Escaping the Dark Side of the Universe

Many scientists have been anxious over the widespread acceptance that invisible "dark matter and "dark energy" make up 95% of the universe. These were not predicted. They were only proposed after unexpected observations. A questioning of the nature of space and time shows the concern was justified. It leads to an exciting new theory, 'Full Relativity'. The invisible field that permeates all space and gives rise to gravity's action-at-a-distance is not a distortable fabric of space-time. Movement, relative to the new background field, changes the scale of time. However, the change in scale of "space" is only apparent. Space, the distance between objects, does not change, it is the properties of objects and their apparent speed that change. The magnitude of the field determines the speed of light, which alters the amount of energy trapped by particles. This stored energy is, as Einstein pointed out, mass. The same matter stores less mass when the speed of light is faster. Thus, gravitational attraction arises from a loss in the mass held by matter as it moves into a denser region of other matter. The background field arises from both matter and antimatter. Changes in the magnitude and asymmetry of this pair of chiral (opposite handedness) contributions alters the speed of propagation of the field and the mass and inertia of particles. The reasons why the new perspective is demanded are set out, together with the necessary consequences. The incredible benefits go far beyond explaining gravity while reproducing the standard predictions of General Relativity. They include removing the need for dark energy, dark matter, cosmic inflation, singularities inside black holes, and a big bang, while solving the flatness and horizon problems of the existing consensus model of cosmology.

The background to background fields

Einstein's General Relativity has reigned as the accepted theory of gravity for more than 100 years. This theory claims that gravity is an invisible distortion of the fabric of space-time by matter and energy. Thus, it proposes that gravity is not a real force. Instead, massive objects follow the shortest path in this distorted field of space and time. The planets moving around the Sun just follow the curved space-time. However, we cannot "see" this distortion, except indirectly in terms of the change in how fast clocks tick and the small amount that massless light is bent when it passes close to the Sun. Observations of galaxies and an apparent accelerating expansion of the universe have also required two other invisible features, christened dark matter and dark energy that are fundamentally different from those we know. They are only seen in terms of their gravitational effects on the motions of galaxies and stars, and on the bending of light. Their existence is based on the theory of General Relativity and its notion of a background of space-time in which distance and time only have a subjective existence except in their combination as a constant speed of light.

The idea of a field, or medium, or aether, was introduced to explain action-at-a-distance. Rubbing an amber rod could make nearby hairs stand up, a magnet could attract metal objects, and planets could be gravitationally attracted by the Sun. All these effects are at a distance, across seemingly empty space. An invisible medium (a field or fields) that can carry light and other radiation, and forces including gravity, is essential. Gravitational attraction requires that this background field can be altered by massive objects. However, it does not require that this be a distortion of the distance between objects. A revised understanding of the nature and effects of the field(s) that permeate space, and determine the movement of objects that we can see and touch, has been put forward. This allows us to make sense of gravity as a real force and removes the need for both dark matter and dark energy.

The shaky postulates that led to space-time

General Relativity was built on Newton's universal law of gravitation. It was said to be universal because it applied to everything from apples falling from a tree, to the orbit of the moon around the

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Earth, to the orbits of planets around our Sun, and to stars orbiting each other. General Relativity also built on a feature of Einstein's earlier Special Relativity which sought to explain why the interaction of electric and magnetic fields depended only on the relative motion of the source and receiver and not which one was moving. His analysis promoted two observations to postulates. The first was that it did not seem possible to tell whether you were moving at a constant speed in the one direction or that you were stationary and the scenery was moving past you in the opposite direction. This observation became the postulate of the "principle of relativity" – that physical laws are independent of the speed of motion relative to anything. There was, therefore, no way of telling which of object or observer was moving. This is a truly remarkable leap of faith. It claims that what you observe, for objects moving with you, is independent of your speed relative to all the rest of the matter in the universe, even if your relative speed approaches that of light.

The second observation was that the speed of light was the same independent of how fast the object emitting the light was travelling. Our daily experience is that you have to take into account how fast a vehicle is moving if you want to work out the arrival time of an object thrown from the vehicle. This was not the case with light. How long it took to reach you did not depend on how fast the emitter was travelling relative to anything else. However, because of the first postulate, this observation was changed into the postulate that the <u>measured</u> speed of light is independent of the motion of the emitter <u>or observer</u>. The conclusion of Special Relativity was that time and space were subjective, only their combination into a constant speed of light was real. Relative movement between the observer and an object slowed time and contracted distance. However, the time and distance for an observer moving with the object were unaltered, and a second observer would see the first observer's time being slowed and separation distances contracted. Space and time were linked into a flat fabric of space-time in which the scale of space and time are altered by relative motion at constant velocity.

Special Relativity has both the scale of distance between objects, and the scale of time flexible. Only their combination in terms of light-speed has a real existence. This idea is at the core of the disputed paradoxes of relativity. Students happily accept that relative motion between observer and object will lead to apparent effects, but many do not realise that the theory requires the effects to be real. It is a remarkable idea that a set of clocks moving relative to the observer (whether towards or away) will be slowed and their spacing reduced, compared to the clock-rate and spacing seen and measured by an observer moving with the clocks. The idea seems to be more readily accepted because of the use of the word "space", rather than "separation distance". It seems to imply an amount of vacuum, whereas it is simply the fixed distance between objects not in relative motion.

How the current theory of gravity arose

General Relativity sought to extend the idea that the laws of physics were independent of motion at constant velocity to also cover accelerated motion. It first took the Weak Equivalence Principle that the mass resisting acceleration (inertial mass) was the same property as the mass that determined gravitational acceleration (gravitational mass). This principle arose from the observation that all objects accelerate at the same rate, under vacuum, in a gravitational field. Einstein then noted that observers in free-fall felt no gravitation (until they hit the ground!). Gravity appeared to be transformed away by acceleration and the laws of physics appeared to be the same as for constant velocity (an inertial frame). This invariance of the laws of physics is called the Einstein or Strong Equivalence Principle. This principle claims that physics in a frame, freely falling in a gravitational field, is equivalent to physics in an inertial frame without gravity. Moreover, physics in a non-accelerating frame with gravity, is equivalent to physics in a frame without gravity but accelerating by a matched amount in the opposite direction.

Einstein took Special Relativity's flat fabric of space-time and allowed the strength of gravity from massive objects and their movement, and any form of energy, to distort its geometry. He concluded that this distortion of the geometry of space-time was related to the gravitational potential of Newton's gravitational equation. His replacement equation of motion expresses how the gradients in mass, energy, and momentum, distort space and time. It adds in the finite speed of light via the time taken for distortions to propagate. The geometry in which we live and unchanged objects exist, is altered by massive objects via the gravitational acceleration they induce. John Wheeler summed it up as: "Space-time tells matter how to move; matter tells space-time how to curve." Under General Relativity, gravitational acceleration is not a real force. It is just the curvature of space-time. The more massive an object the more space-time is bent, which appears as a larger gravitational acceleration. Once an initial distribution of matter, energy and movement is set out, then Einstein's gravitational equation can be used to predict how it will evolve over time.

Lots of evidence but some concerns

General Relativity has had remarkable success. Einstein's equation with its distortion of both time and distance provided an explanation of the slightly anomalous behaviour of Mercury's eccentric orbit and predicted the amount of bending of light passing close to the Sun. When this prediction was confirmed in a solar eclipse of 1919, Einstein became famous. Further evidence over the last one hundred years, has included a gravitational redshift of light in escaping a gravitational field, the expanding universe, and the observation of black holes and gravitational waves. It has been overwhelmingly accepted as fundamentally correct.

Nevertheless, General Relativity appears to be inconsistent with quantum mechanics, the theory of the very small, but it is assumed that this will be eventually resolved by a theory of quantum gravity. It is also inconsistent with the theory that links the other three fundamental forces. That theory, the Standard Model of particle physics, has provided predictions of particle properties that are accurate to twelve significant digits. The one missing piece was the Higgs boson, so the discovery of this particle was a major success. The theory does not require any further particles so there is no place for a particle that could explain dark matter. Under the theory, the interaction of the Higgs field with particles is the mechanism by which they acquire mass. Therefore, this mechanism is a source, or <u>the</u> source, of gravitational attraction. This origin of mass seems difficult to resolve with gravitational attraction, in proportion to mass, not being a real force.

Introducing the dark side

Another concern of many scientists has been the post-observation addition of hypotheses to General Relativity to explain unexpected results. The first surprising observation was that clusters of galaxies, and the outer stars within galaxies, were moving so fast that they could not be held together by the gravity from the visible matter. This led to the hypothesis that galaxies were immersed in a diffuse halo of invisible matter – "dark matter". This new type of matter did not emit or absorb light or interact significantly with ordinary matter, except via its gravitational attraction. Subsequently, it was also observed that galaxies and galaxy clusters bent light more than expected. In both cases about five times as much dark matter as ordinary matter was needed. Final confirmation of the existence of dark matter appeared to come from observations of the small variations in the temperature of the cosmic microwave background. This is the glow left over from the big bang, when the temperature of particles had cooled enough for atoms to form, and light was first able to escape. Simulations showed that the variations were not large enough to have given rise to galaxies and clusters of galaxies, similar to those observed, within the time available since the big bang. Again, five times the amount of dark matter as matter was needed to provide sufficient gravitational attraction. However, such matter was not expected and, so far, has not been seen or detected other than by its gravitational attraction.

The second surprise came from observations of a class of supernovae that always explode when they reach a particular size. They can be used as standard candles whose brightness gives a direct measure of their distance at the time they exploded. This distance, out to galaxies more than 15 billion light years away, was compared with the expected distance indicated by the (Hubble) redshift of their host galaxy. Under, General Relativity, this redshift arises from the expansion of space as the universe has evolved. This expansion of space steadily stretches the wavelength of the emitted photons, and so their wavelength has been redshifted over the time taken for them to reach us. Gravitational attraction had been expected to slow the rate of expansion. However, the supernovae observations indicated that the rate of expansion was now increasing. A new, unknown form of energy – "dark energy" – was hypothesised as the cause of this "accelerating expansion". It appears to push galaxies apart more strongly as the empty space between them increases. Together, the new hypotheses explain most observations if approximately 68% of the matter/energy of the universe is "dark energy", 27% is "dark matter" and only 5% is the ordinary matter of which we are made and can see.

Expanding concerns

A recent addition to the list of ad hoc hypotheses has been an incredibly rapid initial expansion of the universe termed cosmic inflation. This has been postulated to explain the "horizon" problem. The observed uniformity of the large-scale distribution of distant galaxies and of the cosmic microwave background seems to require that the early universe was in thermal equilibrium. Yet distant galaxies in opposite directions to us are now so far apart that, for the current speed of light, they could not have interacted in the lifetime of the universe. It also sought to explain the "flatness" problem. If the geometry of space had deviated ever so slightly from flatness, then General Relativity predicts that its curvature would have been rapidly amplified over time. Yet, it is observed to be very close to flat, that is, to have zero curvature, just when we happen to be around to measure it.

Cosmic inflation proposes an exponential expansion of space in the early universe. The hypothesis is that the universe expanded by some 20 orders of magnitude between the first 10^{-36} to 10^{-32} seconds after the big bang. This incredibly rapid expansion, much greater than the speed of light, locked in the initial uniformity. Following the inflationary period, the universe continued to expand, but at a slower rate. This proposal was initially treated with much scepticism. How could the entire contents of the universe expand faster than the speed of light when Special Relativity says that accelerating just one electron to this limiting speed would take infinite energy? However, the proposal has now been widely accepted and rewarded. It is claimed that such an expansion is possible because "space is not a thing", it is a relationship. The galaxies are not moving it is the empty space between them expanding!

Full Relativity has a field that changes objects, not space-time

The new theory of gravity and of motion at high speeds, Full Relativity, replaces both Special and General Relativity and their supposed fabric of space-time. The new perspective has the invisible field that permeates all space, that carries light and gravity, and enables interactions at a distance, determining the properties of objects and the speed of light. This contrasts with General Relativity which has the space and time, in which objects of constant mass are embedded and the speed of light is fixed, varying with relative location and movement of the observer and of nearby mass. The change in perspective challenges many of the strongly held beliefs of current theory. It claims that both the speed of light and the mass stored in the same matter vary with the magnitude of the field. It also claims that the momentum and inertia of objects depend on a different aspect of the background field. Finally, it claims that "space" is simply the distance between objects not in relative motion. This distance cannot, and does not, change with motion of the observer or with the density of surrounding matter. Any effects are only apparent and not real. Space-time is an illusion.

How Special Relativity's space-time came to depend on the observer

The first point of departure from Einstein's theory, and the explanation of why space-time is an illusion, occurs at the postulates of Special Relativity. The "principle of relativity" claims that the laws of physics are completely independent of any constant motion of the observer moving with the objects being examined. An observer in a closed space, for example in a windowless train carriage smoothly travelling at constant speed, appears to be unable to tell whether they are moving. Two people can still play table-tennis and a ball that goes straight up comes straight down. The principle requires physical laws for any object moving at constant velocity to be the same as they are for the object at rest. Therefore, Einstein postulated that an observer in an inertial (non-accelerating) frame cannot determine an absolute speed or direction of travel in space, and may only speak of speed or direction relative to some other object. This is a remarkable leap of faith. Full Relativity agrees that it is still possible to play table-tennis but claims that the faster the train is travelling the slower the players' watches will be ticking and the harder they will have to hit the ball. Movement relative to the background affects clock-rate and other behaviour. The apparent independence of speed, relative to the background, applies to massless objects (e.g. photons). For massive objects, it is only in the limit that the speed of movement relative to the current, balanced background, from the rest of the mass in the universe, is small relative to the speed of light.

Einstein's original second postulate was: "*that light is always propagated in empty space with a definite velocity c which is independent of the state of motion of the emitting body*". In his analysis he then claimed: "*that light (as required by the principle of the constancy of the velocity of light, in combination with the principle of relativity) is also propagated with velocity c when measured in the moving system*". This is a misunderstanding. It is not the measured speed of light that is required to be independent of movement of the observer. The observational requirement is, and was, that the underlying speed of light is independent of the speed of the emitting object.

For a constant underlying speed of light, the distance travelled by light, per unit of observed time (ticks of a clock), increases if the observer's clocks are slowed. Keeping the measured speed of light constant for observers whose clocks are slowed requires distances (the space between objects) to be reduced. Under Full Relativity, time dilation arises because the clocks of objects and observers (which both have mass) are slowed by high-speed motion relative to the background from all other massive objects (primarily galaxies). However, the speed of (massless) light is not affected. Consequently, its speed will measure faster, but is actually unchanged if the background is constant. The misunderstanding, that the measured speed must be constant, explains why the "space" of Special Relativity's space-time, the apparent distance between observed objects, is reduced by the slowing of time when there is movement of the observer relative to the background. The same distances travelled take smaller time intervals (a fewer number of longer ticks) of slower clocks. The dilation of time is real for observers and clocks moving at speed relative to the background and the contraction of distance is only apparent. Space-time claims that clocks moving relative to the observer are slowed. It then needs a real contraction of distance to maintain a constant measured speed of light.

An examination of Einstein's argument that the moving observer will also see time slowed in the stationary frame is flawed. He performs a two-fold operation using his tentative transformation between the time and distance coordinates of events in a moving and stationary frames. He does this by reversing the sign of the velocity. However, this is not the inverse transformation. The two frames only overlap at time zero. Using $-v$ is only the inverse transformation for the origin ($x=0$) and for zero velocity. The procedure actually compares the coordinates of two frames moving away in opposite directions from the origin after initial coincidence. The two-fold transformation does not give a return to the original frame (as claimed) unless $v=0$, when there is no slowing of time. If time is found to be slowed in going to the moving frame, then time must be increased in returning. Special Relativity's claim that time dilation is independent of which observer is moving is faulty.

The effect of high-speed movement (relative to the free-fall background rather than relative to the observer) has not been experimentally tested. The decay rates of unstable elementary particles slow with increasing speed, but this is relative to our clocks, and we are nearly in free-fall. We, and the Earth, have accelerated until our inertia has produced a uniform background whose rate of change is negligible. We have not been able to send an instrument, with its own clock, at high speed and have it measure the decay rate of approximately stationary unstable elementary particles.

Time and space are linked by a variable speed of light

Full Relativity has the distance travelled by light linked to elapsed time via the speed of light. Special Relativity's linked distance ("space") and time applies when no gravitational field is present and hence to the case when the field from surrounding mass is constant. Thus it applies to a region in which the speed of light (c) is constant. It does not necessitate that the speed of light also has the same constant value in different regions with different densities of surrounding mass. However, the illusory fabric of space-time with a constant measured c was taken over into General Relativity. Thus, the next point of departure from current theory is that the speed of light and mass (m) do not need to be, and are not, constant. They are dependent on the surrounding field (the background) from other mass.

Gravity comes from a change in stored energy (= mass)

Physics teaches that an oscillating pendulum has no kinetic energy at the top of its swing. It then loses potential energy until, at the lowest point, kinetic energy is at a maximum and potential is at a minimum. The difference in potential has been converted into energy of motion. On the upward swing, the work done in lifting the mass higher, the integral of the vertical force over the change in height, restores the potential. This gravitational potential is the energy gained per unit mass. But what is mass? Einstein came up with the answer in 1905 when he derived $E = mc^2$: "*The mass of a body is a measure of its energy content*". Mass is the energy stored in a body. He later observed that: "*Mass and energy are therefore essentially alike; they are only different expressions for the same thing. The mass of a body is not a constant; it varies with changes in its energy*". However, believing c to be constant, he missed the obvious. The same body of matter (that currently stores energy E_0) will store different amounts of energy if the field from other matter changes. It stores mass $m = E_0 / c_0{}^2$ now, when $c = c_0$. If c_0 increases to c, then it will only be able to store energy $E = E_0(c_0 / c)^2$. Mass decreases if c increases and mass increases when work is done to lift an object higher against the pull of gravity into a region of lower c. Gravitational potential is the increase in stored energy held in the object. Hence, Full Relativity, provides a simple explanation of gravitational attraction. It arises from a loss in stored energy (mass) of objects, seen in their gain in kinetic energy, as they move closer to each other and the speed of light is faster.

Newton's equation of motion is a time-independent, energy-balance equation. The work done against the force of gravity becomes a gain in stored energy per unit mass ($\Delta E / m$), so that the fractional change in the total energy ($E = mc^2$) of the small mass m is, to a good approximation:

$$\Delta E / E \cong -G_N M / Rc^2 = \Delta\Phi / c^2 \text{, using } \Delta E = \int_{r=\infty}^{r=R} F dr \text{, where } F = G_N Mm / r^2$$

and where $\Delta\Phi$ is the change in potential (energy) with distance R from a point source of mass M. When the object falls, the energy lost as mass appears as kinetic energy of motion. The total stored energy per unit mass is enormous, with a 1 kg object containing the energy of a 20 megaton (of TNT) hydrogen bomb. Hence, the fractional change is small and the factor $G_N M / c^2$ will be small unless

M is enormous. The gravitational potential from every source of mass falls off inversely with distance (i.e. as $1/R$). Therefore, the contribution to the total potential from the enormous number of distant galaxies far outweighs that from the Earth and Sun and their mass will only induce small gradients in the total background. Therefore the value of G_N will be nearly constant. This new understanding of gravity is termed "Full Relativity" because the mass and motion of objects is determined by the effects of all other objects (the background).

The fractional loss in mass in moving, from a large distance away, to the Earth's surface, for the current background from the rest of the universe, is approximately 6 x 10^{-10}. This explains why it is not generally noticed. However, the effect has, in fact, already been observed. If the gravitational force is stronger, the change in energy is larger, and the pendulum swings faster. Every object or particle, whether matter or radiation, has a de Broglie wavelength of oscillation inversely proportional to the energy carried. The frequency of oscillation is proportional to the energy carried as in $E = \hbar\omega$ for radiation. Time, frequency, and the rate of ticking of a clock are directly proportional to the energy carried. The fractional changes in energy, mass, and time, change in unison with a change in gravitational potential. Thus, the observed changes in time of the clocks of the GPS system come from the change in stored energy. General Relativity, instead, attributes it to the effect on time of objects of constant mass being in a region of different gravitational potential. The understanding of how the effect on time arises is different.

Full Relativity reproduces key predictions of General Relativity

It is now clear why Full Relativity reproduces many of the standard predictions of General Relativity when the background is similar to that currently observed locally. General Relativity's fractional change in time ($\Delta\Phi / c^2$) is the same as Full Relativity's fractional change in mass. The speed of Mercury in its eccentric orbit increases as its mass reduces, so it takes less time. General Relativity has time in that region of space going slower so that less time elapses while events occur. Full Relativity has no change in distance, while General Relativity claims a matched contraction in distance. However, any mean change in distance on the advance of the perihelion is negligible for a nearly circular orbit.

The second of Einstein's predictions from General Relativity was that light would be redshifted, and so seem to lose energy, in escaping the Earth's gravitational field. The effect has been observed in the need for photons emitted from a lower detector to be given a Doppler boost in energy (by upward motion of the source) if they are to be resonantly absorbed by a matched detector higher in the field. Under General Relativity, the effect arises from time running faster in a region of higher gravitational potential. It also explains it as a loss in energy because photons, although massless, are gravitationally attracted in proportion to their momentum. Thus, all forms of energy/momentum give rise to gravitational attraction. Full Relativity, in conjunction with particle physics, has the much simpler explanation that (quantum) oscillation frequency depends on the energy carried. The atoms of the same massive clock, at a higher gravitational potential, have more stored energy and hence a higher frequency. Photons, with no mass have an unchanged energy after emission. The observed apparent redshift of photons is, instead, a blueshift of the atoms of the detector. It is the objects that change, not the empty space-time between them. General Relativity's explanation in terms of a change in time with location is unacceptable because such a change should apply to both the atoms of the detector and the photons. The second explanation, as a loss of energy of a massless photon, is also inconsistent with Newton's law of gravitation, where the force of attraction is proportional to mass.

Dark energy and many other problems solved

The realisation that the gravitational redshift arises from changes in stored energy when the speed of light increases, as the background increases, has other significant consequences. It means that the redshift of distant galaxies arises from the background and speed of light being faster earlier in the history of the universe. The faster speed of light means that the light emitted earlier will have travelled further in the time that it has taken the light to reach us. Correcting for this effect completely removes the discrepancy between the distance based on brightness and distance based on redshift. The evidence for an accelerating expansion is completely removed. In fact, the evidence for any expansion at all is removed. The change in energy (redshift) is fully explained by the change in speed of light. Matter will have held less energy in the past, suggesting identical clocks will have run more slowly, except that how fast massive parts move should also depend on speed relative to that of light. However, there is no matched distortion of space, just an apparent reduction is distance. The horizon and flatness problems disappear and there is no need for cosmic inflation. “Space” is the fixed separation between objects not in relative motion. It is not a magic essence of emptiness, or just a relationship, that can expand without objects moving. The idea that the entire contents of the universe could move apart much faster than the speed of light should have always been seen as absurd.

Full Relativity also removes the unphysical singularities at the centre of black holes. The presence of singularities establishes that General Relativity is either wrong or has been pushed beyond its limits of validity. It has gravitational attraction of massless photons arising from their momentum. As a result, Einstein had all energy and momentum giving rise to a distortion of space-time. When there was no nearby mass/energy there was negligible distortion. Space-time then became increasingly distorted as the mass density increased and the distortion gave rise to additional (kinetic) energy, which then gave rise to more distortion. This positive feedback mechanism is what makes singularities inside black holes inevitable once a critical density is passed. Full Relativity has the mass per unit matter decreasing as density increases. This is a negative feedback that decreases gravity, and so prevents a singularity.

The fact that a photon does not lose energy in escaping a gravitational field also means that black holes do not trap light behind an event horizon at which time goes to zero. This does not mean that extreme concentrations of matter, giving apparent black holes, do not exist. However, the wavelength of light is not shifted after emission by a gravitational field. Any radiation from a black hole would be shifted far into the red and can also be trapped by bending. Wavelength can also not be stretched by the empty space between objects expanding from an initial singularity in and after a big bang. An initially hot, dense universe that cooled by expansion is not required. Instead, the energy at the time of emission was lower.

The change allows stars and black holes to rotate around each other. Under General Relativity, nothing travelling at the speed of light can cross (outwardly) the event horizon. However, it has been observed that gravitational attraction moves when the massive source moves. The changes propagate at the speed of light. Once the horizon has formed then no changes in the location, strength or movement of the mass inside the event horizon should be able to be sensed or observed by an external observer or object. Hence, gravity and changes in gravity should be trapped. Up until now, this inherent problem has been ignored by assuming the distortion of space-time not only remains but can also move.

A larger background reduces the energy that can be stored by the same amount of matter, so the mass of a given amount of matter reduces if its density (ρ) increases. Therefore, the flux from the same matter reduces if it becomes increasingly clumped. This voids the assumption (that Gauss’s law applies) made in deriving the differential, or Poisson, form ($\nabla^2\Phi = 4\pi G_N \rho$) of Newton’s law of gravitation. Einstein based General Relativity on a generalisation of this equation. A necessary consequence of this mistake is that it will predict that an increase in the volume, in which a fixed amount of matter resides, will lead to an apparent repulsive force. Under General Relativity’s assumptions, an apparent dark energy must appear if the universe is expanding. The amount predicted will be that needed to produce a flat space-time, because empty space (distance) cannot be distorted.

In General Relativity, the distortion of space-time is based on the field of gravitational force per unit mass (acceleration). However, the $1/R^2$ dependence of gravitational force arises from the gradient of a potential energy that only varies as $1/R$. Mass and light-speed depend on potential. Use of the gradient meant nearby sources must dominate, with distortions of distance and time from opposite directions cancelling. However, Mach's principle, as seen in the constant orientation of gyroscopes relative to the "fixed" stars, requires that distant sources determine the size of the background.

In hindsight, Einstein's assumption, that the laws of physics were the same, for an observer in free-fall as for an observer in an inertial frame, was another giant leap of faith. It amounts to the claim that the magnitudes of properties, such as mass and the speed of light, are unaffected by the background. The reality is that the observer in free-fall is continuously moving into a larger background which alters the properties. The observer feels no force because the force of gravitational acceleration is matched by the inertial force resisting acceleration. The Equivalence Principle is faulty.

Full Relativity's background affects more than mass and light

Full Relativity links gravity to particle physics and quantum mechanics via the shared background. This is strongly supported by the speed of propagation of electromagnetic fields being the same as that of gravity. It is proposed that mass arises from any force (strong, electromagnetic, weak or gravitational) that confines energy/momentum to a location. It is not just the purported "Higgs field", but any trapping of momentum, that gives rise to mass. The explanation of the nature of particles and their fields is linked to the explanation of the gravitational field.

The change of mass with changing background explains gravitational attraction, but it does not explain why objects resist changes in speed or direction (have inertia) yet happily continue at a new constant speed after acceleration. It also does not explain why inertia increases, but not mass, when an object moves faster relative to the background. If mass increased, then the decay rate of unstable elementary particles would be expected to increase, but they are observed to decrease. These observations indicate that particles must have a memory of their current movement relative to a centroid of motion and that massive particles are sensitive to speed of movement relative to the background.

Full Relativity proposes that the nature of momentum, the $1/R$ dependence of gravitational potential, the handedness (chirality) of weak interactions and the Higgs mechanism for giving particles mass, indicate that a two-component, chiral background from matter and anti-matter is required. The two-component background appears to act like opposing springs where winding up one is resisted by an unwinding of the other. It means that gravitational potential, the effect on energy of an excess of either component, only falls off inversely with distance (as observed) rather than with distance squared. Consequently, the enormous, and proposed equal numbers, of distant galaxies dominate in determining the total field and the speed of light (c). This means that fractional changes in c are small, so that gravity appears weak. However, the chiral components of the background will be nearly matched except within isolated concentrations of one type of matter, such as the core of galaxies.

All particles have a de Broglie wavelength indicating that they have an oscillation/rotation, which is consistent with quantum mechanics and with particles being standing-wave states. Full Relativity proposes that the cyclic frequency, per unit mass, of all particles varies with the matter/antimatter asymmetry of the background. The internal oscillations/rotations resist changes in the velocity of objects, that is, give rise to inertia. Work must be done to maintain the standing-wave pattern if the speed of light decreases. Movement of the matched components relative to a balanced background increases one rate of rotation and reduces the other to maintain the force balance. The relative speed of rotation of the matched components changes. The result is that massive particles have a "memory" of their speed relative to the background and relative to their current pattern. This gives rise to an inertia that is dependent on the asymmetry and is sensitive to changes in velocity.

Dark matter solved

The decrease of frequency and inertia with decreasing chiral asymmetry means that inertia will decrease away from the centre of an isolated galaxy (of just matter or just antimatter). However, it will be almost constant within our solar system (miniscule in size relative to the galaxy). Asymmetry, and therefore inertia, will reduce with distance from the centre of an isolated galaxy giving rise to an apparent increase in the strength of gravity. This appears to be able to explain the flat rotation curves of galaxies, when inertia decreases at the same rate as the gravitational force.

General Relativity predicted a doubling in the bending of light seen in solar eclipses. Half the bending of light came from its loss of energy and an additional half from the matched contraction of space. Under Full Relativity, neither exist and the doubled bending comes from changes in frequency of both the fields perpendicular to, but not along, the direction of motion. If their relative frequency depends on the asymmetry, then the amount of bending will match the apparent change in gravitational force. These hypotheses need further examination but appear to remove the evidence for dark matter based on rotation curves and gravitational lensing. Their effects on the motion of galaxies within a galaxy cluster, on the development of galaxy structure with time, and on the rise and fall times of supernovae light curves needs further investigation.

Summary

The supposed fabric of space-time in which distance and time are subjective and can be distorted by motion, while the speed of light is constant, is an illusion that was taken over into General Relativity. Full Relativity, replaces both Special and General Relativity by reaffirming that a background field is essential. This field arises from competing, but nearly equal, contributions from matter and antimatter, predominantly due to the enormous number of distant galaxies. It is proposed that these have contracted into interlaced, but gravitationally bound, separate regions of like matter and antimatter. The presence of antimatter galaxies will not be revealed by their collision with matter galaxies.

The introduction of the concept of a pair of chiral background components allows effects of the background to reduce more slowly (as $1/R$) with distance. This is why distant galaxies dominate and the background field is related to the gravitational potential, rather than to the acceleration field. The small asymmetry in the contributions from matter and antimatter, which will occur within isolated galaxies, enables a mechanism that gives rise to resistance to acceleration (and hence inertia). This, in turn, appears able to remove the need for dark matter by explaining galaxy rotation curves and gravitational lensing. It also explains the link between inertial and gravitational mass, including why an object that contains enough energy to destroy a city can be thrown many metres by a puny human.

The removal of the need for ad hoc hypotheses, together with the avoidance of singularities inside black-holes and that gravity can cross their supposed uncrossable event horizons, provides strong evidence for the validity of Full Relativity. In addition, unreasonable postulates, faulty understanding and assumptions, logical errors and inconsistencies in Special and General Relativity have been demonstrated together with how they necessarily give rise to apparent effects such as dark energy and contracted distances without movement. Moreover, unlike General Relativity, Full Relativity is consistent with Quantum Mechanics, appears to remove all current evidence for physics beyond the Standard Model of particle physics, and is consistent with the Higgs mechanism as a source of mass.

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