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Gravity, Time & Space
A theory of three dimensional Spacetime
Part IV

Abstract

Gravity becomes a localised force, thus is not a force working over an infinite distance as has always been assumed and gravity is modelled without using Newton's universal gravitational constant. The need for dark matter to explain the almost fixed rotation of stars inside spiral galaxies can be explained away if gravity is a localised force. Time dilation is attributed to movement from the rest frame where acceleration dilates time in the frame of the object under acceleration and velocity regulates time dilation from the point of view of the observer. Every object or particle is considered to be truly relative to every other particle or object, hence the name for this concept of space and time, True Relativity. The explanation for the existence of time and space is a natural consequence of the concept of True Relativity.

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Throughout history time has been measured as a separate dimension but considered inseparable from space. Einstein knew space and time have an unbreakable relation to one another hence the common term used by physics, 'spacetime'.

Whilst it is true we all experience the direction or arrow of time there has never been a real physical explanation for time itself in known physics nor has there ever been any real physical explanation for the presence of space.

All theories of gravity, until now, have used Newton's universal gravitational constant but the purely geometrical nature of TR and the radical way spacetime is viewed in this concept does away with the need to use 'G'.

The foundation of the theory of TR is based on time and space being exactly the same entity. In this concept matter radiates a zone of spacetime by a fixed volume each and every second.

Although radical, by thinking in terms of matter radiating spacetime, I will show it is possible for the gravity field of any object with mass to be modelled using this concept and simple geometry.

A free falling object in a gravity field where spacetime is distorted will move a given distance over a given period of time for which physics uses the term 'displacement'. The time period used to measure displacement is of little consequence and will only affect the value of the constant used to convert mass into a retardation of spacetime. As known physics uses the second I will stick with this convention but the second itself used in TR is based in free space not inside the gravity field of the Earth.

I will introduce the first equation of TR which is based on the distance that light travels in the vacuum of free space in a period of one second. The new term which I call a Universal second (Us) has only the dimensions of space because time and space are considered the same entity in this theory of spacetime.

The equation to calculate a Universal second is

$$Us := \frac{4}{3} \cdot \pi \cdot d^3 \tag{1}$$

Where d = 299792458 m, the distance that light travels in free space over a period of one second. This gives the Universal second a value of Us $\approx 1.12863 \times 10^{26}$ m^3, if the second is used, and is the basis of TR's comparison zone nominated as the Universal clock. All spacetime zones of objects with mass are measured against this Universal clock. As previously stated, any time period could be used but that same time period must be used with all the following TR equations where 't' is used.

TR functions by comparing the spacetime zone of a mass-less particle considered at rest with the spacetime zone of any object with mass, thus the equation for the Universal clock is simply

$$UC := \left(\frac{3 \cdot Us \cdot T}{4 \cdot \pi} \right)^{\frac{1}{3}} \tag{2}$$

where UC = Universal clock (m), T = the numerical multiple of the Universal second and is dimensionless.

It is the contention of TR that a massless particle considered at rest in free space will radiate this volume of space each and every second whereas objects with mass retards the volume or zone of space slightly behind the Universal Clock.

To find out the relationship of how mass effects the volume of spacetime radiated, I can use the mass of any large body where the displacement of an object due to the gravitational field of that body at its surface is known to enable the calculation of a constant.

TR can only be truly calibrated by using experimental drop test data, therefore the Earth is the convenient body of mass to use, thus using some simple geometry I will introduce a new term called the spacetime constant or STC. Any large body with mass such as the Sun or Moon could be used providing the displacement of an object due to the gravity field of the body close to its surface is accurately known and the mass of the body is also accurately known.

The value for the STC will change if a different time period from the second is used but TR will still be able to model gravity, time dilation and gravitational redshift accurately.

It is also the contention of TR that mass itself is a retarded zone of spacetime therefore it is a distortion of spacetime and the STC will help calculate the volume of the 'missing' or 'retarded' space of any large body of mass. Equation (3) calculates the STC.

$$STC := \frac{4 \cdot \pi \cdot (R + s)^3 - 4 \cdot \pi \cdot R^3}{3 \cdot M} \tag{3}$$

Where s = the displacement (m) of an object at its surface due to the gravity field of the body over the given period of time, R = radius (m) of the body and M = mass (kg) of the body.
The STC has dimensions of (kg^{-1} m^3) and will allow for the calculation of any mass to be converted into the missing volume of spacetime and thus for the calculation of the value of displacement by a free falling object inside any gravitational field as shown by equation (8).
The next term is the time constant and it can be used to find the numerical value for the retardation of spacetime caused by any mass.

$$tc := \frac{1}{Us} \tag{4}$$

giving the time constant a value of $tc \approx 8.8603 \times 10^{-27}$ m^{-3} if the time period used to calculate the 'Us' is the second.
Example: When combined with the mass of any object and the STC the time constant will give a dimensionless numerical value (N).

$$N = M \times STC \times tc \tag{5}$$

where M = mass of the object, STC = spacetime constant and tc = time constant.
The radius of the radiated zone of a body with mass as it moves outward from that body is calculate according to this next equation

$$RST := \left[\frac{3 \cdot Us \cdot (T - N)}{4 \cdot \pi} \right]^{\frac{1}{3}} \tag{6}$$

where RST = radius (m) of the zone of spacetime for a body with mass.
When used with the comparison zone (the Universal clock) the next TR equation will give the difference between the radii of the two zones thus the value of the displacement of an object in free fall inside a gravitational field.

$$s := \left(\frac{3 \cdot Us \cdot T}{4 \cdot \pi} \right)^{\frac{1}{3}} - \left[\frac{3 \cdot Us \cdot (T - N)}{4 \cdot \pi} \right]^{\frac{1}{3}} \tag{7}$$

By using the combined and manipulated equations from above we arrive at a single equation that will give the displacement of any object in free fall at any point in a gravitational field.

$$s := r - \frac{1}{2} \cdot \left[3 \cdot \frac{2}{\pi} \cdot \left(\frac{4 \cdot \pi \cdot r^3}{3} - M \cdot STC \right) \right]^{\frac{1}{3}} \tag{8}$$

where r = radius (m) from the centre of mass, M = mass (kg) of the object and STC = the spacetime constant (kg^{-1} m^3).
The values obtained from the TR equation (8) are equivalent to Newtonian mechanics yet TR does not use Newton's universal gravitational constant unlike any theory of gravity yet conceived but it should be noted that the accuracy of equation (8) is limited according to the accuracy of pi.

Whist known physics considers acceleration to be a constantly increasing velocity over time, TR views acceleration as not only movement from the frame considered at rest but as a retardation of spacetime for the object under acceleration as viewed from its own frame. For any object held motionless inside a

gravitational field the rest frame must be the centre of the gravitational field so the rest frame for any objects on the surface of the Earth is the Earth's centre of mass. The force you feel when under acceleration and when standing inside a gravity field, like on the surface of the Earth, are manifestations of the same entity, a retardation of spacetime.
For any object considered to be in free space the rest frame is the objects centre of mass.
The TR equation to give the rate of acceleration at any given point in the gravitational field will be

$$\alpha := \frac{2 \cdot \left[r - \frac{1}{2} \cdot \left[3 \cdot \frac{2}{\pi} \cdot \left(\frac{4 \cdot \pi \cdot r^3}{3} - M \cdot STC \right) \right]^{\frac{1}{3}} \right]}{t^2} \tag{11}$$

where α = rate of acceleration, t = time period i.e. 1 second.
As explained previously, if the time period is changed then the value of the STC must also be recalculated using the same period of time so that equation (11) will always provide the rate of acceleration in m s^{-2}.
It follows from there that the TR equation for gravitational redshift at any point in the gravitational field will be equation (12) which gives a value for gravitational redshift in line with experimental results.

$$z := r \cdot \frac{2 \cdot \left[r - \frac{1}{2} \cdot \left[3 \cdot \frac{2}{\pi} \cdot \left(\frac{4 \cdot \pi \cdot r^3}{3} - M \cdot STC \right) \right]^{\frac{1}{3}} \right]}{c^2 \cdot t^2} \tag{12}$$

This equation can be simply expressed as

$$z := \frac{r \cdot \alpha}{c^2} \tag{13}$$

Whilst it is true time dilates for fast moving objects, in this concept of spacetime acceleration plays a significant part in the dilation of time. The present understanding of acceleration as merely the changing rate of velocity is not the whole truth. In this concept spacetime distorts for any object under acceleration therefore this TR equation for time dilation due to acceleration will give the correct value time dilation in any particle accelerator in line with the experimental results.

$$td := t \cdot \sqrt{1 - r \cdot \frac{2 \cdot \left[r - \frac{1}{2} \cdot \left[3 \cdot \frac{2}{\pi} \cdot \left(\frac{4 \cdot \pi \cdot r^3}{3} - M \cdot STC \right) \right]^{\frac{1}{3}} \right]}{c^2 \cdot t^2}} \tag{14}$$

This equation can also be simply expressed as

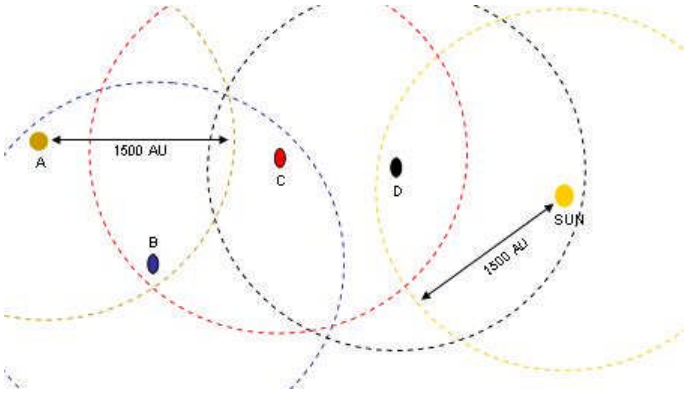
$$td := t \cdot \sqrt{1 - \frac{r \cdot \alpha}{c^2}} \tag{15}$$

Where td = the value of the dilated second, t = 1 second and r = radius from the rest frame, i.e. the centre of particle accelerator ring.
The time dilation caused by acceleration is real and not the same as that caused by relative velocity. It is only the frame under acceleration that is affected.

The measurement of force is part of known physics and has been experimentally verified but gravity is localised in this concept of spacetime. The size of any objects spacetime zone will depend completely on the age of the Universe. The limit of the edge of the zone of spacetime is also the limit over which a gravitational field will have an effect thus this limit depends on the true age of the Universe as shown by the next equation

$$F := \frac{M \cdot m \cdot \sqrt{1 - \frac{r^2}{\left[2 \cdot \left(\frac{3 \cdot Ua \cdot Us}{4 \cdot \pi}\right)^{\frac{1}{3}}\right]^2}} \cdot STC}{2 \cdot \pi \cdot r^2 \cdot t^2} \qquad (16)$$

where F = force (kg m s^{-2}), M = mass of 1st object, m = mass of 2nd object, Ua = dimensionless numerical age of the Universe, r = the distance between the objects and t = time period used (1 s).
The effect of the gravitational field will only be felt at a distance of approximately 3122 AU but this distance depends only on the true age of the Universe (Ua).
The fact that gravity is no longer a force that works over an infinite distance means that 'dark matter' is no longer required to explain the almost fixed rotation of stars inside spiral galaxies.
What must be kept in mind is that every particle of dust, gas and larger objects floating in the interstellar medium are all radiating their own zone of spacetime.



Here objects 'A' & 'B' feels no direct influence from the Sun but they are linked via a chain of spacetime zones through object 'C' & 'D'. The gravitational zone of object 'C' and the Sun's gravitational zone overlap so their distorted spacetime still has an effect on each other.
There are billions and billions of spacetime zones radiated by particles and objects in the interstellar medium thus space is a thick soup of spacetime zones all having only a direct effect where their zones overlap but also an indirect effect on all the other objects via the chain like links between them. What happens on one side of the galaxy will have an indirect effect on the other side of the galaxy. A simple analogy would be a rotating pile of soap bubbles in the middle of a washing up bowl. In that case it is the surface tension that keeps them together. In the case of the stars inside a spiral galaxy they are all linked via the spacetime zones of all particles of dust, gas and larger objects so they will moves in an almost fixed like manner without the need for dark matter to hold them together.
TR also negates the need to invent 'dark energy' because the value of the redshift is dependant on distance from the rest frame. If two galaxies are experiencing exactly the same rate of acceleration but are at different distances from the Milky Way then the most distant galaxy will show a greater redshift. The further away the greater the redshift will be. Dark matter and dark energy are not required to explain our observations when using this radical concept of spacetime.
Any new theory of spacetime must be testable in some way and the existence of the individual zones of spacetime is testable due to the collapsing of the zone of spacetime of an object when under acceleration.
If the zone of spacetime does collapse for an object under acceleration then it may be possible to observe this in the lab.

For this experiment we require a large vacuum chamber two test masses and a projectile. It is purely an observational experiment to see if indeed individual zones of spacetime do exist.
According to TR when an object is accelerated, its own spacetime zone collapses as it accelerates from the rest frame and if this is correct then the experiment shown below will reveal a movement of the two test masses when a projectile is accelerated between them. As the projectiles zone collapses the two test masses will be seen to move towards each other.
If this experiment is undertaken and movement of the test masses is observed then there is no explanation for this within the known physics of Einstein's relativity.

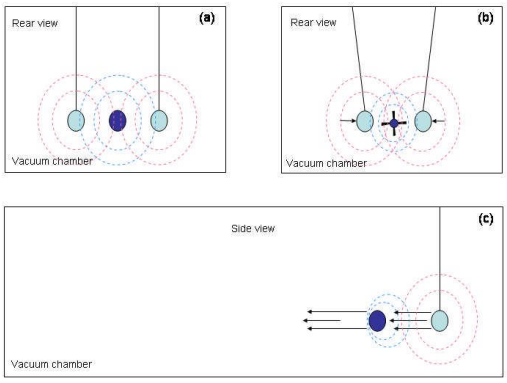


Figure 7
In (a) above are two non-metallic test masses are attached to the ceiling of the vacuum chamber with a projectile held in place by a magnetic field. In (b) the projectile is accelerated by the magnetic field causing its own spacetime field to collapse and the two test masses will move in towards each other. (c) is a side view of the experiment.

The collapse of individual zones of spacetime is the reason I believe gravitational radiation does not exist. The loss of energy in a rotating binary system such as that put forward by Hulse-Taylor may be explained by collapsing zones of each of the two objects concerned within that system.
The results for frame dragging from the gravity probe 'B' experiment, another prediction of Einstein's relativity, are eagerly awaited. Gravity probe 'B' may be the biggest test yet of General Relativity and is a fantastic technical achievement for all those involved. The effect predicted by General Relativity should give the "geodetic" precession due to the Earth's rotation at 6.6 arcsec/yr north, and the "motional" precession due frame-dragging at about 0.041 arcsec/yr east. I believe the "motional" procession will give a higher value because True Relativity predicts that local spacetime is rotating with the Earth and not being dragged around by the Earth as shown in Figure 26.

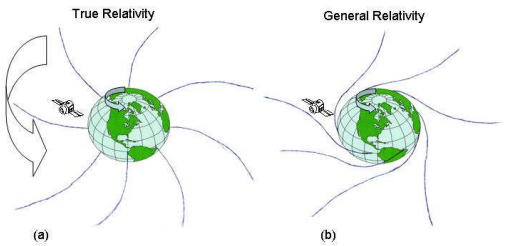


Figure 6: (a) Diagram showing how according to True Relativity the local spacetime field rotates with the Earth. Shown in (b) according to General Relativity Space-Time is being dragged around by the Earth.

I cannot emphasise the importance of this experiment enough. The fact sheet from the Gravity probe 'B' website states;
"*Any geodetic and frame-dragging effects are being measured to exceptional precision by GP-B's gyroscopes. These measurements will help shape our understanding of Einstein's theory. If GP-B gives results consistent with general relativity, it will help solidify our understanding of topics like black holes and the evolution of the universe. If, however, the results of the GP-B experiment are inconsistent with Einstein's theory, it will significantly change our perception of the universe*."

I eagerly await the release of the data and I believe the results will give the motional precession above 0.045 arcsec/year, possibly nearer to 0.047 arcsec/year.
The gravity probe 'B' experiment was due to release its findings in April 2007, this was extended at first to April 2008 and now they may not be released until 2010. Whilst I understand the need for precision and accuracy of the results this delay is indeed troublesome.
If TR holds merit the rate for frame dragging will be higher than expected by General Relativity because according to True Relativity 'local' space near the Earth will be rotating around with the Earth and is not being dragged around by the Earth.

Conclusion.

Because this view of spacetime is so radical I do not expect mainstream physics to embrace it but it is a testable concept. It is also the first theory of spacetime to model gravity without having to use Newton's universal gravitational constant which no other person or institution has ever been able to do. Therefore I think it will need a brave professional to investigate and study the concept of True Relativity but if I am right about this concept, the rewards finally point to being able to manipulate spacetime and overcome gravity.