FORCE OF TIME

by

Darren Borrows

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First published in Great Britain in 2019 by
Inc Dot Design and Print, Seafire Close, York, YO30 4UU

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Third edition.

ISBN 978-0-9954587-6-5

For Pascha
and Glenda

‘If you can’t explain it simply,

you don’t understand it well enough.’

- *unknown*

Time is a fifth fundamental force and is directly related to gravity.

This is demonstrated in thirty one pages using thought experiment, reasoned argument, and some of the insights of Albert Einstein derived from his Theory of General Relativity published in 1915.

There are no equations.

The first nine pages describe a single observation, growing into a thought experiment intended to illuminate how we perceive in time.

The following twenty pages apply this idea to space time, examine alternate interpretations, and propose models to satisfy observation.

It begins with a problem within the Standard Model, and offers a solution that seems to be fundamental and self evident.

The Standard Model

The Standard Model is derived from Albert Einstein's Theory of General Relativity and the later observation that the universe is expanding.

Albert Einstein revised his original conclusions to accommodate this then new observation.

We know the universe is expanding because the wavelength of light changes the further away a star or galaxy is assessed to be.

And we now know this expansion is accelerating.

This is a loose history of the evolution of the standard model, and it represents our best explanation for observation and experience. We believe it to be true because it satisfies the evidence.

An unforeseen consequence of this systematic evolution is we have arrived at a conclusion that breaks the first law of thermodynamics. Constant acceleration requires a constant input and creation of energy.

Any solution using the Standard Model requires some sort of alchemy.

Or something has been missed that is science.

Einstein's Theory of General Relativity predicts time travels at different speeds at separate locations. Time at any point in space is related to the gravity at that point, and both gravity and time are directly related to, and fixed by, the relative mass of the body that has caused the gravity experienced. For any observer we know, this is the earth.

The mass of the earth dictates the gravity we feel and the time we experience. Beyond the earth we cannot expect this to remain true. We can see and try to make sense of how gravity works on space in space, but observing how different rates of time might affect observation has, so far as I have found, not yet been considered.

We measure distance to observable light sources trusting that the speed of light is constant. Which it is. Light travels at ~300,000,000 metres per second. For every observer we know, an earth second. If time elsewhere is not consistent, the distance light travels there in a second cannot be measured without knowing the local rate of time.

Distance measured with light can only be constant in consistent time.

This book re-examines Einstein's original concept including this idea.

Relativity of space

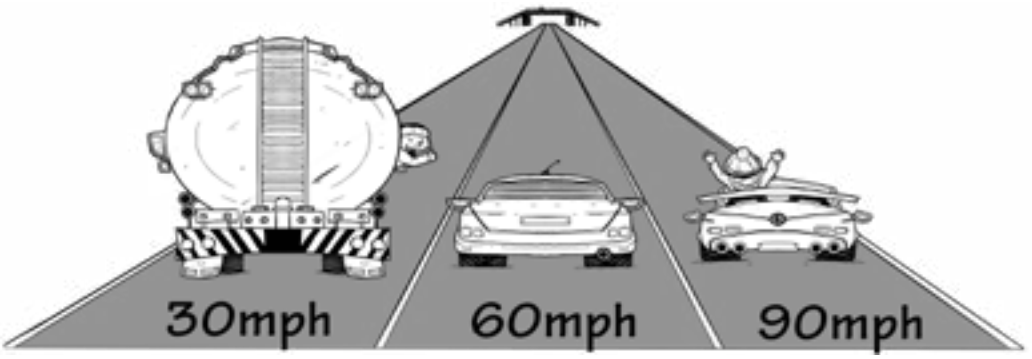
All observers are alive.

Machines may be used to view at distance or to calculate beyond our abilities, but they do not observe.

We do.

You and I are trapped within a biological body travelling in time from which we perceive the universe, whatever tools we use.

To appreciate why this idea is required for us to understand how we observe space relatively, consider the following thought experiment.



To create a platform we can use to build on, imagine three vehicles are travelling at different constant speeds on a motorway.

A driver in the truck sees cars moving past them.

A driver in the sports car sees other vehicles disappearing behind.

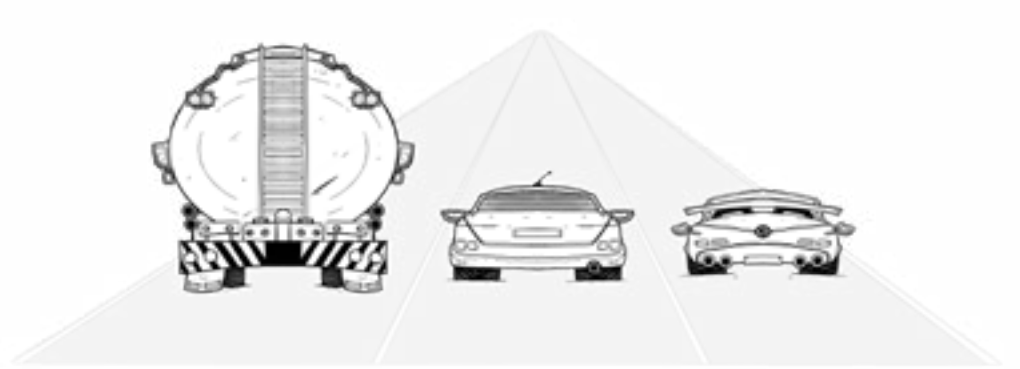
From the distant bridge over the motorway, a viewer would see the vehicles travel underneath them at different moments and at different speeds.

Speed is assessed from their common surroundings.

Whether judged by eye or read from a speedometer, they all use the earth as a common fixed reference.

The thought experiment is to imagine there is no common fixed reference. And we can do this by imagining the earth, road and bridge

don't exist for any driver. A driver within our thought experiment sees only the vehicles, and has no common fixed reference from which to measure speed.



For the driver of any vehicle, the imaginary lane they are in becomes the extent of their relative space and the vehicle occupied becomes their most reliable fixed reference. They observe other vehicles relative to themselves.

In this thought experiment we are external observers, and we can see what is happening for the driver *and* relative to an imaginary earth.

For the driver of the truck, motion is now relative to the truck. They are stationary, or in motion if they believe they are. Cars move past them at different faster speeds, the furthest away moving away the

fastest. This is similar to what an external observer would see on an imaginary earth.

For the driver of the sports car the situation is different. If the driver believes they are stationary the other vehicles are moving away, and the truck in the most distant lane is moving away the fastest. On an imaginary earth the sports car is the fastest.

The imaginary driver of the sports car makes sense of their experience from what they believe to be true about their world.

They observe relative to the limitations of their point of view.

Having an external point of view allows us to see a different perspective, one relative to a bigger structure, in this case an imaginary earth.

Taking this thought experiment as a new platform to work from, we can create a further thought experiment.

One that allows us to explore the relativity of time.

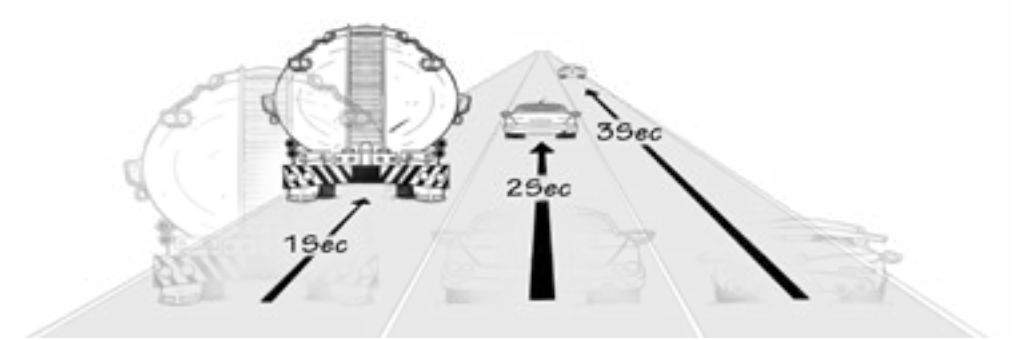
Relativity of time

Time and Albert Einstein are connected by his theories of Special and General Relativity in which he first proposed the idea time can travel at different speeds at separate places. Something difficult to appreciate as time is only ever one thing experienced by any viewer.

To understand how different rates of time may affect observation it would be useful to have a way of exploring this idea.

And to do this we can adapt our thought experiment.

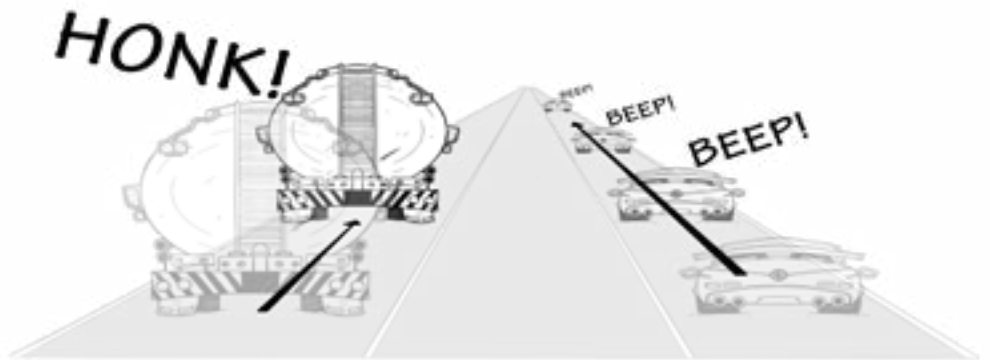
If we were to imagine it is time is travelling down our highway, we can pretend the road is a moment of time. This allows us to picture time as distance, and measure seconds visually as if they were yards.



An imaginary slice of time that gives us a way to picture vehicles driving into the future at different speeds.

And provides a stage for our next thought experiment.

To help clarify what is observed in this thought experiment let's sound the horn in each vehicle each second as the vehicles travel along.



When the truck honks for the first time the sports car is sounding its third beep.

The truck appears to see the sports car travelling into the future.

An external observer sees on an imaginary earth the vehicles at this point are both in the present. For them, the lanes are moving at different speeds rather than the cars, and they see a different reason the truck's first honk coincides with the sports car's third beep.

For the driver of the truck each of the sports car's beeps comes every ⅓ second. They hear 3 beeps to each of the truck's honks.

For the driver of the sports car, the truck travels ⅓ of a honk down the road in a beep. They have to beep twice more before they hear a honk. They understand honks come every three seconds.

If a honk comes every 3 seconds for the sports car, and a beep comes every ⅓ second for the truck then they are both experiencing different time.

An external observer sees the truck arrive at one second the same moment the sports car arrives at three. The truck has raced to the sports car's 3 seconds in a second. Time must be faster for the truck.

The truck in faster relative time sees the sports car to be moving faster in slower relative time. And the sports car in slower relative time would also see the truck to be moving more slowly in faster relative time.

This may be confusing, but the evidence seems clear.

Time that is fast appears slow, and time that is slow appears fast.

We began with the idea you and I are each a single point of observation trapped in the consistent time of the earth's gravity.

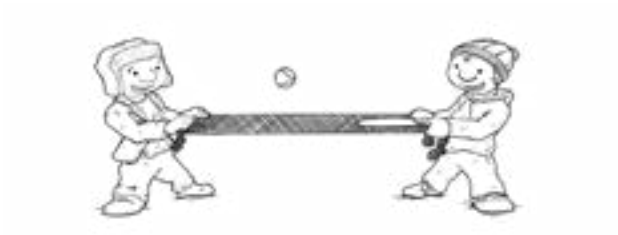
And we have Einstein's prediction that time in outer space varies relative to the gravity at that point, and this may be influencing observation.

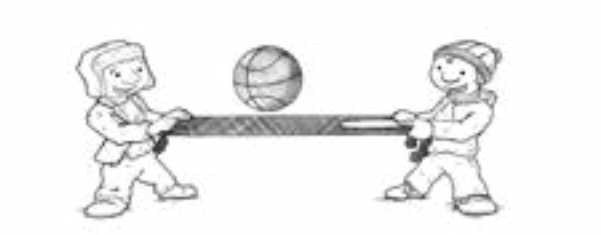
We may now have a tool we can use to account for difference in rate of time, and the ability to predict how this affects observation.

Space Time

Albert Einstein wrote the Theory of General Relativity in which he explores the association between mass and time and gravity, and he created a framework he called space time to help describe this. In it he imagined the larger the relative mass of an object, the greater its gravity and the slower its time, relative to a plane of space time.

The idea of space time can be conveyed using the elastic property of a pair of nylons catching a tennis ball and a basketball.





Caught balls stretch the nylons.

And the basketball, being heavier, stretches them more.

The basketball's greater weight causes a deeper impression in the nylons because greater mass has more force in constant gravity.

Gravity is relative to the mass of the planet and is the same for both balls. For the balls the earth is a fixed reference.

They share a common point of reference for gravity, where every caught mass has the same gravity and time.

The earth and the sun influence the shape of space time in a similar way to the balls on nylons, only for them there is no fixed plane. They continue to fall through space time. There is no common centre of mass stopping their fall, catching them in constant gravity.

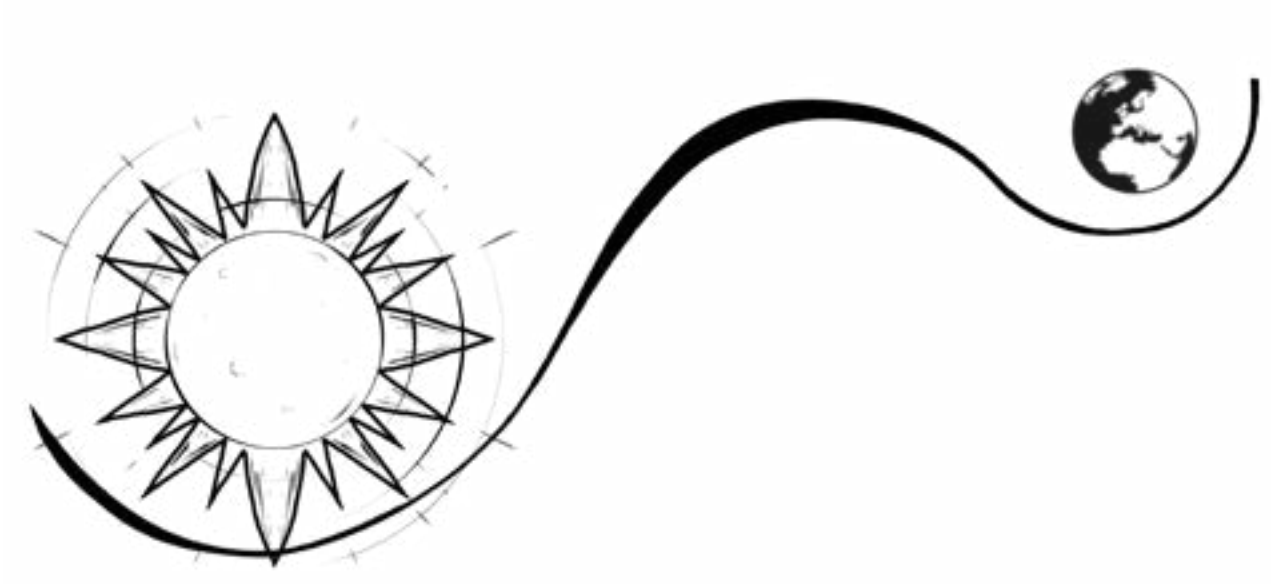
Each will have a different reference for gravity, and also for time.

They are like the truck and the sports car in the thought experiment.

With no common fixed reference, each becomes their own best reference for gravity and time.

The Theory of General Relativity predicts the greater the relative mass of an object, the greater its gravity and the slower its time, relative to its space time.

The sun and the earth are relative to each other in space time.



The gravity of the sun pulls the earth toward it space time, and the earth orbits around as it chases after and will add a little to its mass.

In the same way, the sun is being pulled by the galaxy. And the sun with the earth will add to the galaxy's mass.

The local group of galaxies may influence each others gravity and time, too.

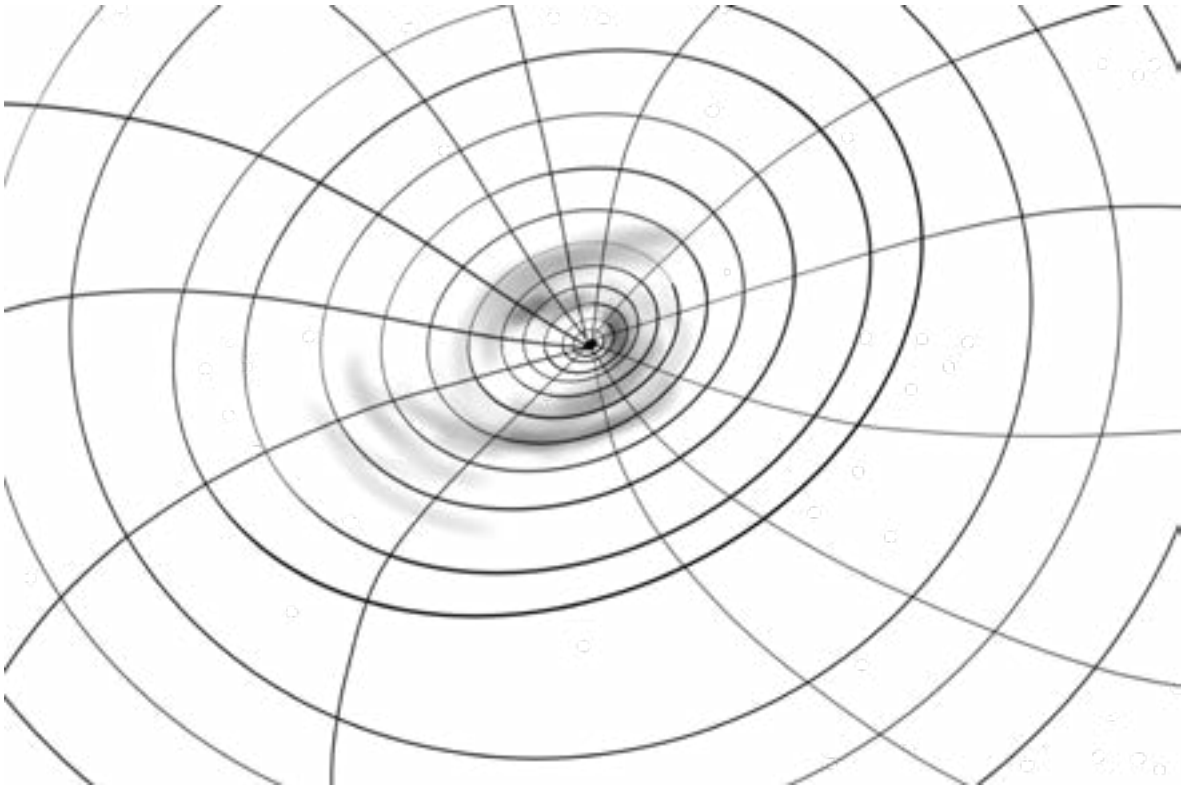
All mass in space time will influence gravity and time, and some will contribute to the gravity and time we experience on earth.

It would appear the centre of the galaxy is the greatest mass we are relative to in space time, and be the point of greatest gravity and slowest time in the universe, relative to an observer on earth.

It would seem our galaxy is likely to be our ultimate well of space and time, and as such would be the point of greatest mass we are relative to in space time, and be the primary cause of gravity in space time.

It would also be a point in time that slows in time infinitely.

According to this prediction, stars close to the centre of the galaxy are in slow time and should be among the fastest objects in the universe relative to an observer on earth, and be shooting across the night sky.



However, the stars of the Milky Way are almost stationary relative to each other when we observe them from earth.

This theory is not immediately supported by observation.

For this interpretation of the Theory of General Relativity to be viable something else needs to be accounted for.

The speed of light

The speed of light is constant in a vacuum. It travels at different slower speeds through glass, water and air; but we can be confident it has a maximum velocity of a little less than 300,000,000 metres every second when it travels through empty space.

And we understand this remains true whatever our relative time.

The maximum speed of light in relative time is ~300,000,000m/s.

Light from the sun takes around 8 minutes to arrive at the earth. This is measured from the moment light leaves the sun to the moment that same light arrives at the earth. Two fixed events relative to any observer.

The sun is estimated to be around 333,000 times the mass of the earth, causing a funnel in space time that stretches across the solar system. We observe this as an invisible plane of two dimensions holding the planets in a consistent orbit around the sun.

The sun is at the bottom of this relative well of space time.

The Theory of General Relativity suggests the sun is the greatest mass the earth is relative to in space, and has the greatest gravity and slowest time of the solar system. Slower than the time we experience on earth.

How much slower is unknown.

And there seems to be no way for us to measure the difference.

To explore the idea time is slower for the sun let's use the thought experiment from before and take a guess. This will allow us to see how observations may be affected by time.

Let's assume time is 3 times slower.

Using the thought experiment, we can put ourselves in a sports car parked on an imagined surface of the sun and take a look.

Our guess tells us time here is three times slower than on earth, and for us the time between sunlight's two fixed events is three times as long. Around 24 minutes by our dashboard clock.

As light always travels at ~300,000,000m/s, any light we observe travelling the other way will have travelled three times further than we on earth would observe.

Viewed from the sports car on the surface of the sun the earth would be three times further away. It would be even smaller than we might have pictured.

And the earth, like the truck, would be in faster time and would be moving three times slower. An earth day would be 72 hours long measured by our dashboard clock.

The earth is further away from the sun than the sun is from the earth when we measure with light.

This remains true whatever the actual difference in rate of time.

There must be a difference in rate of time so long as the Theory of General Relativity is valid.

It means there can be no true distance when we measure with light.

Only a perceived distance, relative to the observer, at their rate of relative time.

Applying this idea and using light as our tool, we can create an alternate interpretation for some other observations.

An Expanding Universe

Greater relative mass slows time. It follows where there is less relative mass time will be faster. And between galaxies, perhaps much faster.

Two galaxies might be pictured on a wave of space time like this:

Where time between galaxies will be faster relative to an observer within either galaxy.

If time were 3 times faster, in one earth second ⅓ second would have passed at this point, and light would have travelled only ~100,000,000m. On earth we would measure this as ~300,000,000m.

It seems distance measured with light is being distorted by time.

And the universe may be smaller than we observe it to be.

Its expansion may even be an optical illusion.

Accelerating expansion

The expansion of the universe is observed to be accelerating. This breaks the first law of thermodynamics, otherwise known as the law of conservation of energy, and dark matter and dark energy have been proposed to overcome this problem.

In the universe of space time described by these thought experiments the observation of accelerating expansion is inevitable.

This is because all space is falling into slower time relative to the universe of space time, and any observer is constantly falling into slower time, too. The observer neither feels nor observes any change because for them there is no change. For any observer on earth, time is relative to the earth and is consistent.

An external observer would see an observer on earth falling into slower time and understand their time will always be slowing in future.

Objects in space are viewed as they were minutes in the past by an observer on earth. By the time we observe them, what we see is from when time was faster for us. Time in the past is always

faster. Any observer is in the relative future and has slower time.

An observer in consistent time on earth sees objects in the fast time of space time moving away. And as time slows for the observer relative to space time, the rate objects are moving away would be observed to be accelerating the further into our past the objects are.

All observers make sense of their world from what they believe to be true about it.

And we are no different.

Albert Einstein's Theory of General Relativity indicates faster time between galaxies will be exaggerating our observed expansion of the universe, and accelerating expansion can be accounted for if we are prepared to accept we are not the centre of time in the universe.

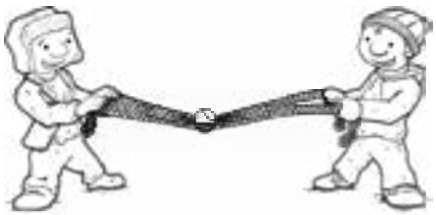
We can be confident the universe is not expanding as we currently understand it to be, and we may have to concede it may not be expanding at all.

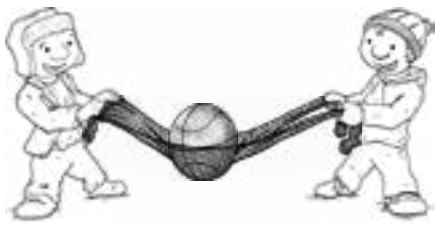
It seems a big bang has become unnecessary to explain observation.

As above, so below

Gravity describes how objects interact. Perhaps the laws of gravity may be applied to that which we cannot see. The following chapters propose models around this idea. Please refute or improve upon them.

Let's picture again the tennis ball earth and basketball sun:





The balls fall vertically and parallel to each other toward the centre of the earth, a common shared point of gravity. A static plane of two dimensions catches them before they hit the ground.

The solar system is a dynamic plane, and the bodies within it lie on a relatively stable plane of two dimensions of space time centred on the sun. To remain as they do we can imagine planets fall parallel to each other through the plane of space time of the solar system toward the centre of the galaxy, like the balls on the nylons.

The mass of the earth relative to the balls approaches infinite. Let's consider the unknown mass at the centre of the galaxy to be similarly infinite relative to the mass of all the bodies of the solar system.

The gravity of this unknown centre of mass is universal throughout space time and will be independent of any mass that is relative to us.

Bodies falling into the galaxy under this gravity maintain distance and have stable orbits due to gravity on a two dimensional plane.

We know space falls though space time under the laws of gravity. Perhaps the sun and the earth are falling into the galaxy under a similar law, one that exerts equal force regardless of mass.

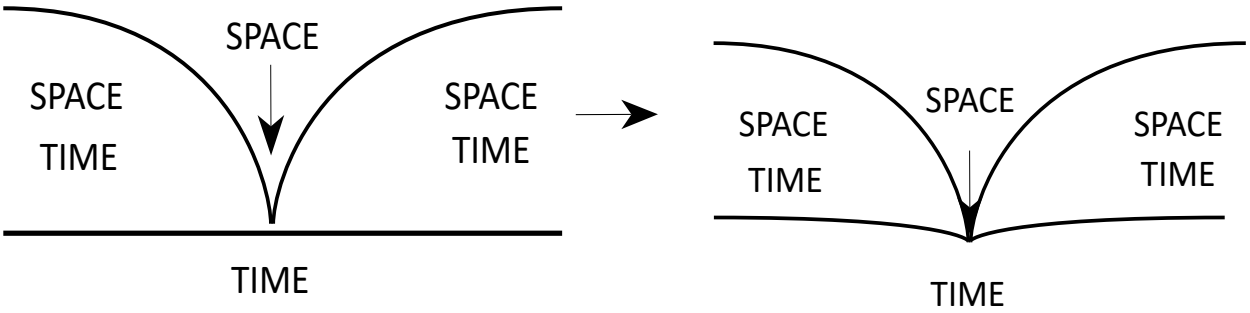
Perhaps this force is time.

A way to picture time as a force is to consider space and time as two separate planes sandwiching a plane of space time.

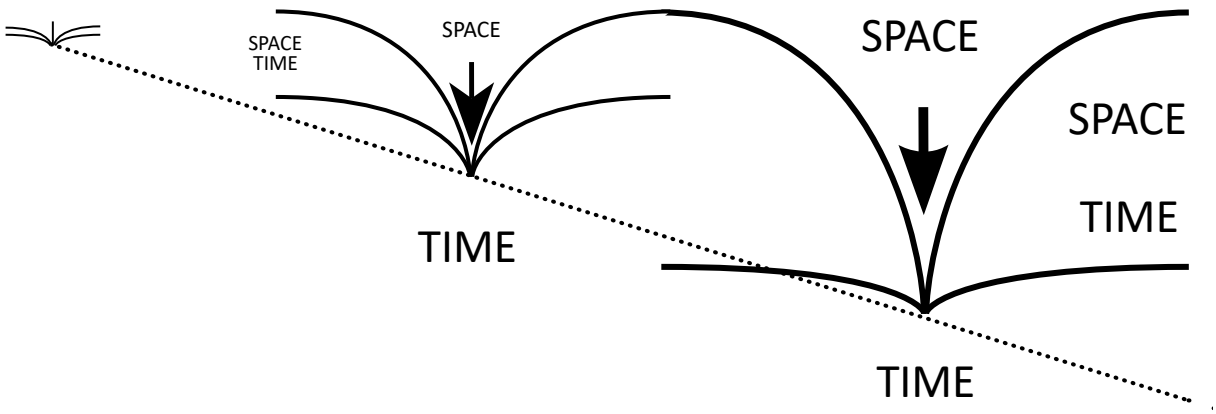
In this model, the force of gravity acts on space, across a plane between space and space time. And this force happens in time.

The force of time would act across a plane between space time and time, and have no space.

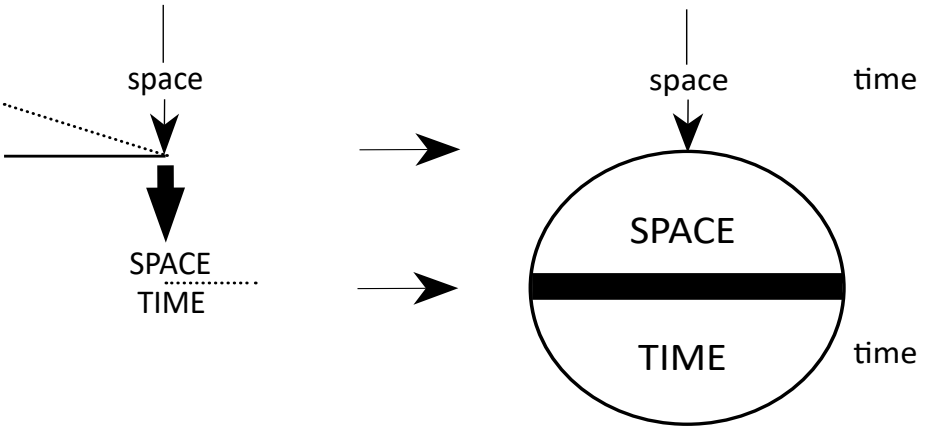
If we were to imagine the plane of space is now a point of space in space time, this would also become a point of space in time.



And as mass at this point increases, time would slow relative to space time and the distance between the planes would grow as the fast time of the past is left behind.



This space time would grow until at infinite relative mass the planes are perpendicular, and relative to an observer they become space and time.



They become a point where there is no relative space time. Only space and time exist. Time and gravity are constant, and both are relative to the mass of the point of space created.

The earth's mass relative to any observer can perhaps be considered infinite, and be understood as a point of time and a point of space. A point of stopped time relative to an observer on earth, and a point falling into the non-relative time of the sun as the earth travels around.

Time would radiate out from this stopped point into faster time causing a wave that is both passing through the earth and is part of it.

Stars

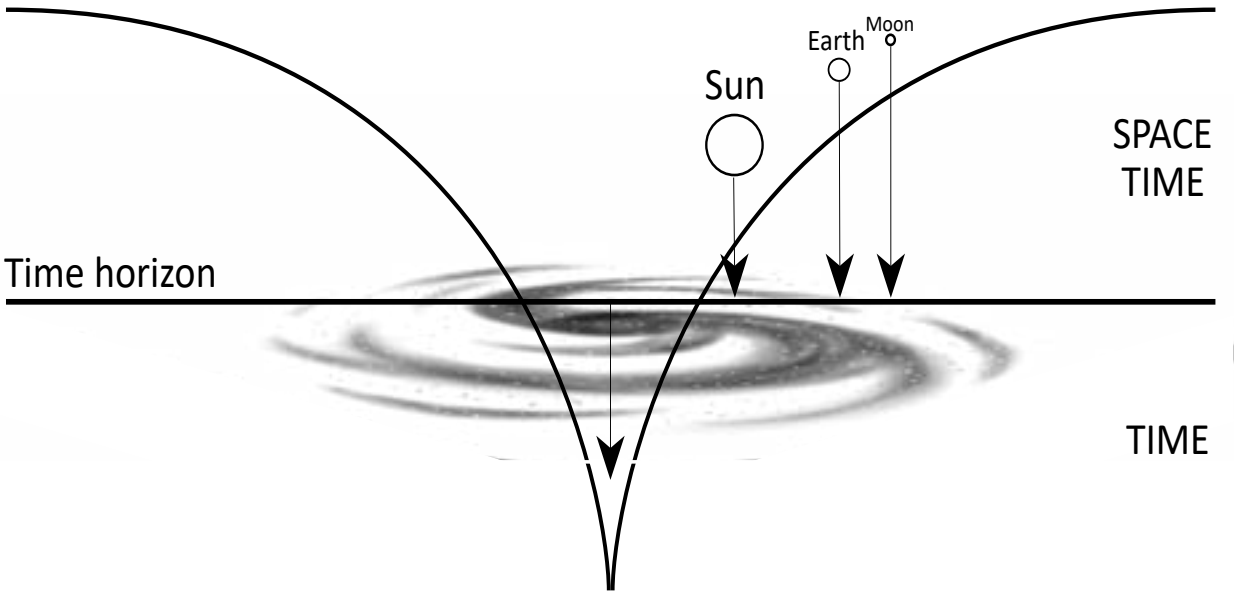
Stars have greater mass than the earth and have slower relative time. They fall into a plane of time faster than us because we are in faster time. The extra time they consume relative to us is radiated as light.

Other than the sun, stars are fixed in space because we observe them through the fast time of the empty space within the galaxy. We understand they are massive and must be moving into slower time faster than us, but it seems the time between us is so fast they effectively have no space relative to us, and exist only in time. Relative to an observer on earth they have no mass to be moving, and we see only their time being radiated.

The sun moves in the sky because it has mass relative to us. Its greater mass causes slower time and faster relative movement when compared to the lesser mass of the moon in the gravity of the earth. The moon would have faster relative time for an external observer.

These different rates of time may cause them to fall parallel to each other in space through time, maintaining stable orbits.

An external observer might imagine there is a plane of time relative to them that is infinitely slow, and this plane pulls space of different time through space time into slower time infinitely.



Our point of observation is from a plane of time between the slow time of the sun and the fast time of the moon.

We might imagine this plane as a spherical wave that is both radiating out from the centre and surrounding the earth at the same time.

Together these would create the present we continue to experience.

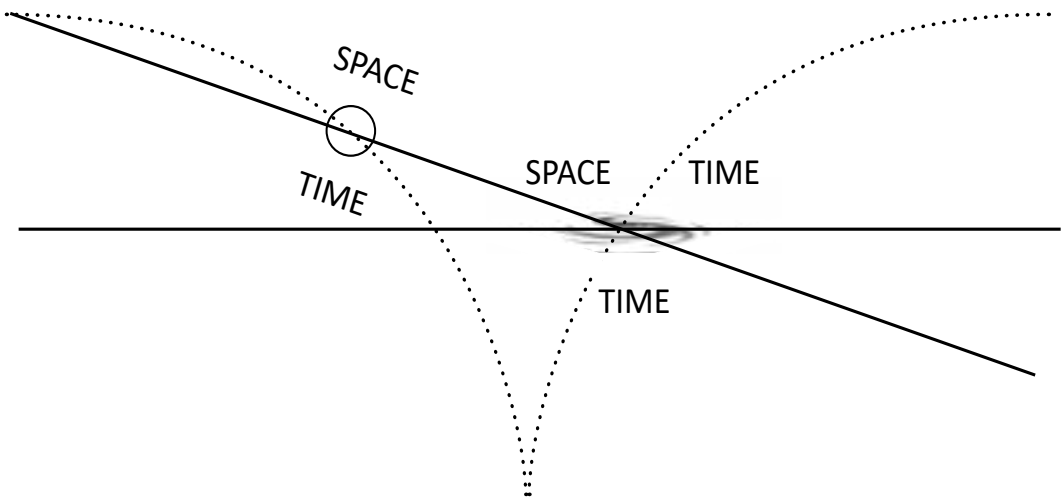
Duality

Any known observer has one experience of time, relative to the earth.

It seems likely there are two time horizons that influence this time.

One between space time and time, where time slows to an infinite stop. A point hidden at the centre of the galaxy, within a super massive black hole.

And a second between space and time. A point of space that falls into time ahead of us in time. Any solid surface is beyond our relative experience, and we see its form only in the time the sun leaves behind.



The idea of a point of ultimate stopped time may give us a theoretical point the galaxy is heading for. A point that will always travelling in time, just in time that is not relative to us.

Duality of time

Balls fall parallel to each other on earth, and fall at the same rate.

The bodies of the solar system fall parallel to each other in space time.

Maybe the sun and the galaxy fall parallel to each other, too. In time.

In this model other galaxies would not be relative to our space.

They would only be relative in time.

We are able to observe them as they are probabilities of space time in time containing space that has mass so great they fall into slow time faster than us and radiate time into space time as a probability. Whew!

Galaxies would be falling in time toward a point in time at the centre of the universe. A point beyond space and space time relative to us.

Every observer we know is relative to the earth.

And time is constant for each observer due to the mass of the earth.

The rate of time each observer experiences will be caused by, and relative to, this infinite point of non-relative time.

The earth is a point of space travelling around the sun.

The sun is moving only into time.

The earth is also a point of time. It moves through the non-relative time of the sun creating it's own relative time. A point that becomes the root of gravity, where time becomes dual with gravity in space.

The earth is both a point of time and a wave travelling in time.

Force caused by space in space time is experienced as gravity.

Force caused by space time in time is experienced as time.

Force caused by time on itself is time relative to any observer.

An observer has a single experience of time because their time is experienced in the earth's constant gravity.

The same observer is able now to appreciate through thought experiment the cause of time may be at least dual from what we see in the universe, and it may be the duality of time and the duality of light have the same underlying cause.

Opinions and decisions

Perhaps we now have two explanations for our observations of the universe and it is for the reader to judge where the likely truth lies.

1) The Standard Model, or big bang theory, in which the universe is expanding; an expansion that is accelerating, breaking the first law of thermodynamics. Resolving this problem requires the discovery of dark energy and dark matter. Or of something else that can create energy in time, or otherwise cause constant acceleration.

or,

2) A model derived from a single (as yet unmeasurable) factor predicted by the Theory of General Relativity; one that seems to satisfy all observations and result in no law of physics being broken. It effectively makes time the source of all energy, and the thing that cannot be created or destroyed. It also suggests time may be the force that gravity, and perhaps all fundamental forces, are derived from.

The next book, 'Gravity of Time,' examines this idea in greater detail.

Acknowledgements

Albert Einstein

Isaac Newton

Stephen Hawking

Megan Meek

Reginald D Hunter

Dave Ward

Tim Bull

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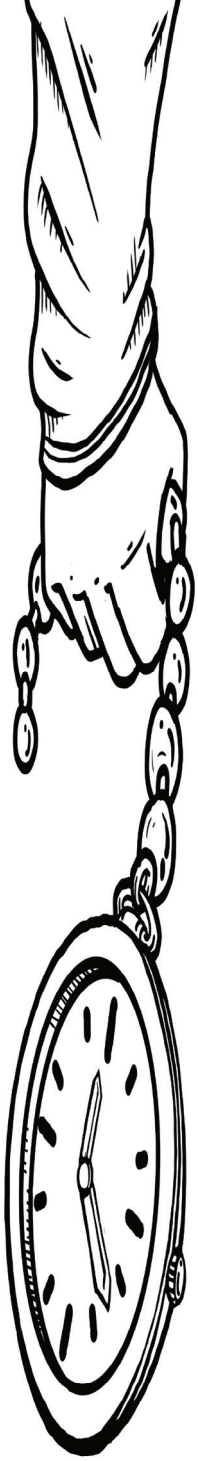

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