton gravity also predicted the curvature of light, but his equations only predicted half of the observed value.

The Spin Linear Model Of Gravity
The basic premise of the Spin Linear mechanism of gravity is that the gravitational field throughout space, is made up of very tiny gravity particles. These permeate in all directions and either travel in straight lines, or, occasionally during impact with matter particles, convert all of their linear motion into spinning motion. As they either move linearly, or in spin, we have called them Spin Linear Particles (SLPs). They are deflected or repelled by impacts with each other and impacts with matter particles. SLPs are extremely small compared to baryonic matter particles and normally pass through the voids in general matter. Whether in linear or spin motion, they always travel at the speed of light. Like light, they are long range particles. Like light they exert inertial force when they impact with matter particles and like light, the combined velocity of SLPs relative to matter, is always the speed of light upon impact regardless of the speed of moving matter. (See explanation provided in the "Mechanism Of Matter" paper.)

Every so often SLPs make contact with matter particles at just the right angle and instead of being deflected or repelled, all of their linear velocity is converted/knocked into angular velocity. They go into spin mode and remain in the approximate location in space of the impact. Not completely stationary, but bouncing around in a similar way to molecules in a gas. There is a net flow of SLPs towards all matter and there is a resultant gravity pressure force which is the attractive force of gravity. Gravity is an exceptionally week force and so the proportion of these particles that would need to be converted from linear to spin motion would be tiny. To emphasise how week gravity is compared to the electromagnetic force, if two electrons were sitting side by side, the repulsive electromagnetic force would be 417×10^{42} times stronger than the gravitational attractive force.

The result of SLP interactions with matter, is that in all areas of space where matter exists, or where matter has been, there will a build-up of SLPs in spin mode. As a great deal of all matter in the universe is moving, the matter, whether it is in the form of a star, a planet or a lonely atom, will leave SLPs behind in spin mode, as a wake in the SLP gravitational field.

The quantity / density of spin SLPs sharing the same space as baryonic matter will be in proportion to the density of the baryonic matter as the conversion of SLPs to spin mode is intrinsically linked to the quantity of matter/mass.

These SLPs will remain in spin, but not forever. Whilst impacts between 2 linear SLPs cannot send them into spin mode, when SLPs that are already in spin mode, impact with linear SLPs, they will every so often be knocked back into linear mode. This will happen on a consistent (linear relationship) basis whether in very dense matter or very non dense matter. Although the density of baryonic matter varies greatly throughout the universe, the density of the linear moving SLP field is homogeneous and so the frequency of impacts of linear SLPs with spin SLP, will be fairly consistent regardless of the density of the baryonic matter.

SLPs in spin, impacting with others also in spin, will also get knocked back into linear mode every so often. This reversion relationship is not however linear for dense and non dense matter. This is because the frequency of impacts will be a second order relationship. If you double the density of the matter (and therefore the density of the spin SLPs present), you will quadruple the frequency of these double spin SLP collisions. This is analogous to molecule impacts in a gas. The reason for this is that if you double the number of vibrating particles, each particle will have double the number of collisions so double the number of particles each having double the number of collisions equates to 4 times as many collisions in total.

This two mode reversion rate is a significant point as SLPs will be released from spin much more quickly for dense matter, ie stellar / planetary matter, compared to very non dense interstellar medium. This is important to the Dark Matter issue as we will discuss later. It means that in dense matter, there will be a weakening of the field due to a higher reversion rate and so gravity will be much stronger for interstellar gas than it is for stellar matter.

It shouldn't be difficult to visualise SLPs reverting from spin mode to linear mode. For anyone who has watched or played with spinning tops, they will have seen two spinning tops collide and both tops fly off linearly. Although it is a much rarer event, they might have even seen a linear moving spinning top impact with a spinning one and both shoot off linearly.

A wake of Spin mode SLPs is continuously being formed and continuously dispersing but with a time delay between the two events. SLPs are not generally knocked from spin mode back into linear mode when they contact with matter, if they were, the model would be flawed.

The net flow of SLPs towards all matter and the resultant force is directly proportional to the magnitude of the masses considered (ie the more mass, the more impacts and the more conversions to spin). It is inversely proportional to the square of the distance between masses (as explained in the introduction paper, because as the area of the gravitational sphere expands, it effectively dilutes the field effect in proportion to the area).
Where matter is at rest relative to the gravitational field, there will be a buildup of SLPs in spin mode in that area. These will be dispersing and some form of equilibrium may be reached. They will diminish the local gravity field over time. The more static the matter, the lower the force of the field. There is therefore a tiny relationship between the field strength and the velocity of the gravitating matter through it.

Newton's Universal Gravitational Constant "G" is not therefore an absolute constant in the SLP model. The more static the matter is relative to the isotropic gravity field, the lower the value of G. The faster the movement of the matter relative to the isotropic gravity field, the higher the value of G. We now have an anisotropic G in an isotropic gravity field.

The maximum "G" for a given local matter density would therefore exist where the gravitational matter is hypothetically travelling at the speed of light. The weaker "G" would be where the matter is totally stationary relative to the field and it would weaken more as the stationary time increases. (We will call the version of 'G' where the matter has just become stationary: G_0). The effective G (G_eff) would need to be calculated for each situation by taking the minimum G_0 and adding back in the speed of the two gravitating bodies through the local gravitational field. The equation for G_eff will take a form similar to the equation below.

$$G\_eff = G_0\left(1 + \frac{\text{Function. } V^2}{C^2}\right) + \text{Low space Density Factor}$$

Tiny Correction in order of 10^{-6} to 10^{-9}

Huge Correction in order of 5-10

We will side track for a moment to consider how we know the value of G. It has been measured many times but the first time was by Henry Cavendish in 1787-1798. His famous experiment measured the attraction of two masses in a laboratory. It was an ingenious experiment and there are many articles and videos explaining it on the internet. His figure for G varies with the accepted figure today by only 1%.

A recent paper by J D Anderson et al, states " The official value of *G* is 6.673889×10^{-11}N·(m/kg)2, but the 13 measurement values analysed in this study range from approximately $6.672.10^{-11}$ N·(m/kg)2 to 6.675×10^{-11} N·(m/kg)2, which is a percentage variation of about 10^{-4}." Our velocity effect on G would be lost within these variations but would still result in the perihelion precession of Mercury.

The force equation in the SLP model changes slightly and so if we are considering the Sun and Earth for example it would be:

$$Force = \frac{G_s.M_s \times G_e.M_e}{R^2}$$

We believe that we know the mass of the planets in the solar system, etc to a high degree of accuracy based upon the value of G measured on the earth and their rotational velocities. But what we actually know is the Mass x G to a high level of accuracy and so it is possible that the mass of each planet is a very slightly different than is currently thought.

The rotational velocity of the earth is not added to the overall velocity as the rotation is not leaving the spinning SLPs behind, it is just spinning within the wake. There is a term called the low space density factor that we touched on earlier. This makes G larger for low density matter.

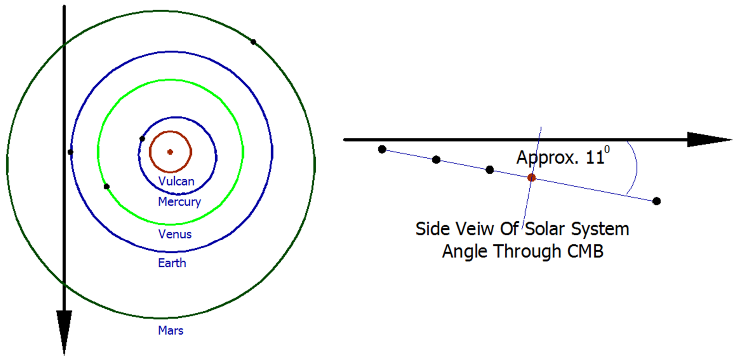
In the equations of GR and the PPN approximation, the overall force of gravity decreases with velocity. In the SLP model, the force of gravity increases with velocity.

In the paper, "The Cause Of The Precession Of Mercury And Of Elliptical Orbits" we have shown that the precession of elliptical orbits can be caused by a gravitational potential that increases with velocity. We have also shown that rate of elliptical precessions may accord much more closely with the ratio of force increase at the perihelion Vs the increase at the aphelion when compared to Newton gravity, rather than simply the magnitude of the force change.

Whilst the velocity related change in gravitational potential in General Relativity refers to the relative velocity between the gravitating masses, In the SLP model the velocity must be relative to the isotropic gravity field. Whilst we know the approximate velocity and angle of the solar system through Cosmic Microwave Background (CMB), we don't know whether the SLP gravity field is stationary relative to the CMB. If the gravity field is static relative to the CMB then our movement through both would have the same magnitude and the same direction. In the diagram, the Earth and other planets are shown in the location of their respective perihelia.

The arrow shows the direction of movement of the solar system through the CMB. The Earth is moving directly forward through the CMB when it is at it's perihelion and this occurs at around the 2nd of January each year. As Mercury's and Venus' perihelia are offset almost equally in their angles from the Earth's, this velocity direction would work well for Mercury, the Earth and for Venus. It would not work well though for Mars where the perihelion is aligned at a very different angle.

The Direction Of The Solar System Through The CMB



It is already possible to detect our velocity of movement through the CMB and perhaps before long technology will advance so that we can detect our velocity through an isotropic Spin Linear Particles gravity field. However at this stage we simply don't know what our velocity is relative to the field and so for the moment we will have to follow the lead of GR and assume planetary velocities are relative to the Sun.

The velocity effects discussed above are substantially local effects on G and are very small. If we consider the gravitational field across the huge distance of a galaxy, the velocity effect on G is of no significance.

So far then, the model produces the force of gravity in accordance with the product of the masses considered, divided by the square of the distance between them. In addition, G_eff replaces G. In low density space, G_eff will increase and in situations where the gravitating masses are moving, G will increase by a tiny amount. In the SLP model, there are free parameters. The size and abundance of SLPs, the rate of their conversion to spin mode and their reversion to linear mode can be chosen to suit the empirical data.

When introducing the SLP model we stated that SLPs knocked from linear motion to spin motion during impacts would be left behind moving matter in a wake. We also stated that spin SLPs in the wake will revert to linear mode over time. When these reversions occur, reverted linear SLPs will dissipate in all directions travelling at the speed of light. There will therefore be a larger number of impacts arising from the rear of any moving object than from the front so there will be an impulse inclined to accelerate the object.

Whilst Linear SLPs behave in a substantially Relativistic way, Spin SLPs despite their intrinsic velocity of C behave much more like molecules moving around slowly in a gas, impacting with one another and causing drag.

Now we can add the final dimension to the model. A proportion of SLPs knocked into spin mode will not be left in the object's wake as described previously. They will also impact with the baryonic particles forming any moving object as that object moves through space and so they will end up being shunted along with the object. So a portion of the spin SLPs will be left behind as a wake and a portion will become entrained with the object.

Entraining these spin SLPs will have a drag effect on the object during the process of accelerating them. This drag will incline the object to decelerate. In order for stars, planets and lonely atoms to pass through space unimpeded, this decelerating force must be exactly equal to the accelerating force of SLPs in the object's wake that are reverting to linear motion.

Dark Matter

Dark Matter has been hypothesised to exist because there is effectively too much gravitational force observed in galaxies relative to the amount of gravitational mass available to generate the force. Adding Dark Matter (DM) substantially solves the problem without changing the existing theories. Whilst Newton gravity had tiny velocity related inaccuracies on local scales, it had been assumed that on galactic scales, it was still almost perfect. If Newton's gravity is incorrect on a Galactic scale then so of course is General Relativity.

MOND theory may explain away a large part of the problem, but there are areas where the modified equations fail and some form of dark matter, is required to supplement it. MOND theory effectively changes the R^2 part of Newton's inverse square law to just R where the gravitational acceleration drops below 10^{-8}cm/s^2. We have already discussed the logical reason for the R^2 term, and so it would be good if the modification could be justified via an intuitive model. Whilst it appears that the majority of physicist prefer DM to MOND, there are also a lot who consider that a combination of DM and MOND will eventually prevail. The benefit of combining the theories is that the amount of DM that would be required would be greatly reduced.

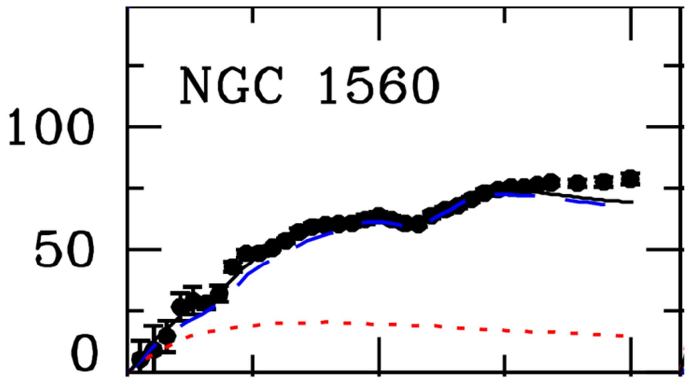
There are a variety or Dark Matter Particles hypothesised. The leading candidate was and perhaps might still be the WIMP. **W**eekly **I**nteracting **M**assive **P**article. This would be a slow moving particle and would therefore fit into the Cold Dark Matter category. Importantly the WIMP would accord with the Standard Model of Particle Physics. There are a number or ongoing research experiments around the world looking for the WIMP. The most precise of these is the LUX experiment which operates beneath a mile of rock at Sanford, South Dakota in the US. In July 2016 after a 20 month run, the LUX team announced that it had failed to find any trace of Dark Matter / WIMPs so far.

Returning now to the Spin Linear Particle of gravity. As we know very accurately how gravity works in the proximity of stars, but could it be that Gravity acts differently for the areas of very low density matter, between the stars, as suggested previously. This matter is called the Inter Stellar Medium (ISM) and is made up of a mixture of dust and gases.

The density of the constituents of the ISM vary significantly. We think of air as fairly non-dense matter with a density of around 0.0011g/cm^3 , however interstellar dust molecules can have a density of around 1.0×10^{-16} g/cm^3 and ISM gas can have a density as low as 1.0×10^{-26} g/cm^3. A tiny difference in the rate of dispersal of SLPs relative to matter density, could easily account for G being increased by a factor of 5-10 times. As mentioned, there are two types of impacts with spin SLPs that would return them to linear mode (and therefore reduce the local G and the field strength). Impacts between 2 spinning SLPs which would occur on a sliding scale with density, analogous to molecular impacts. And impacts between linear and spinning SLPs which would not be on a sliding scale and would be consistent regardless of the density.

Neutral Hydrogen (HI) is one of the most abundant elements of the ISM followed by Helium. It is possible to quantify HI distribution as it emits radiation at a wavelength of 21cm. The mass distribution has been analysed for a number of galaxies and compared to the predicted mass distribution of Dark Matter. It turns out that HI is generally distributed in the right places to replace dark matter but that the magnitude is wrong. For HI to be the solution to the galactic rotation curves, there would need to be an amplitude factor, ie a lot more of it would be needed or G would need to be bigger for this ultra-low density matter. The amplitude factors found by Professors Hoekstra, Van Albada and Sancisi in their 2001 paper, were typically around 7 after corrections for Primordial Helium. There were however a few with scaling factors as high as 20.

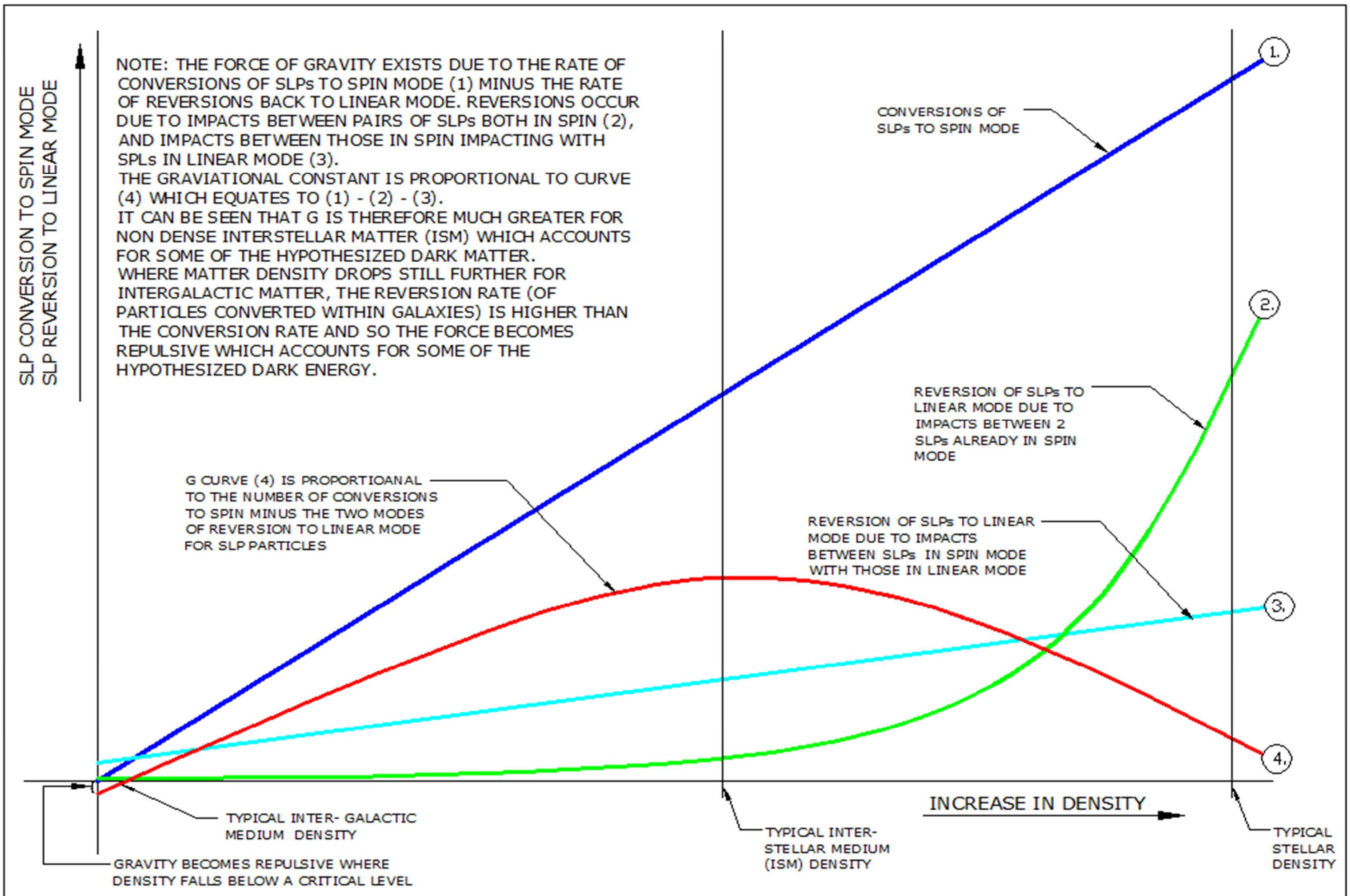
In the graph taken from their 2001 paper (with thanks), the dots represent the published rotation curve for galaxy NGC 1560 and the solid black line indicates the model including the scaled Hydrogen. As can be seen there is a pretty good correlation for the inner part of the curve but the two divide at the outer regions. Their paper concludes that due to this and other inconsistencies, "it is not possible to establish a definite connection between the scaling factor of HI and the Dark Matter".



(Credit: Professors Hoekstra, Van Albada and Sancisi 2001)

Whilst the 2001 study attempted to find a single scaling factor for HI in each particular galaxy, the SLP model would suggest that the scaling factor will vary inversely with a function of density and so to look for this correlation, this variable G would need to be considered for each ISM constituent by their density and by their abundance.

It might be that the modified G alone could then provide correct rotation curves without any supplementary Dark Matter, or it could be that some dark matter is still required. In the graph below we have shown how the conversion and reversion of SLPs might vary for different densities of baryonic matter through space and how this would affect the gravitational field strength. The graph is not to scale but simply an indication of how the two reversion factors for the SLP model would affect gravitation through space.



VARIATIONS IN NEWTONS GRAVITATIONAL CONSTANT Vs DENSITY

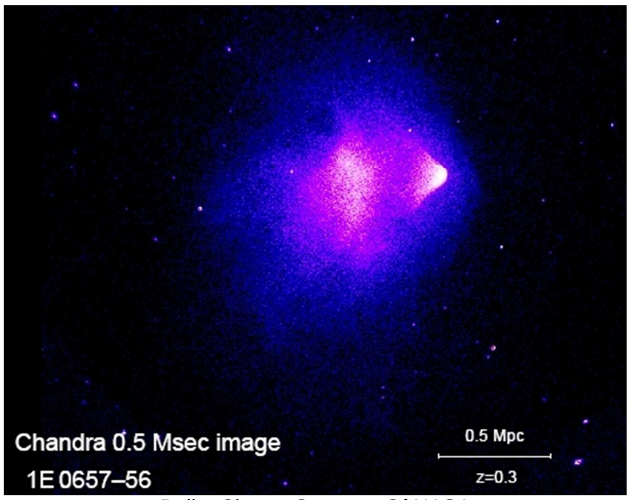
An international team of astronomers, including Dr Hongsheng Zhao from the SUPA Centre of Gravity, University of St Andrewsour School, has reported in the journal Nature an unexpected link between mysterious 'dark matter' and the visible stars and gas in galaxies. This could revolutionise our current understanding of gravity.
Dr. Benoit Famaey (Universities of Bonn and Strasbourg) explains: "The dark matter seems to 'know' how the visible matter is distributed. They seem to conspire with each other such that the gravity of the visible matter at the characteristic radius of the dark halo is always the same."
Of course if dark matter is simply baryonic matter in which gravity is scaled up, you would expect the two to coincide.

Whilst the evidence of dark matter originally hinged on observation of galactic rotation curves, the advancement of gravitational lensing techniques has allowed direct observations of the force of gravity by the way it bends light approaching the earth. One of the most exciting observations using this technique has been that of "the bullet cluster" (1E 0657-558).

The bullet cluster consists of two colliding clusters of galaxies. The name Bullet Cluster refers to the smaller sub-cluster, moving away from the larger one.

The white areas are the stars, the blue is the hot gas and the red is the dark matter or inflated gravitational area.

Gravitational lensing studies of the Bullet Cluster are claimed to provide the best evidence to date for the existence of dark matter.



Bullet Cluster Courtesy Of NASA

What the bullet cluster appears to show is the stars of the two impacting clusters passing straight through the collision but leaving the galactic hot gas behind. In theories without dark matter, such as Modified Newtonian Dynamics (MOND), the lensing would be expected to follow the baryonic matter; i.e. the hot gas. So what is claimed is that the dark matter has passed through with the stars. If the Spin linear theory is correct then what actually happened is that the stars passed through the collision only slightly impeded but the hot gas and the residue of Spin SLPs were left behind due to the self impact. As a buildup of Spin SLPs around any matter reduces the strength of the gravitational field, the removal of these particles has revived the stars to a virgin level of gravitational strength.

Over a very long period of time you would expect SLPs in spin mode to accumulate around the stars and so the gravitational force would slowly revert to what we consider to be normal. What would happen to the spin SLPs adjacent to the hot gas is less clear.
Whether the spin SLPs would drift away from the hot gas is difficult to say.

The image below is of another extremely exciting observation. This is Abell 520, often referred to as the Train Wreck Cluster due to its chaotic structure.

Abell 520 Courtesy Of NASA

The starlight is indicated by the orange areas. The hot gas is the green and the blue indicates the location of the elevated gravity region, ie what would be assumed to be dark matter. How long ago these galaxies collided is not currently known. I would assume that this is a much older collision in which the spin SLPs would have been initially removed from the stars but have reformed thereby removing the appearance of dark matter from them. The distribution of dark matter and hot gas in more confused. It is possible that some of the hot gas has ended up embedded with spin SPLs thereby reducing its gravitational field where as other areas of the hot gas has moved away from the spin SLPs and so it has the higher gravitational field associated with it giving the appearance of dark matter.

Dark Energy
The graph on the previous page showed how the density of baryonic matter would affect the reversion rate of spin SLPs and this would reduce the gravitational field for higher density matter and Vice Versa. It also shows that there will be a critical point where the conversion of linear SLPs to spin (which creates gravity) is actually lower than the reversion of spin SLPs (generated in denser areas of space) to linear mode. The outcome of this is that the SLPs changing between spin and linear mode actually create a repulsive force rather than an attractive one.

Photons And SLPs

I have described SLPs as long range particles analogous in certain ways to photons. The standard model states that photons have no mass other than their relativistic rest mass. As far as I am aware the reason it doesn't attribute any mass to photons is that this would disagree with SR and would preclude them therefore traveling at the speed of light. The SLP model works if we assume that SLPs, like photons are massless particles, exhibiting inertia effects on impact. When photons are emitted from a body, the body will reduce in mass. When photons are absorbed by a body, the body will increase in mass. When photons impact with mass, they have an inertial effect just as though they have mass. It is possible that photons and SLPs are both types of spin linear particle and that both do have mass but they are able to travel at light speed because in linear mode, they do not interact with the Higgs Field or any other field that would impede them.

For SLPs to cause the deflection of light in the way that we know it to occur, they must be very small even compared to the mass of photons. If they were similar in mass to photons, instead of bending light, they would miss many photons and those that they did get hit, would be knocked in a multitude of random directions. You would not expect to see the beam of light being deflected. Instead, part of it would continue in a straight line and the rest would be dispersed / lost.

In their 1931 paper," On the Gravitational Field Of Light", Tolman, Ehrenfest and Podolsky concluded that photons travelling along parallel paths do not attract gravitationally. If they did attract, then light rays from distant galaxies would clump together, but this has never been detected. There have been a number of papers over the years offering different reasons for this, including the suggestion that electromagnetic repulsion of photons, or electron positron pair repulsions oppose the gravitational effect. If this was the case, the opposing force would have to perfectly balance the gravitational force otherwise light would either clump together or scatter/disperse. We would propose though that the actual reason is that photons are a type of spin linear particle in linear mode and so they simply don't knock SLPs into spin mode and are not therefore generators of gravity. They are deflected by the net flow of SLPs towards all massive objects This is discussed further in the later paper.
Newton proposed that light should be deflected by gravity in his 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 was
Angle = $2GM/C^2R$. Einstein derived the exact same equation but later modified it to give exactly double the deflection.

In the 1931 paper, Tolman et al, it also concluded that "Newton gravity predicts the correct bending of light if we assume photons to have double the gravitational mass compared to the inertial mass". Whilst Newton gravity could not be adapted in an intuitive way to accommodate this as there is no model, just action at a distance, the SLP mechanism can. To obtain twice the deflection you would simply accept that photons have twice the side on area relative to their mass when compared to general matter. They would then be deflected by twice as much when passing gravitational fields when compared to baryonic matter. This is the simple mechanism that would allow them to have a gravitational mass that is twice as large as the inertia mass.

The **LIGO** interferometer team have now reported their finding of gravitational waves. This demonstrates that gravity acts through a gravitational field. It isn't exclusive evidence that curved spacetime is the correct model of gravity. It equally validates any field model of gravity including this one.