"Time…is what allows things to happen in sequence but keeps everything from happening at once".

Time and Gravity

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Abstract

The second law of thermodynamics is an expression of the universal principle of decay observable in nature. Time is a measure by which things happen, the yardstick of causality and is a fundamental property of the universe. We can deduce from $E = mc^2$ it is mass that gives an arrow to time and energy that gives it a rate of flow. Flexi-time is the square root of the energy of the universe divided by its mass (matter less antimatter). As mass is responsible for gravity, it can be re written as flexi-time is the square root of the energy of the universe divided by its gravity. The speed of light in a vacuum without the influence of gravity is infinite. In the real universe, gravity 'slows' the photons down. It is this 'slowing' down of photons by gravity that we call time. Time is the notches on the yardstick of entropy. Gravity is a manifestation of the universe trying to reach its ground state.

Word list

Time, the arrow of time, mass, matter, antimatter, energy, causality, second law of thermodynamics, entropy, speed of light, $E = mc^2$, gravitational time dilation, gravitational time contraction, photon, homogenous and isotropic, cosmological constant, inflation, universe, galaxy, solar system.

Ray Cummings, an early writer of science fiction, wrote in 1922,

"Time… is what keeps everything from happening at once".

It would be more accurate to say

"Time…is what allows things to happen in sequence but keeps everything from happening at once".

Abbreviations used-

Flexi-time or ∫(t) is used to convey the meaning that the passage of time is variable. Although it is constant within its own reference frame, from any other reference frame it can be variable. Flexi-time is used throughout this paper as a reminder that time is only constant within a limited reference frame, in general and from most reference frames it is flexible. (This is unlike light, which is a constant speed in a vacuum for all reference frames.)

Definition

***"Time** is a part of the measuring system used to sequence events, to compare the durations of events and the intervals between them, and to quantify rates of change such as the motions of objects. The temporal position of events with respect to the transitory present is continually changing; future events become present and then pass further and further into the past. Time has been a major subject of religion, philosophy, and science, but defining it in a non-controversial manner applicable to all fields of study has consistently eluded the greatest scholars. Among prominent philosophers, there are two distinct viewpoints on time. One view is that time is part of the fundamental structure of the universe, a dimension in which events occur in sequence. Sir Isaac Newton subscribed to this realist view, and hence it is sometimes referred to as Newtonian time."* http://en.wikipedia.org/wiki/Time

This theory supports the above realist view of Newtonian time.

"The second law of thermodynamics is an expression of the universal principle of decay observable in nature. It is measured and expressed in terms of a property called entropy, stating that the entropy of an isolated system which is not in equilibrium will tend to increase over time, approaching a maximum value at equilibrium; and that the entropy change dS of a system undergoing any infinitesimal reversible process is given by δq / T, where δq is the heat supplied to the system and T is the absolute temperature of the system.

Entropy (arrow of time)

Entropy is the only quantity in the physical sciences that "picks" a particular direction for time, sometimes called an arrow of time. As one goes "forward" in time, the second law of thermodynamics says, the entropy of an isolated system will increase when no extra energy is consumed. Hence, from one perspective, entropy measurement can be thought of as a kind of clock—although not really an accurate measure of time."

Originally Posted by **Wikipedia**

The problem with time and gravity
Time, which in itself is a difficult subject, is made more difficult because we cannot 'look' at it from the outside, nor can we divorce ourselves from it in any way. This is very much like the problems we have in understanding gravity. The problem is compounded by having a limited language that frequently leads to what appears to be contradictions.

Everything in the universe is made of energy but energy; on its own does not a universe make.

The universe is made of two things, energy and matter. Time is an expression of that relationship. The universe has to contain both energy and mass (gravity) for the concept of either time or universe to have any real meaning.

$E = mc^2$

$c^2 = E/m$

$c = \sqrt{E/m}$

$c = d/t$

$d/t = \sqrt{E/m}$

$c^2 = E/m$

Where E = *energy*, m = *mass*, c = *speed of light*, d = *distance*, t = *time*

We can see from this that as m goes toward *0*
E goes towards ∞
Then the speed of light goes toward ∞

We can also see that as if $m = \infty$ it can only do this if $E = 0$
In which case
The speed of light is *0*

We can see from the above that looked at in this way the speed of light can vary between *0* and ∞.

$d/t = \sqrt{E/m}$
$d = \sqrt{E/m} \times t$
$d = \infty$

We can see that in a **hypothetical universe that contains energy but no matter** the 'Speed' of light and distance are both infinite. If you have an infinite rate of flow of time then the speed of light would be infinite. However, without gravity there is no arrow of time, so the concept of time becomes meaningless, hence the speed of light, in that scenario is meaningless. What we can say is that light 'travels' instantly and without causality in all possible directions and to infinite distance, although in this scenario, the concept of distance is also meaningless.

Likewise in a **hypothetical universe that contains only matter and no energy** the speed of light is *0*. Therefore, time does not exist.

$d/t = \sqrt{E/m}$
$d = \sqrt{E/m} \times t$
$d = \infty$

Distance is zero.

How can you have a universe in which time does not exist? If we think of a hypothetical universe containing only mass, the mass is contained within a singularity. It contains zero space-time. If we introduce energy then it must be contained within the Schwarzschild radius, as there is 'nothing' outside. By increasing the energy level, the Schwarzschild radius increases. The universe is by definition contained within a Schwarzschild radius.

Matter plus energy = space and time.

It contains an arrow of time but the clock never ticks. Matter is the only thing in this universe (and its associated gravity) so the arrow of time must be a product of matter/ gravity.

We can see that in a **hypothetical universe that contains energy but no matter** the 'speed' of light is infinite. Theoretically, if you have an infinite rate of flow of time then the speed of light would be infinite. However, without gravity there is no arrow of time, so the concept of time becomes meaningless, hence the speed of light, in that scenario is also meaningless. What we can say is that light 'travels' instantly and without causality in all possible directions and distances. *Another way of seeing this scenario is to say the speed of light is infinite in both* ***directions as the arrow of time is equally double ended.*** *I will use this term in the remainder of this paper as by retaining 'time', it allows things to happen within 'time' even if there is no causality.*

From the above we can see that although the speed of light is infinite it has no direction.. In which case it must flow in all possible directions. Keeping it as simple as possible let us assume that the arrow of time has just two directions, forward and backward. We know the arrow points forward but if antimatter is ordinary matter with a reversed arrow

of time then the arrow of time is double ended. In which case *m* in any of the above terms can be replaced with *m* + -*ma* where ma is antimatter.

From the above we can see that it is the interplay of energy and mass that we call time. Or more correctly 'flexi-time' henceforth referred to as ∫(t). Energy, what does it do, it wants to dissipate over the largest possible volume of space in the shortest possible time. This process is entropy.

We have also seen that mass wants to 'slow photons down'. (Now we are getting into the language problem) What we can see, so far is the interplay of energy and mass are what we call flexi-time or ∫(t). The rate of flow of time in the universe is its energy divided by its mass. Mass curves space time and this space-time curvature is called gravity. Therefore, we could say that the flexi-time in the universe is equal to the square root of its energy divided by its gravity.

$c = t\sqrt{E/m}$
As speed is distance divided by time then distance and time are both relative terms.
$d/t = \sqrt{E/m}$

$d = t\sqrt{E/m}$

We can see that as m goes toward 0. E goes toward ∞
So d goes toward ∞
and
$t = d/\sqrt{E/m}$

If d = ∞ and E/m is infinity then √E/m is still infinity, so one could think that ∞/∞ = 1 but that would be wrong in this case as √∞ must be smaller than ∞ and ∞/ any number is ∞.

We can see that in a hypothetical universe that contains energy but no matter flexi-time is infinite (in both directions) as is distance.

Let us look at the opposite situation where mass is infinite and energy = 0.

$d = t\sqrt{E/m}$

We can see that as m goes toward ∞ then E goes towards 0
And
$d = t\sqrt{E/m}$
$E/\infty = 0$
d = 0 We can see that in a hypothetical universe that contains matter but no energy the rate of flow of time is 0 as is distance.
Therefore this universe must be contained within a single black hole singularity.

When Einstein wrote $E = mc^2$ he was explaining how mass and energy are related through the speed of light. The energy mass equivalence formula was possibly not meant to explain some of what I have used it for here. However, I am only considering the same things as Einstein considered, the relationships between energy, mass, the speed of light, time and distance. Therefore, I believe $E = mc^2$ is a valid tool to examine and predict certain characteristics of the universe. As you have just seen, it explains what 'time'is.

You may be confused by the use of the term flexi-time or ∫(t), if so a reminder. **Flexi-time or ∫(t) is used to convey the meaning that the passage of time is variable. Although it is constant within its own reference frame, from any other reference frame it can be variable. (This is unlike light, which is a constant speed in a vacuum for all reference frames.)**
I have also considered the speed of light to be 0 and ∞ which quite obviously it cannot be, this was by way of math's to see what was predicted. Einstein made it quite clear that the speed of light is invariant to all observers in any reference frame. He did not add "within the universe". He presumably thought he did not have to. Sometimes, taking a hypothetical look at the universe from an outside reference frame clarifies what's going on inside. Einstein was trying to make sense of the universe and he did a superb job of showing the mass energy equivalence principle bound together with the postulate that the speed of light in a vacuum is constant. This constant, the speed of light is the single most fundamental constant; it is upon this that all constants of nature depend.

For the speed of light to be a constant, there is only one-way, this can happen; light has to be the universal clock, the heartbeat of the universe. We measure this heartbeat as speed. Speed being distance, divided by time. Theoretically, the universe could have distance and time as standards but it does not for this reason. We know from Relativity that clocks vary in speed and measuring rods change their length. For the speed of light to be a constant flexi-time has to be variable. Speed is distance divided by time, so by having a variable flexi-time distance (length of a meter) is a standard.

From the above we have seen that the energy mass ratio in the universe is what defines the passage of flexi-time in the universe. Although is obvious that the 'total energy' (mass energy $E = mc^2$) of the universe must remain constant. (The first law of thermodynamics) The mass energy ratio is continually changing in accordance with $E = mc^2$. Stars convert mass into energy for example.
$\int(t) = c = d/t = \sqrt{E/m}$
As $\int(t) = \sqrt{E/m} = c$ then for c to remain a constant ∫(t) has to be a variable.
As $c = d/t$ then distance has to be a constant.
Another way of looking at this are, the speed of light and distance are a constant because the rate of flow of time is a variable.
This was shown to be the case by Einstein when he showed that clocks run slower [∫(t) is slower] in a gravity well.
This is shown by $\int(t) = \sqrt{E/m}$. As gravity increases (due to an increase in mass) so ∫(t) decreases.

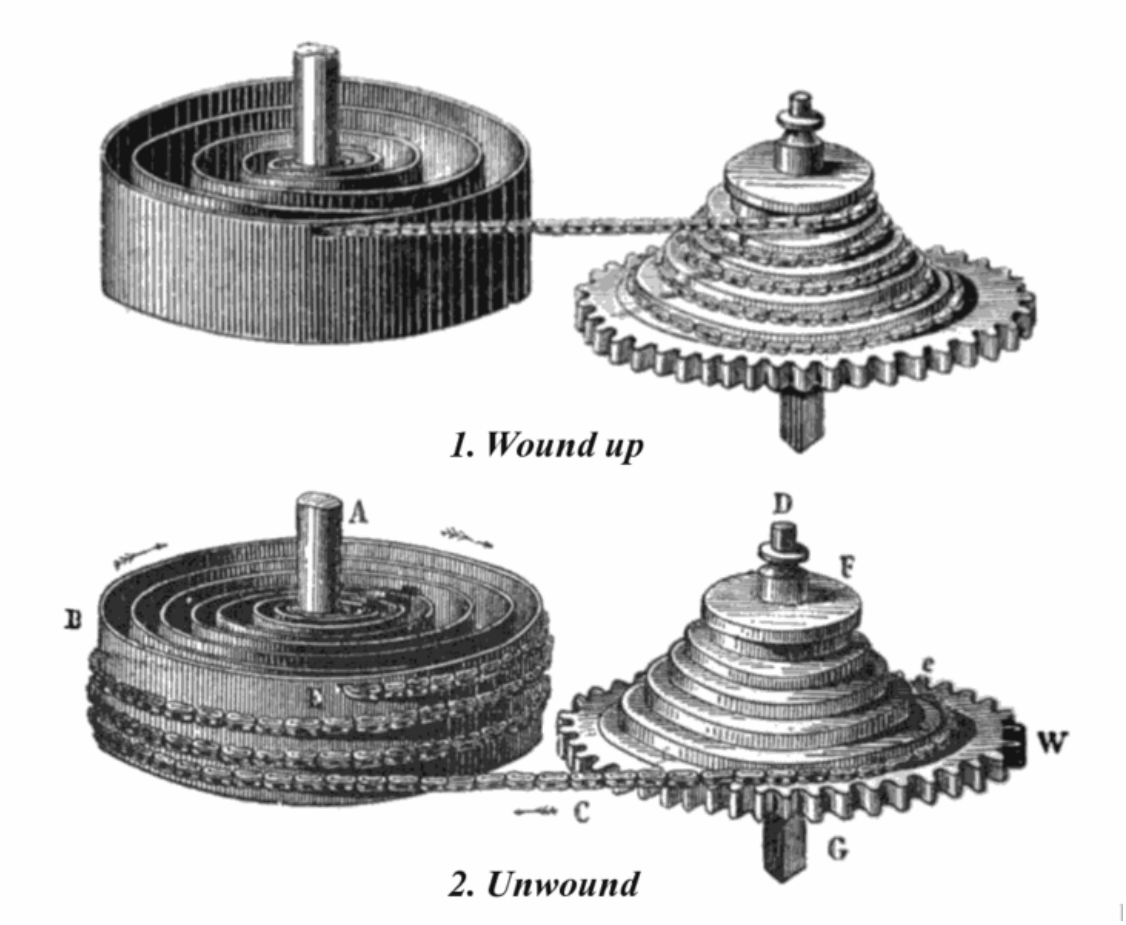
Flexi-time is real, not abstract, it is the energy of the universe divided by its mass. The universe can be considered a very large clock.

How does the universe 'tick'?

The clockmaker can adjust the speed of the clock, he can make it run fast or slow. (Flexi-time means that as the clockmaker makes the clock run fast or slow, he is not doing that within time but it is time itself that is being dilated or contracted.) He can disable the governor or regulator, in which case it will run down essentially instantly or he can stop the clock. In this universe, the beings that inhabit it will not experience any changes whether the clock runs fast or slow. To them the passage of time, flexi time, will remain the same within their time frame. It is flexi time that allows the speed of light to be a constant.

Lets use the analogy of a mechanical clock to explain what I mean by flexi-time or $\int(t)$.

A clock needs a power source to supply the energy to drive the mechanism and a regulator to stop it from running down all at once. The regulator in a mechanical clock is called the escapement. It is called the escapement because it only allows one tooth of a cog to escape at once. This motion is geared down and rotates the hands on the face of the clock. The escapement may use a pendulum as the timekeeper. A pendulum of 39 ¼ inches swings once per second (1 meter). In a grandfather clock the energy to drive the mechanism comes from converting the potential rest energy of mass contained in a weight on a string or chain as it slowly falls being regulated by the escapement. The weight has constant mass so gravity pulls at it with a constant 'force'. The energy of the system is constant. The escapement applies a small amount of energy to the pendulum at every tick otherwise, the clock would stop. The pendulum swings at a given rate depending upon the energy applied to it in every swing, it's length and gravity. For a clock to keep accurate time, the energy applied to the pendulum via the escapement must be constant but escapements are not perfect. In a weight driven clock this is no problem as gravity is constant. However, most clocks use the energy of a wound up spring to operate. This has the problem that a fully wound spring exerts more force on the mechanism tending to make the clock run fast. When the spring is unwinding, it contains less energy and the clock runs slower. This was obviously an unsatisfactory arrangement and with the arrival of trains, accurate clocks became a necessity. The answer to this dilemma, the fusee was a good mainspring compensator and used in train stations, by the military and Post Offices all over the world for many years. The principle being that as the mainspring unwound the variable ratio due to the conical driven shaft would compensate and keep the force applied to the mechanism and pendulum constant.



The whole point of this being to obtain a constant "speed' independent of the energy and gravity ratio.

Do you see it?

This is exactly what the universe does. It takes a varying ratio of energy (photons) and matter (gravity) and produces a constant speed. The speed of light

At the start of this section, I referred to a mechanical clock as an analogy. As you can now see, it is not. Both the universe and a clock derive the rate of flow of time from the same process, which is the division of energy by gravity.

If you are still following me then you can see that the speed of light in a vacuum is a constant because the rate of flow of time is a variable. This still begs the question what makes light special? It is special because it is the most fundamental of 'particles' out of which everything else is made. It is special, I believe, because it contains its own unique clock in the sense that it travels at constant speed in a vacuum. What does that mean it contains its own clock. The photon being the only massless particle can only travel at the

speed of light; it is born and dies at that speed. It experiences no passage of time. How can something travel at the speed of light without experiencing time?
Speed v is distance d divided by time t,
$v = d/t$
$t = d/v$
If the speed of light is infinite then it takes no time to travel an infinite distance. Einstein said that the speed of light in a vacuum is a constant. *This paper proposes that the speed of light is the ratio of energy divided by matter and that* ***the speed of light in a vacuum when not subject to gravity is infinite.***

A photon travels infinite distance instantly in a vacuum if not subject to gravity but is 'slowed' down by gravity endowing upon it finite speed.

Speed is distance / time. It would be more technically correct to say that gravity does not influence the speed of light because gravity does influence time in precisely the right way.

The Equivalence of Energy and matter
The two most fundamental things are the speed of light and the frequency of vibration of an electron. In the Rutherford picture of an electron the frequency of light emitted is the same as the orbital frequency of that electron. The Bohr picture is a little different but at high energy levels, they are virtually the same.

Rutherford	Bohr
$f_{light} = f_{electron}$	$f_{light} = \Delta E / h$

As we can see that the frequency of light emitted is the same as the orbital frequency of that electron, the two being equivalent we could choose either the speed of light or the orbital frequency of an electron as the fundamental constant, the "clock". The speed of light would seem, in a way to be more fundamental as matter is created from energy.
All of the other constants of nature are constant in regard to the speed of light. However, the speed of light is only a constant because the rate of flow of time is a variable.
A photon is the most fundamental object. It carries the arrow of time because it is both emitted and absorbed. It quantifies the rate of flow of time as it travels at the speed of light but the photon experiences no passage of time itself. As it has no mass it is unaffected by gravity but can tell us the relationship between itself and gravity.

During the twentieth century, the speed of light in a vacuum has reached the theoretical status of a "universal constant", a fixed value of c0 = 299,792,458 m s −1 being chosen in 1983 as a basis for the international unit system.

Gravitational time dilation
General Relativity allows for both relativistic time dilation and mass to affect the rate of flow of time. Mass slows the rate of flow of time as does traveling near the speed of light.

*"**Gravitational time dilation** This has been demonstrated by noting that atomic clocks at differing altitudes (and thus different gravitational potential) will eventually show different times. The effects detected in such experiments are extremely small, with differences being measured in nanoseconds."*
From Wikipedia, the free encyclopedia

The relative rate of flow of time
As the rate of flow of time in the universe is proportional to the amount of energy divided by its mass (matter), a stationary observer from his reference frame in the universe will always experience the same passage of flexi-time. However, a distant observer outside the universe would perceive a very different passage of flexi-time in his reference frame. One hour to the observer within the universe could represent one minute or a million years to the observer outside. Also the outside observer would see clocks running at different rates and measuring rods contracting and expanding all over the universe.

Conclusion

"Time…is what allows things to happen in sequence but keeps everything from happening at once".

We can now explain the above statement:-

"Time" – the dynamic relationship between energy and mass (or energy and gravity).

"is what allows things to happen in sequence" energy does work and in so doing dissipates (entropy increases)

"but keeps everything from happening at once" energy is slowed down by gravity (mass).

Time is a measure by which things happen, the yardstick of causality and is a fundamental property of the universe. The direction of the arrow and rate of flow of time equals the square root of the energy of the universe divided by its gravity.

Mass gives an arrow to time (forward for matter, reversed for antimatter); energy gives it a 'rate of flow'. The interaction of mass (gravity) and energy is what we call time.

The speed of light in a vacuum without the influence of gravity is infinite. In the real universe, gravity *'slows'* the photons down endowing them with finite speed. It is this *'slowing down'* of photons by gravity that we call time. The rate of flow of time is a variable so that the speed of light is a constant. Any fuzziness in understanding this is probably due to language being inadequate. For c to be a constant speed, it has to be directly tied to flexi-time or ∫(t).

As the frequency of light emitted by an electron is the same as the orbital frequency of that electron, it is another way of seeing the duality of energy and mass.

Entropy is the main example of the arrow of time as it shows order to chaos increasing over time. However, it is not the 'physical', arrow, which is either matter or antimatter depending upon the universe. The arrow points toward the source of gravity.

Gravity

$\int(t) = \sqrt{E/m}$

$c = \sqrt{E/m}$

In a black hole gravity is infinite so passage of time is 0

When $g = \infty$ then speed of light = 0 and $\int(t) = 0$

So if $g = \infty$ then $\int(t) = 0$
And if $g = 0$ then $\int(t) = 0$

So ∫(t) and c are inversely proportional to gravity or
Gravity is inversely proportional to flexi-time.
$g = 1/\sqrt{E/m}$

Everything in the universe is made from Energy.
Energy when un-hindered by gravity wants to dissipate over the largest possible volume instantly.
Everything in the universe is made of energy and matter.
Matter has gravity that wants to shrink all matter to a singularity.

Energy and matter interact. That interaction of gravity 'slowing' energy down is what we call time.
The interaction also creates space.
Energy wants to make space expand.
Gravity wants to make space contract.

Energy, mass, time, gravity, space, acceleration and entropy are all related. Gravity is the deformation of space time by mass in trying to:-

1) reach the lowest energy level (0 ground state)
2) reach the highest entropy level
3) reduce the universe to its minimum size
4) reduce the rate of flow of time to a minimum

Each of the above are equivalent and are saying the same thing but in different ways. All of the above conditions are satisfied within a black hole.

The universe has an average flexi-time but in any locality, this can be variable.
Likewise
The universe has an average strength of gravity but in any locality, this can be variable.

The infinite speed of a photon in a vacuum not subject to gravity, when slowed by gravity has a certain speed. Speed is distance divided by time. $v = d/t$
$\int(t) = \sqrt{E/m}$
So $v = d/\sqrt{E/m}$
Another way of thinking about this is a photon traveling at infinite speed when slowed by gravity looses energy. Flexi-time adjusts in just the right manner to cancel the effect and the speed of light remains a constant.

Zero size and time when 'stretched' (expanded) by energy creates space and time. The universe is trying to return to a singularity with no energy, space or time, this is what we call gravity. Gravity squeezes mass into a singularity. While entropy is the term used to describe energy reduction (by conversion to matter or absorption by a black hole or both)
$g = 1/\sqrt{E/m}$
and $v = d/\sqrt{E/m}$
$\sqrt{E/m} = c$
therefore $g = 1/c$

The speed of gravity, $v.gravity = 1/c$, taking c as 1 then
The speed of gravity is 1, the same as the speed of light.

"Newton thought that gravity's force was instantaneous. Einstein assumed that it moved at the speed of light, but until now, no one had measured it," said Sergei Kopeikin, a physicist at the University of Missouri-Columbia.

"We have determined that gravity's propagation speed is equal to the speed of light *within an accuracy of 20 percent," said Ed Fomalont, an astronomer at the National Radio Astronomy Observatory (NRAO) in Charlottesville, VA. The scientists presented their findings to the American Astronomical Society's meeting in Seattle, WA. January 7, 2003* http://www.nrao.edu/pr/2003/gravity/

If we think of a hypothetical universe containing only mass, the mass is contained within a singularity. It contains zero space-time. If we introduce energy then it must be contained within the Schwarzschild radius, as there is 'nothing' outside.

Matter plus energy = space and time.

By increasing the energy level, the Schwarzschild radius increases. The universe is by definition contained within a Schwarzschild radius.

How does gravity work?
All mass has potential energy as it is in a gravitational field. If two massive objects combine their joint mass creates a slower (dilated) flexi-time than either of them experienced individually. An increase in mass causes flexi-time to dilate. Flexi-time dilating is equivalent to a reduction of energy.
In other words when two massive objects combine they loose energy and flexi-time for them dilates. See points 1 to 4 above.
This process if not stopped by some other action the will continue until the universe is contracted to a singularity with no energy, space or time.

John Wheeler famously said, *"Matter tells Space-time how to curve, and Space-time tells matter how to move."*
We call it gravity when referring to how mass tells space-time to curve. We call it entropy when space- time tells mass how to move. Both take place within space-time.

Entropy is the main example of the arrow of time as it shows order to chaos increasing over time. However, it is not the 'physical', arrow, which is either matter or antimatter depending upon the universe.

If we consider a hypothetical universe that contains a black hole, mass and energy, it makes it easy to understand both time and gravity.

A black hole has gravity, gravity although by itself is not 'time' does contain the arrow of time. the arrow points toward gravity (the singularity). Everything moves in space time toward that singularity which ultimately, unchecked, will devour all matter, space and time.

Size of the universe
The size of the universe is dependent upon the total amount of energy (including mass) that it contains and its energy/mass ratio at any given time.

Static, expanding or contracting?
Although the total amount of energy in the universes is finite, its energy/mass ratio is continually changing. Therefore, the universe cannot be static. While stars still convert mass into energy at a high enough rate, energy will continue to expand the universe. When energy production decreases below a certain threshold gravity will cause the universe to collapse.

Overall Conclusion

Time is

The speed of light in a vacuum without the influence of gravity is infinite. In the real universe, gravity *'slows'* the photons down endowing upon them a finite speed. It is this *'slowing down'* of photons by gravity that we call time. The rate of flow of time is a variable so that the speed of light is a constant. For c to be a constant speed, it has to be directly tied to flexi-time or ∫(t).
The passage of time or flexi-time is the square root of the energy of the universe divided by its mass.
$\int(t) = \sqrt{E/m}$. where $\int(t)$ *is flexi-time,* m is mass or $\int(t) = \sqrt{E/m + -ma}$ where m is matter and ma is antimatter. Time is counting down to reach points 1 to 4 below.
Although entropy carries the main arrow of time, matter and antimatter carry the physical arrows. The arrow itself is gravity and it always points towards mass.

Gravity is

A clock runs faster (flexi-time is faster) in space than it is on the surface of the Earth. This slight warping of space time is what causes gravity. Remember, gravity is an outcome of the energy/mass ratio of the universe as is time. Mass always seeks to exist in a slower flexi-time, this is gravity.

All mass has potential energy as it is in a gravitational field. If two massive objects combine their joint mass creates a slower (dilated) flexi-time than either of them experienced individually. An increase in mass causes flexi-time to dilate. Flexi-time dilating is equivalent to a reduction of energy.
In other words when two massive objects combine they loose energy and flexi-time for them dilates. See points 1 to 4 below.

Gravity is the deformation of space-time by mass in trying to:-

1)	reach the lowest energy level (0 ground state)	0	
2)	reach the highest entropy level	∞	*
3)	reduce the universe to its minimum size	0	
4)	reduce the passage of time to a minimum	0	

Each of the above are equivalent and are saying the same thing but in different ways.
All of the above conditions are satisfied within a black hole.

*2) Another way of looking at this is, if there is no energy there can be no entropy so this could also be regarded as 0. If there is no space or time then entropy would be 0. However, entropy exists until the black hole consumes everything.

The speed of gravity is the same as the speed of light in a vacuum.
The arrow of time is gravity, which points towards mass.

Space is

Space is the, three-dimensional extent in which objects and events exist and have relative position and direction plus it has the fourth dimension of time. The three dimensions of space-time and one of time are possibly not discrete but interwoven.

Space is a volume that is both filled with energy and gravity. Without energy, there will be no space. Without gravity, there will be no space.

Everything in the universe is created from energy

The universe contains energy and matter

The relationship between energy and matter creates time and space

Gravity is an attribute of matter

The creation of time
Photons in a vacuum when not subject to gravity travel infinite distance instantaneously. Gravity 'slows' the photons endowing them with a finite speed within a finite 'space'.

The creation of space
The 'pressure' of photons inside the Schwarzschild radius of a singularity creates space and time.

The creation of gravity
The resistance of space and time to being created is known as gravity.

Cosmological constant
Energy is the 'force' that drives the expansion of the universe. No cosmological constant is required.

This paper covers both Time and Gravity. Of necessity, it also covers the universe in a limited manner but is not meant to be a paper on the universe. A paper on the universe is published separately.