Paper 2: The Properties of Matter and Space

By Grant Witheridge, BE, MEngSc, Catchments and Creeks Pty Ltd, Bargara, Queensland, Australia, June, 2022

Executive summary

From our observations of gravity we learn that something in the mechanics of gravity has the ability to both store and release energy, and that this energy can exert a force on physical matter. From the propagation of gravity waves we learn that spacetime is a continuous entity. From our observations of the frictionless movement of matter through space we learn that space (or more correctly what fills space) has the properties of a superfluid. And from our observations of planet and galaxy spin we can speculate that what fills the space around planets and stars most likely has the properties of mass and inertia.

All of these observations allow us to speculate that dark matter surrounds all physical matter, and that this space has the ability to hold large amounts of energy.

Space, however, does not exist as a specific entity, it exists only as a concept. What creates the properties of space is not the 'space', but the substance that fills the space. Ironically however, what fills space is likely to be mostly made of empty space. The energy of time (time energy) is expected to exist throughout all of space, and it is likely that time energy is what has commonly been referred to as dark energy.

1. Introduction

Education helps a person to recognise what they are seeing when they expect it, and experience helps a person to know what to expect when they see it. My observations of astrophysics leads me to believe that spacetime shares many of the properties of fluid mechanics. Through this paper I will try to compare my observations of astrophysics with my professional knowledge of fluid mechanics.

The aim of this paper is to demonstrate that the fluid-like behaviour of spacetime is not limited to just the propagation of gravity waves. In the short-term I will use the term 'spacetime' to refer to the substance that fills space, which may include time energy, dark matter, and/or dark energy.

Throughout this paper I will try to refer to the rotation of plants, stars and galaxies around their own axis as 'spin', and the movement of plants, stars and galaxies around a distant axis as 'rotation'. However, this is not a strict rule, and some exceptions do exist in order to improve the readability of the paper.

2. What is matter?

Albert Einstein presented the energy equation $E = m.c^2$, which implies that matter can be converted to energy, which suggests that matter is simply the product of concentrated energy.

If we accept that matter is the product of concentrated energy, then this means humans and everything we interact with is ultimately made of the same thing; energy. This means that there is really no such thing as physical matter, there is just energy in different forms.

So what about everything we see, smell and touch, is this matter real, or is it just something that appears to be real? Consider the following discussion.

Sight:
Firstly, electromagnetic radiation does not produce 'light'. Light is only produced within the minds of some living creatures. Electromagnetic radiation only becomes visible to humans because its photons are capable of causing electronic excitation within all molecules, which leads to changes in the bonding, or chemistry, within the visual molecule retinal of the eye, which in turn triggers the sensation of vision.

This means that stars do not produce light, only the brain can do that; therefore the whole universe actually exists in permanent darkness!

Colour:
Colour is only produced within the minds of some living creatures; therefore, the universe exists without colour.

Sound:
Noise is only produced within the minds of some living creatures; therefore, the universe exists in total silence.

A tree does not create a noise when it falls in a forest, even if people are there to hear the noise. A falling tree produces only waves of air pressure, which are caused by molecular repulsion. These air pressure fluctuations are detected by our ears, which send an electrical signal to our brain, and only then is the 'idea' of a noise created. An actual 'noise' is never created.

Smell:
The sensation of smell is produced only within the minds of some living creatures; therefore, the universe exists without smell.

Taste:
Taste is the perception produced or stimulated when a substance in the mouth reacts chemically with taste receptor cells located on taste buds in the oral cavity, mostly on the tongue, which can detect five taste modalities: sweetness, sourness, saltiness, bitterness, and savouriness. The sensation of taste is produced only within the minds of some living creatures; therefore, the universe exists without taste.

Touch:
Objects that we have traditionally referred to as 'matter' cannot physically touch each other. Molecular repulsion prevents any direct contact from occurring. The sensation of touch is registered by sensory neurones, which in turn send messages to our brain, which then creates the sensation of touch, even though no physical contact actually occurs.

However, 'touch' involves an action that is not created within the brain. The concept of touch, and therefore physical contact, exists because some forms of energy can take on the properties of mass, inertia, and the ability to exert a force. It is the 'force' that causes pain and injury, not the 'touch'.

Heat:
The existence of heat is also an action that is not solely created within the mind of living creatures. It involves a transfer of energy, and sometimes a transfer of matter.

Momentum and inertia:
Similar to the principles of 'touch', momentum and inertia exist because some forms of energy can take on the properties of mass, and the ability to exert a force on a mass.

3. What is space?

How big is space, what is space made of, and when was space made?

There are at least three possible definitions of the size of space:

- space as defined by the location of distant galaxies (i.e. visible space)
- space as the region through which light has travelled (i.e. the creation of space and time through the movement of light); or
- space as an entity with fixed dimensions that existed before the Big Bang.

If space did not exist prior to the Big Bang, then the extent of space would be defined by the travels of the first rays of light that left the Big Bang 13.77 billion years ago.

The only way for space to have existed **prior** to the arrival of light would be for space to have existed prior to the Big Bang (which is what some experts believe). This would mean that space would likely have achieved its maximum size prior to the Big Bang.

If Time was formed from energy during the Big Bang, then the energy of time would likely be spreading out across space, which would suggest that Time, and the rate of time, are both slowing with time (i.e. as Time spreads through space). Time would at least have to exist wherever light travels, because light cannot travel without Time.

In my opinion, there is no element or substance that exists as 'space'. When we talk about 'space' we are actually talking about what fills the space, rather than the structure of space. If we imagine space as a balloon, then ultimately it is the properties of the material that fills the balloon that governs the behaviour of the balloon, for example, an air-filled balloon, a water-filled balloon, and a helium-filled balloon all behave differently.

The substances that could fill space include:

- physical matter
- dark matter
- light
- time, and
- dark energy.

4. The ability to store and release energy

In Paper 3, '*An Alternative Theory of Gravity'* I provide four possible explanations for the mechanics of gravity. In the paper I suggest that gravity results from spacetime pushing inwardly on physical matter (i.e. pushing inwardly on the Earth), and not from an internal force pulling matter inwards towards the centre of the Earth.

In this case the term 'spacetime' has been used to describe the entity that fills the space around the Earth (and other large objects of mass), and which uses either dark energy, or a time density gradient, to generate the force of gravity.

If an object of mass is lifted to a higher elevation, it is said to have gained potential energy in the form of 'height'. However, height is not a form of energy, it is only a measure of the potential work that this energy can perform. The potential energy generated by the lifting of an object is stored within the additional 'stretching' of spacetime. If the same object is released from a height, then spacetime will inject energy into the system similar to the relaxing of a stretched elastic band.

However, the mechanics of spacetime differs from the mechanics of an elastic band because the force generated by the stretching of spacetime reduces as the stretching increases, while the force generated by an elastic band increases as the stretching is increased.

Energy is imparted into an object of mass through the actions of a force, a force we know as 'gravity'. It can therefore be concluded that spacetime has the ability to both store and release energy, and that spacetime also has the ability to impart a force onto physical matter.

5. The propagation of gravity waves

A gravity wave (or gravitational wave) is said to be a 'ripple' in spacetime, and it has the ability to alter the force of gravity. Fluid mechanics tells us that such a wave could only move through space if space is formed from a continuous entity (a continuum).

Even though it has been reported that parts of space contain as little as one proton per cubic metre, this proton must exist within a continuous, but undetectable, substance (such as dark matter, or time energy) in order to allow the propagation of gravity waves.

There are two possible explanations for the movement of gravity waves, either:

- space is filled with dark matter that can facilitate the movement of a time density gradient; or
- 'Time' exists as a form of energy (i.e. time energy or dark energy), and this time energy exists as a continuous entity throughout space.

This means there is no such thing as an absolute vacuum in space. However, if a 'vacuum' were redefined as a region of space in which there is no physical matter, then space can largely be treated as a vacuum. If time energy exists, then it seems logical that time energy would exist throughout space, possibly at varying degrees of time density, and it is through this time energy that gravity waves travel.

6. The frictionless properties of spacetime

Planets, stars and galaxies are known to be able to move through space with virtually no loss of speed or energy. This suggests that space is effectively frictionless, meaning that space acts like a superfluid.

However, this paper will present the theory that what fills the space around stars and planets most likely has some of the properties of matter, and thus it must begin to lose some of the properties of a superfluid when it is near physical matter.

7. The rotation of real fluids

It has been suggested that the rotation of galaxies, and the spinning of stars and planets, is a consequence of the conservation of the rotational momentum generated within the original gas cloud. If this were correct, then it would seem logical that all the planets in our solar system would have developed similar directions of spin, with a similar axis of rotation, but Table 1 shows that this is not the case.

Table 1 – Planet spin axis and spin period

Planet	Axis	Period
	degrees	Earth days
Mercury	0	58.6
Venus	177.4 (anticlockwise)	243
Earth	23.4	1.00
Mars	25.2	1.03
Jupiter	3.1	0.41
Saturn	26.7	0.44
Uranus	97.8	0.72
Neptune	28.3	0.67

Using the principles of fluid mechanics I would like to present an alternative description of how planets, stars and galaxies could develop both rotation and spin. I have no data to support the following theory—it is just an idea.

I will begin this discussion by first describing the mechanics of water rotation as it approaches a drainage hole (Figure 1), and then the rotation of atmospheric pressure cells (Figure 2).

When you pull the plug from a bath filled with water the following outcomes may be observed:

- while the water remains relatively deep, the plug hole (outlet orifice) will discharge the water in a fully drowned condition, and there will be no obvious rotational flow patterns on the surface of the water
- as the water level falls there will be a point where the surface of the water begins to rotate (spin)
- eventually a visible whirlpool may form, which could rotate either in a clockwise or anticlockwise direction
- towards the end of the discharge the rotating motion may stop, and the water will once again flow in a relatively straight trajectory towards the plug hole.

Figure 1: Hydraulic whirlpool above a drowned waterway culvert (not a bath!)

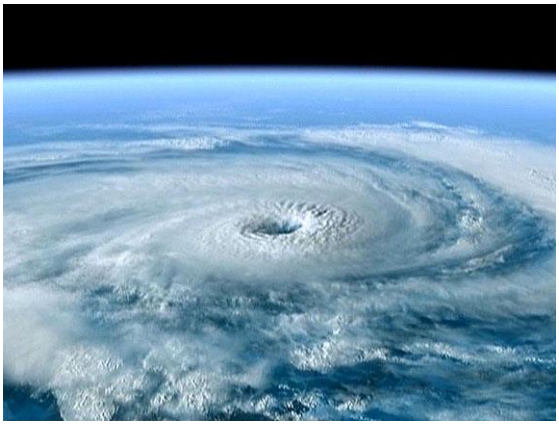

Figure 2: Rotating (spinning) low pressure cell in the southern hemisphere

So why does the water develop a whirlpool? What force is involved? And do all whirlpools in the southern hemisphere rotate in the same direction?

While the water in the bath remains relatively deep, the water will approach the drainage hole along a relatively simple trajectory with curvature only in the vertical plane. In hydraulics we draw this flow pattern using either streamlines or a flow net. The force that drives this motion is obviously 'gravity', which causes a pressure difference to exist within the water.

As the water level falls, the effective flow area around the plug hole becomes smaller and smaller. Consequently, the approach velocity of the water not only increases due to the pressure difference, but also because the effective flow area through which the water travels is decreasing, which further distorts the flow net.

While the water depth is relatively shallow, the flow conditions in the bath will be dominated by the flow's horizontal momentum. When the water reaches the drainage hole this horizontal momentum needs to be replaced by vertical momentum. But you cannot convert horizontal momentum into vertical momentum without a force, and the only force available is gravity, which is a relatively weak force.

As the water approaches the drainage hole, the flow's horizontal momentum causes the water to flow past the edge of the drainage hole, similar to water approaching the edge of a waterfall (Figure 3). However, because a drainage hole is round, the water will approach the drainage hole from all directions, which means the water must compete with the surrounding water in order to move towards the centre of the drainage hole.

If the water continues to approach the drainage hole along a near horizontal trajectory, then the water above one side of the drainage hole will try to move into the space currently being filled by the water approaching from the other side. Such flow conditions are unstable. Eventually some disturbance in the water will cause the water to move into a spiral pattern, which allows the water's

horizontal momentum to be converted into angular momentum without the need of a significant force (Figure 4).

The resulting whirlpool is a stable hydraulic condition that feeds itself energy until the rotational velocity equals the velocity of the approaching flow. Once a whirlpool is formed, the active centrifugal forces within the whirlpool force the water to move closer to the outer surface of the drainage hole (i.e. the opposite outcome to the previous non-whirlpool flow condition).

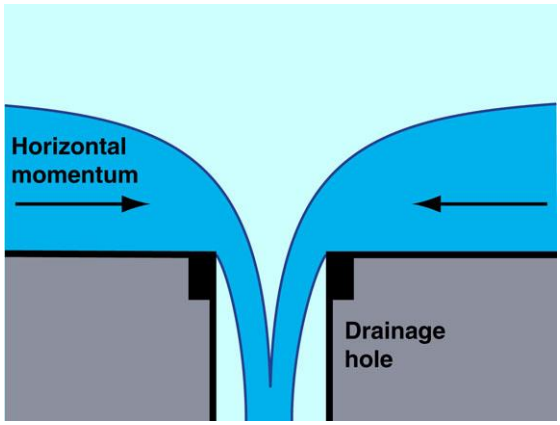

Figure 3: Likely flow conditions at a drainage hole if a whirlpool vortex is not formed (side view)

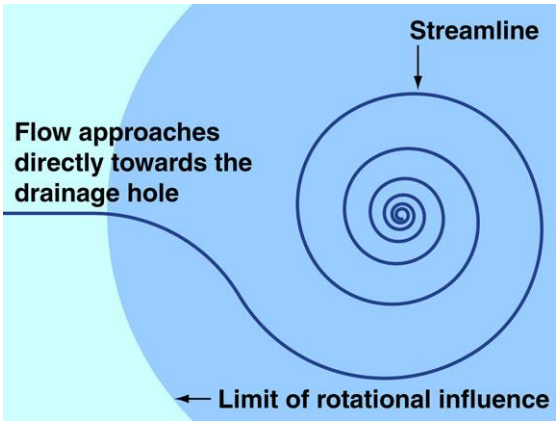

Figure 4: Induced whirlpool vortex at a drainage hole (viewed looking down towards the drainage hole)

Given time, similar whirlpools can develop in deep water conditions (Figure 1), but your typical bath tub drains too quickly for a deep water whirlpool to form.

One way to think of the water approaching a drainage hole is to consider a bowling ball rolling down a bowling lane. The floor of a bowling lane is slightly curved, with a 'flat' crest running down the centre of the lane. On either side of the bowling lane are the channels (Figure 5).

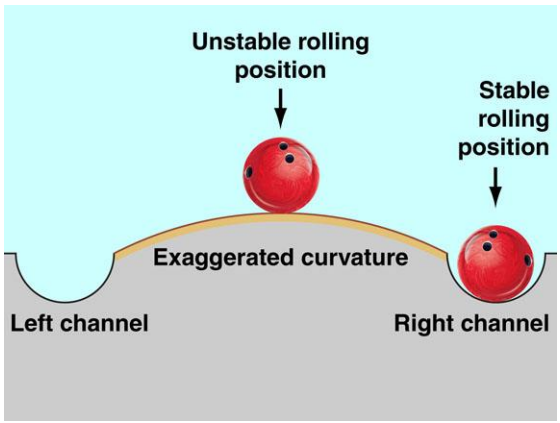

Figure 5: Stable and unstable rolling conditions (Ten pin bowling lane)

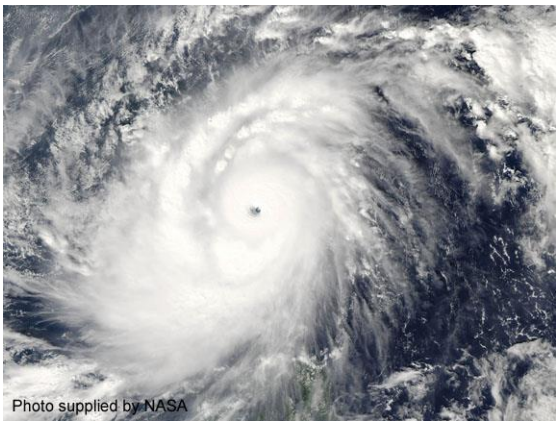

Figure 6: Anticlockwise rotation of a low pressure cell in the northern hemisphere

Initially the bowling ball may spend some time travelling along the centre of the lane, but given enough time, the ball will either fall to the left, or to the right, and then drop into one of the side channels. However, due to the relative short length of a bowling lane, there is a good chance that the ball will hit the pins before it falls into one of these side channels.

The passage of the bowling ball down the centre of the lane is considered to be unstable because of the curvature of the floor. Similarly the passage of water moving along a straight path towards a drainage hole is unstable because of the influence of the surrounding water, which is trying to compete for the same space above the drainage hole.

All that is required is for a minor disturbance to cause the bowling ball to move towards either the left or right channels. Similarly, if the water approaching a drainage hole is pushed to the left it will begin a stable clockwise rotation. If the water is pushed to the right it will begin a stable anticlockwise rotation.

The difference between the bowling ball example and a whirlpool is that a bowling ball has no memory of past travels, and therefore is not influence by the movement of any bowling balls that had previously travelled down the lane. However, water is a continuous, and usually homogeneous substance, which experiences movement that can be influenced by the movement of the surrounding water, as well as the immediate past movement of the water.

So in answer to the original questions, a whirlpool develops because the water finds it easier to convert its horizontal momentum into rotational momentum, rather than vertical momentum. The force energising this flow condition is gravity. And whirlpools in the southern hemisphere can rotate in either a clockwise or anticlockwise direction.

If we now consider the movement of air towards an atmospheric low pressure cell, the first thing we should note is that air is a 'fluid', and as such it exhibits flow properties similar to water.

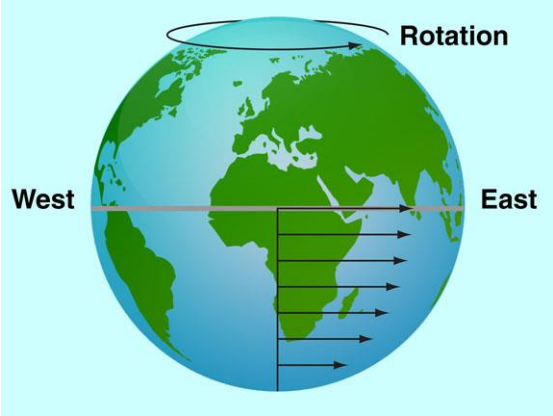

Figure 7: Variation in surface velocity of the earth (Earth's rotation to the east)

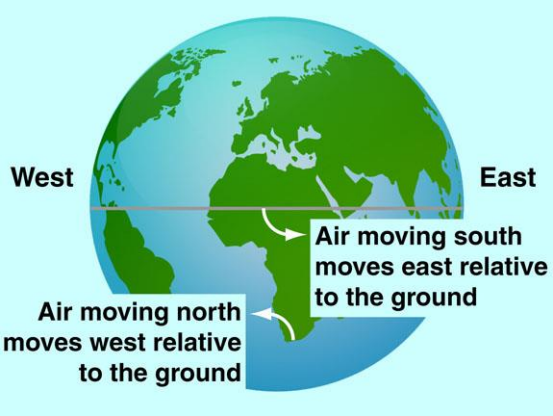

Figure 8: Movement of air relative to the Earth as it moves north and south in the southern hemisphere

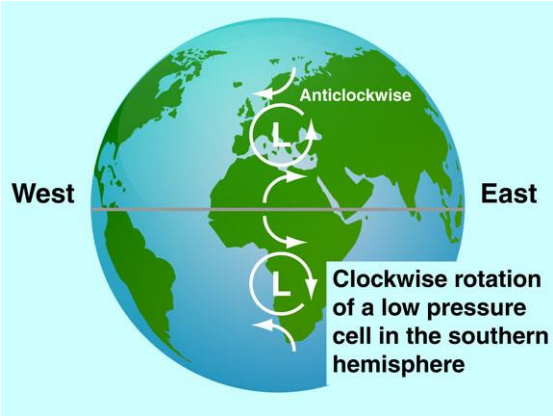

Figure 9: Clockwise rotation of low pressure cells in the southern hemisphere, with anti-clockwise rotation in the north

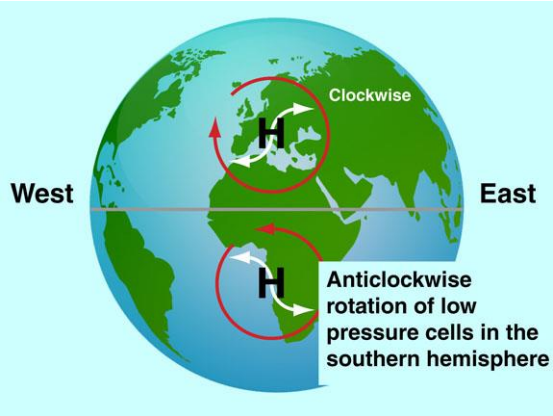

Figure 10: Movement of air relative to the Earth as it moves north and south in the southern hemisphere

The primary driving force for the movement of air is the air pressure gradient, and the rotation of high and low pressure cells is primarily due to the rotation of the Earth. As the Earth rotates (spins) towards the east, it causes the air above the equator to travel faster than the air north or south of the equator (Figure 7). As a low pressure cell draws air away from the equator, this air will try to move towards the east faster than the ground below it (Figure 8).

Similarly, as a low pressure cell draws air away from the poles, this air will try to move towards the east slower than the ground below it, which results in its 'relative' movement west. In the southern hemisphere this means that air to the north of a low pressure cell wishes to move east relative to the centre of the cell, and air to the south of a low pressure cell moves west. Collectively this causes low pressure cells in the southern hemisphere to rotate clockwise (Figure 9). The reverse action results in high pressure cells rotating in an anticlockwise direction (Figure 10).

This means the rotation of atmospheric low pressure cells is caused by forces that cannot be related to the formation of planets, stars and galaxies. Consequently this type of fluid motion cannot improve our understanding of astrophysics.

8. The spinning of planets, suns, solar systems and galaxies

If a giant gas cloud (Figure 11) did inherit a small degree of 'spin' from the Big Bang, then it is likely that any galaxy formed by such a gas cloud would develop a similar, but more rapid, spin around a common axis.

If a large scale spin did form within a gas cloud, then I would assume that gravitational forces and the spin axis would eventually collapse the cloud into a disk-like formation (Figure 12).

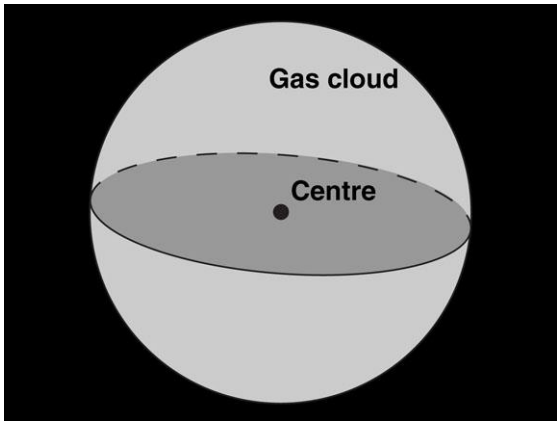

Figure 11: Representation of a solar gas cloud prior to the formation of a galaxy

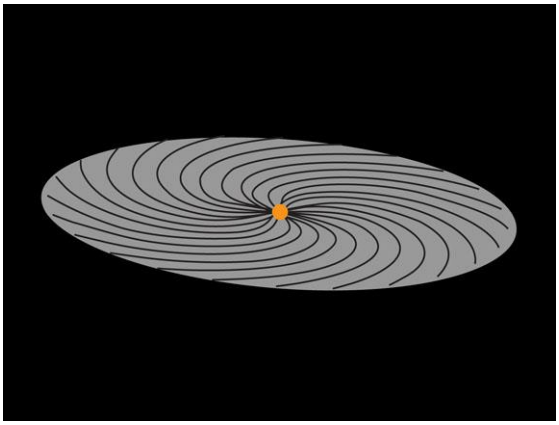

Figure 12: Conversion of a largely three dimensional gas cloud into a spinning disk-like formation

If the gas cloud did not have a rotation, then weak gravitational forces would eventually cause matter to be drawn (actually 'pushed') along a straight path towards the centre of the gas cloud (Figure 13). This contraction would occur along all three dimensions, and is unlikely to result in the galaxy developing a spin.

So is the initial rotation of the gas field the only mechanism by which a galaxy could achieve spin, or is there some other mechanism that could cause the contracting matter to enter into a curved travel path (Figure 14)?

One possible mechanism could be due to variations in the gas cloud's density, which could cause matter to follow an irregular (non-straight) trajectory toward the centre as a result the matter being pushed by non-symmetrical gravitational forces. Such an irregular trajectory could possibly result in the accelerated matter entering into an orbital path as it approached the centre of the gas cloud.

However, you would expect that the majority of matter would arrive at the centre of the gas cloud in a random pattern, so no particular direction of rotation would dominate. Also, unlike water, a gas cloud is not considered to be a continuous fluid. So if some matter did enter into a curved path, the trajectory of any subsequent matter would not necessarily follow the same path.

In conclusion, it would appear that the ‘spin’ of a galaxy around its own axis would most likely have developed from the initial spinning of the gas cloud.

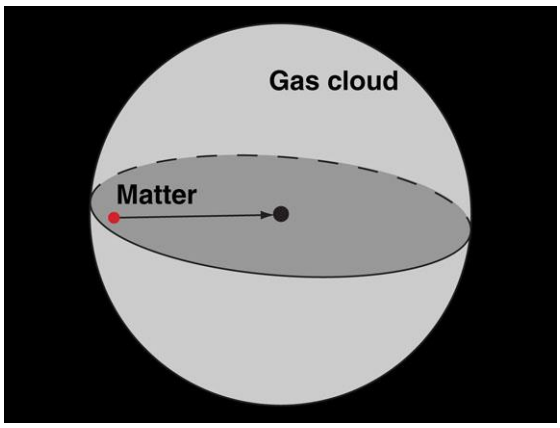

Figure 13: Initial contraction of the gas cloud

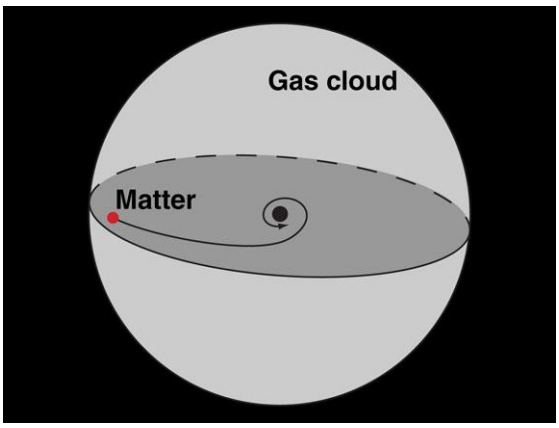

Figure 14: Curved travel path

If we now consider how planets and stars develop their ‘spin’, it does not seem likely (or even possible) for forming planets and stars to inherit their spin from the original gas cloud. The gasses that contract to form a star or planet (Figure 15), would continue to follow a path of rotation, but without the attribute of spin. So the mechanics that forms a spinning galaxy cannot be the same as the mechanics that forms a spinning star or planet. Consequently it is not unexpected to find that each of the planets in our solar system has a different axis of spin (Table 1).

It should also be obvious that once a star has formed within a galaxy (Figure 16), there would be no mechanism that would induce spin that could be related to the rotation of the gas cloud.

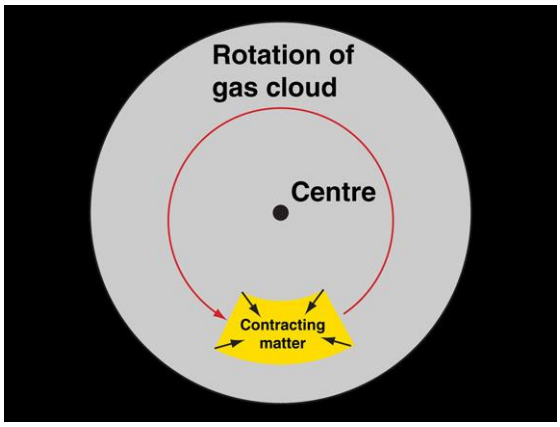

Figure 15: Formation of a planet within a gas cloud (looking down the axis of spin)

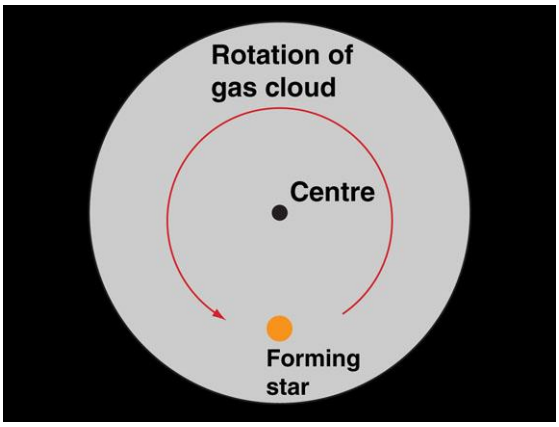

Figure 16: A growing star forming within a collapsing gas cloud (looking down the axis of spin)

9. A possible cause of planet, star and galaxy spin

In order for a planet (or star) to develop spin during its formation, it would be necessary for the collecting matter to arrive along a dominant travel path. If all the matter arrived in a random nature, then it would be difficult to see how a planet could develop spin. Given that it appears that most planets do develop spin, it would seem reasonable to speculate that there must be some type of mechanism that causes a majority of the collecting matter to arrive along a dominant travel path.

The generation of ‘spin’ by planets (and stars) would appear to be far more likely if the space around these objects was able to generate a similar spin, and therefore a ‘memory’ of the travel path of the matter that had previously travelled towards the growing planet (Figure 17).

Therefore, the probability of a planet developing spin would appear to be more likely if:

- dark matter collects around the forming planet
- the dark matter has some of the properties of physical matter, specifically mass, inertia and the ability to exert a force on physical matter
- the dark matter begins to develop a spin in unison with the planet (Figure 18); and
- the travel path of the matter that is travelling towards the forming planet is influenced by the spinning dark matter, thus allowing a dominant direction of spin to develop.

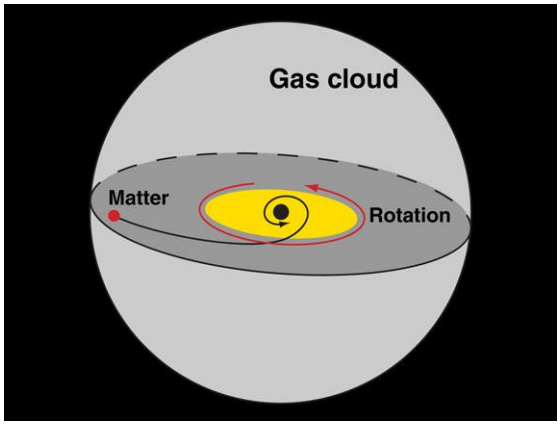

Figure 17: Speculation of a possible inner space-time developing a rotation (spin) around the centre of a gas cloud

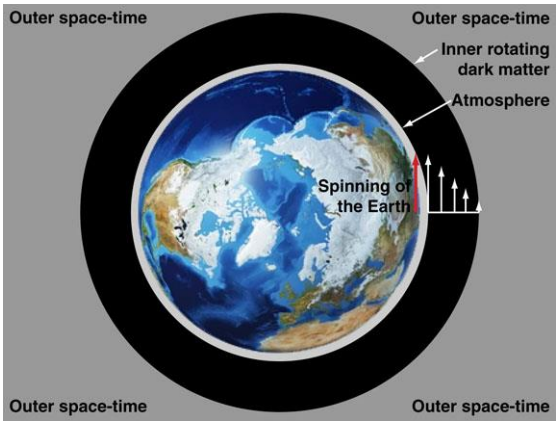

Figure 18: Speculation of a band of space-time (or dark matter) circulating the Earth (looking at the north pole)

Figure 18 displays a rotating ring of dark matter around a planet that is relatively thin. In reality, however, this dark matter would extent endlessly into space at a decreasing density. The dark matter would likely have a density that reduces with the square of the distance from the planet (i.e. the dark matter would be linked to the slowing of time and the generation of gravity).

It is noted that the formation of a rotating ring of dark matter around a planet would not affect the frictionless movement of the plant through space because the dark matter would be travelling with the planet, and the dark matter would move without friction or turbulence through the surrounding space, whether such space was filled with dark matter, dark energy, or time energy.

It is also noted that an Apollo rocket passing through the dark matter on its way to the Moon would not experience the presence of the dark matter because the dark matter would be spinning in unison with the Earth.

I cannot confirm that such dark matter exists, or that there would be a mechanism that would force the dark matter to attach itself to physical matter—it is just another idea.

10. Dark matter and dark energy

The various theories presented in this series of papers suggest that:

- dark matter exists around all physical matter, with a density that varies with the inverse of square of the distance from the planet; and
- dark energy is the same as time energy, which is the dominant force in the generation of gravity.

11. Expansion of the universe

It would appear that the expansion of the visible universe is related to either:

- a repelling force that exists between either dark energy and dark matter, or dark energy and physical matter; or

- the effect of changes in the rate of time (i.e. the time density) across the universe that makes distant galaxies appear to be moving faster than they are moving within a local frame of reference.

If, however, we consider the expansion of space as being determined by the passage of light, then we may come to another conclusion.

If we accept that:

- Time and space did not exist prior to the Big Bang; and
- light cannot move unless there is Time and space; and
- the dimensions of space are defined by the travel path of light; then,

. . . we must also accept that light can only travel as far, and as fast, as the expansion of Time and space.

If we also accept that:

- 'space' does not exist as an entity, but instead space is defined only by what fills the space; and
- the substances that can fill space include: physical matter, dark matter, light, time energy, and dark energy; and
- both physical matter and dark matter cannot travel at the speed of light; then,

. . . we must accept that space cannot be filled completely by physical matter or dark matter because this would result in space expanding at a significantly slower rate than our observations of space suggest. This means space must be filled by either: light, time energy, or dark energy.

Now we know that wherever light travels, Time must also travel. We also know that Time has some special properties. As children we think of 'time' as being something that does not physically exist, as something that was not created, nor can it be modified. Most of us freely accept that time must have existed before the Big Bang. We find it hard to accept that time only started during the Big Bang. We find it hard to accept that time can be slowed, but strangely, due to the power of movies, we find it easy to accept that Superman and space travellers can travel back through time.

If we accept that the rate of time is slower on the surface of the Earth than it is at a high altitude, then we must decide:

- does Time actually become slower near stars, planets and moons; or
- does the curvature of space (or what fills space) cause Time to take a short-cut and therefore only appear to be functioning slower near stars, planets and moons?

If it is what fills space that causes Time to take a short-cut, and therefore only appear to be slower near stars, planets and moons, then it must be either light or dark energy that fills space (i.e. we eliminated 'Time' from our previous list).

Well we know it cannot be 'light' that alters Time because the rate of time does not change when light slows as it passes through gases, glass and water.

So by elimination we are left with the idea that space is filled with dark energy. This means the rate of movement of the light generated by the Big Bang, and therefore the expansion of space, must be governed by the speed that dark energy can travel. So the question is: How fast can dark energy travel? Does dark energy travel at the same speed as light energy?

If we accept that dark energy both fills and defines the limits of space, and that dark energy can travel at the speed of light, then what will govern the expansion of space will now become the

expansion of Time, because light cannot move without Time. So the question now becomes: How fast can Time travel, or how fast can a time density gradient move through space?

We possibly could determine the speed of a time density gradient by measuring the speed of a gravitational wave.

But what if, as I suspect, dark energy is time energy. Then what governs the expansion of space would still be the speed of a time density gradient. If the speed of a time density gradient is less than the speed of light, then all the light radiated from the Big Bang would slow to the speed of a time density gradient (because this light would have to wait for Time to be generated before it could move any further).

So here is my parting gift to all those readers that have a strong imagination.

Imagine if the following were true:

- light is the consequence of all mass energy and time energy being converted to kinetic energy, in other words, 'light' exists as pure kinetic energy
- as light slows, it converts some of its kinetic energy to mass energy (i.e. matter) and time energy (i.e. time); however, this does not happen if light slows solely because of a slowing of Time, but would happen if light was forced to slow because it had reached the edge of space (i.e. the edge of Time)
- the generation of time energy creates both Time and space (because time energy fills space)
- the Big Bang generated a large amount of light energy, which radiated out from the Big Bang as fast as the light could generate Time (because light cannot move beyond the limits of Time or space)
- this means that immediately after the Big Bang there would have been a very intense time density (i.e. rate of time) due the high intensity light being slowed at the current edge of space
- as the light generates Time, it also generates mass energy, in other words the matter that, in part, make-up the original gas cloud
- as more light is generated within the growing universe, this light would travel at the light speed until it arrives at the edge of space where Time is still being generated (i.e. this new light catches up with the expanding edge of space because it travels faster than the speed that Time can be generated)
- as space expands, the density of light energy decreases, which means the time density (or time energy) generated by this light also decreases
- if time is being generated throughout space at the speed that a time density gradient can travel, then this would mean that (i) a uniform time density would exist across the universe (outside the influence of moons, planets and stars), and (ii) the background level of the time density (i.e. the rate of time experienced in deep space) would decrease with time as the universe expands.

It is just a thought!

12. Conclusions

What this paper has demonstrated is that many of the attributes we associated with matter, such as its visual presence, sound, smell, touch and heat, can be explained as simply the properties of concentrated energy. Also, the properties of space are defined by the properties of what fills the space, rather than the properties of space itself.

It is also believed that dark matter exists around all physical matter, with a density that varies with the inverse of the square of the distance from the centre of the physical matter, and that time energy exists throughout all of space, and that it is likely that time energy is what has commonly been referred to as dark energy.