

18. LIFE, THE UNIVERSE & EVERYTHING...

As a final chapter for the year, I propose to give you my assessment of the way the universe operates. Those of you who have read Douglas Adams' science fiction story, *The Hitch-hiker's Guide to the Galaxy*, will understand why, somewhat facetiously, I have given the piece this title.



Earth—that's the tiny white spot—from the probe Cassini viewed from the far side of Saturn [NASA/JPL]

The Miracle Of Gravity

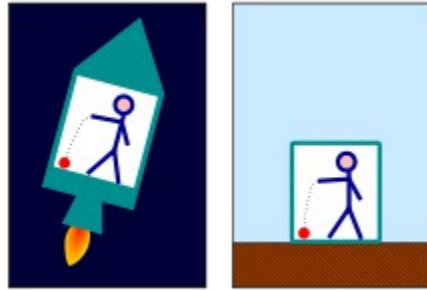
Like everything that God has given us, we take gravity for granted. Imagine life without light, for instance. We are utterly dependent on it. We don't make it ; we are the recipients of it. We enjoy it and all that it brings us through the complementary gift, the power of sight. And, as with all God's gifts, eyes and light are given us for some end. We did not ordain the end ; God did.

Now the same comments are to be made about gravity.

Albert Einstein was a remarkable thinker with a remarkable imagination. In about 1903, even before man had mastered powered flight, he imagined a man in space, unaffected by gravity, floating. If one were to put that man into a cupboard (spaceships hadn't been thought of at that time), attach a hook to the top, and apply a force in one direction he reasoned, the man would begin to feel his weight. If that force were sufficient, he might think it was just like being on earth under gravity's influence.

Now we know that the force of gravity is such that if, for instance, the earth was to open under our feet, we would fall at a rate of acceleration of 9.8 metres per second² (or 32 feet per second² for those, like me, who were brought up under the Imperial system of measures). Let's replace Einstein's cupboard with a space ship, 'Einstein's space ship'. You have all seen footage of men in the space stations that orbit the earth. They float around in the vehicle like fish in the sea. Once some element of thrust is applied, however, they begin to feel their weight, a degree of gravity. Let's assume we are in Einstein's space ship outside earth's atmosphere at some point in space and we elect to try and

replicate the force of gravity. Let's assume there is in the space ship a small room just like there is back home, with a table and some chairs—all fixed to the floor, so they won't float ! The captain engages the rocket engines and the space ship starts to accelerate. Let's assume the thrust applied produces acceleration of 9.8 mps^2 . Immediately, the men in the room would begin to feel at home.



They could walk about the floor, sit on the chairs at the table ; place something on the table, like a book or paper, and generally conduct themselves as if they were back home. **BUT ONLY AS LONG AS THE ROCKET ENGINES WERE IN OPERATION !**

Twenty seconds after leaving the point where it began to accelerate, and away from that point, Einstein's space ship would be travelling at a speed of 196 mps and have covered a distance of 1,960 metres. After 40 seconds, it would be travelling at a speed of 392 mps and have covered a distance of 7.84 kilometres. But this could only go on for a limited period of time or the space ship would run out of fuel. And as soon as the rocket engines ceased to operate, and even though the space ship would now be travelling at a very high speed relative to its starting point, the gravity-like force on the men in the ship would cease. They would be floating around like fish again !



We are familiar with science fiction depictions of its characters in their space ships walking about, sitting at consoles, communicating with each other, and generally conducting themselves as if earthly gravity applied.

There was an inventive instance in the 1968 Stanley Kubrick film, '2001 : A Space Odyssey', where the hero, to keep in trim, is depicted as jogging around the inside circumference of a great circle. All this is, of course, great nonsense—*imaginary being* which is impossible of real existence. Without some acceleration from beneath him, a man in a space ship cannot experience gravitational force.



This force, so difficult to reproduce artificially, Almighty God produces universally over the face of the earth such that every creature is affected by it, conditioned by it.

If the ground were to open, the accelerative rate at which we would fall (9.8 mps^2) is the same as the rate that generates gravitational force. Sir Isaac Newton spelled out the rules demanded by the applicable principles in his Second and Third laws. His Second Law is expressed in the formula *force = mass x acceleration* ($f = m a$). For a force to be exerted on some body there *must be* acceleration. His Third Law supplies the reason why we feel this accelerative force as gravity—*For every action there is an equal and opposite reaction*. When you are running for the ball with an opponent on the football field, you endeavour to bump him away, and he does the same to you. If the two of you are about the same weight each will bounce off the other equally. In the same way the earth under our feet resists equally the downward accelerative force of gravity with its component of acceleration of 9.8 mps^2 on our feet *upwards* ! If that force was not constantly exerted we would not be able to walk around or do the things we do at every moment. The peril of falling from a height is part of the price we must pay for the great advantages of gravity : the one is corollary of the other. We are like the men in the space ship. It is as if we are being constantly accelerated away from the centre of the earth at 9.8 mps^2 . But we don't feel like we are being accelerated, do we ?

NEWTON'S THREE LAWS OF MOTION

I. Every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it.

II. The relationship between an object's mass m , its acceleration a , and the applied force F is $F = ma$.

III. For every action there is an equal and opposite reaction.

How Does He Do It ?

Now, after a year's lessons in first philosophy, you understand the important distinction laid down by Aristotle of corporeal being into *substance* and *accident*. A *substance* is that which exists in itself (*be-in-self*), an *accident* that which exists—can only exist—in some substance (*be-in-other*). What is gravity (gravitational force) ? Is it a substance or an accident ? An accident, of course. You don't find gravity by itself, you only find it inhering in some corporeal substance. So, accepting that it is an *accidental* reality rather than a substantial one, let us analyse gravity's four causes.

<i>Gravity,</i> its causes are :	[Intrinsic	[Formal	inclination to centre of Earth
	[[
	[[Material	any & every body on Earth
	[
	[[principal – Almighty God
	[Extrinsic	[Efficient	[
		[(twofold)	[instrumental – <i>what ???</i>
		[Final	order on the planet, & sub-order among Earth's creatures

So, we know all the causes of gravity except its *instrumental* efficient cause. How does Almighty God achieve this remarkable effect, not only on earth but in all the heavenly bodies ? It helps if we note that two other phenomena are just as universal as gravity, circular motion and sphericity of shape—though this latter feature would seem to be an effect of whatever it is that causes gravitational force. There is also, of course, light which is visible throughout the universe though, curiously, only in light sources not in the heavenly matrix itself. Gravitational force is simply *centripetal* force, the inclination towards the centre of mass of any heavenly body, or collection of heavenly bodies, like the Moon and the Earth, like the various planets and asteroids and the Sun that they circle.

Before we proceed further we should note carefully a philosophical maxim : *cause and effect are proportional*. The more particular an effect, the more particular the cause ; the more universal an effect, the more universal the cause. I huddle close to the fire on the hearth on a cold night because it is the *particular* cause of heat in the room. During the day, however, I can get just as warm by walking in the Sun. But the Sun's warmth is available not only for me but for every body—animal, vegetable or mineral—on the Earth's surface, to say nothing of its influence upon every planet in the solar system. What follows ? Why, the cause of gravitational force throughout the universe must itself be universal ! It must be as extensive as the universe and, like the Sun, it must be a *substance*.



Is Gravitational Force Caused by Attraction Or Repulsion ?

This is a most important question. Newton was inclined to the view that, though its effects could be *calculated* as if the force was attractive, gravity's cause was repulsive. He was also insistent on the need for a medium of transmission of its force. His words on this subject addressed to Dr Richard Bentley, Master of Trinity College, Cambridge, are memorable :

“It is inconceivable that inanimate Matter should, without the Mediation of something else, which is not material, operate upon, and affect other matter without mutual Contact... That Gravity should be innate, inherent and essential to Matter, so that one body may act upon another at a distance thro' a Vacuum, without the Mediation of any thing else, by and through which their Action and Force may be conveyed from one to another, is to me so great an Absurdity that I believe no Man who has in philosophical Matters a competent Faculty of thinking can ever fall into it. Gravity must be caused by an Agent acting constantly according to certain laws ; but whether this Agent be material or immaterial, I have left to the Consideration of my readers.”

These words should be written **in bold** above the computer screen of every scientist. Why ? Because there is hardly a scientist in the world who does not think that a medium is unnecessary. Gravity is treated by science as a species of attractive force with a force-field analogous to that applicable to magnetism. But the thesis has a number of problems. In the first place, there is nothing in a body which demands it should attract another body. Moreover, without a medium whereby the immense centripetal forces of gravity could be conveyed, it is impossible that they could be transmitted. Further, there is no reason why, if one body was attracted by another, the two would move in a circle around each other. They ought to collide and combine ! But they do not. They move in equilibrium around each other, or around their common mass, in perfect, circular motion, which motion is compounded only by the influence of their moving masses.

Endeavours over the centuries since Newton to show how the cause could operate by repulsion have foundered because of the belief that the medium of repulsion must be like any other body of common material being. Science could show that all material bodies are largely comprised of empty space, or what seems to be empty space. How then, it was reasoned, could a material medium so refined as, so far, to have avoided detection be able to exert pressure on a heavenly body ? The pressure it exercised would be largely ineffectual.

If a medium could be found that overcame these two objections, it would provide the key to the instrumental efficient cause of gravity.

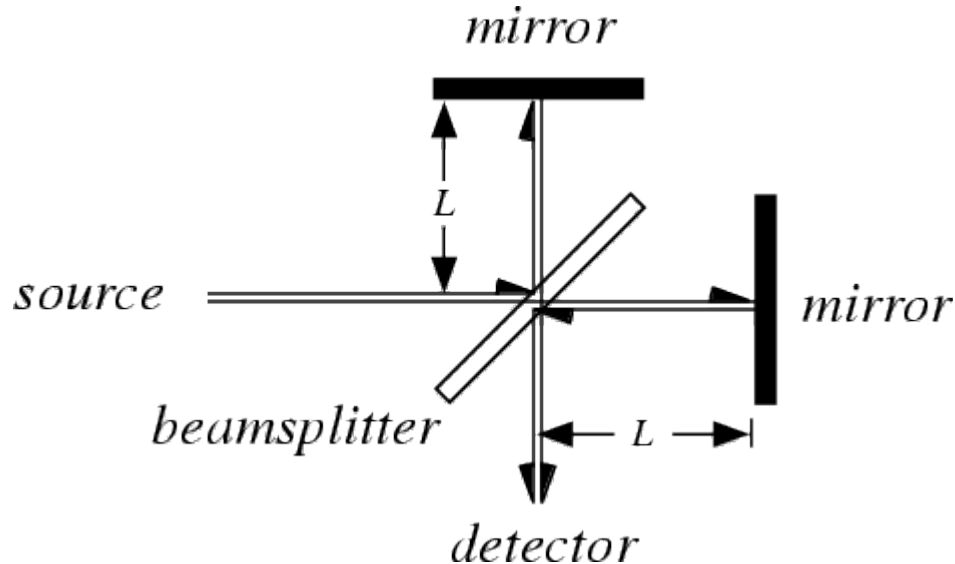
The Michelson-Morley Experiment

In 1887 two scientists, Michelson and Morley, conducted an experiment at a university in Cleveland, Ohio, in which they compared the speed of light in directions at right angles to each other in an attempt to detect the relative motion of the planet through what was apprehended to be a stationary ether. They discovered that the speed of light was the same in each direction. There was no lag that might be expected from a ponderous medium. They concluded that the medium, *ether*, did not exist. Now, they did not reach that conclusion because they were scientists, but because their science was constrained by materialism. There was another conclusion open to them, but it did not suit the philosophy to which, perhaps quite unknowingly, they subscribed.

Incidentally, notwithstanding this view which was to attain the force of a scientific truth, that there is

no such thing as 'ether', radio buffs and pilots during the second world war and since, have persisted in referring to 'ether' as the medium through which their radio transmissions are conveyed, in which practice they demonstrate, as we will show, that they have more common sense than scientists.

An illustration of the Michelson-Morley experiment splitting a beam of light to measure its speed at right angles



Under the influence of Descartes and other enlightenment thinkers, science had forgotten the understanding of reality that Aristotle had taught, a teaching endorsed by St Thomas Aquinas in the thirteenth century and fostered by scholastic philosophers in the centuries that followed. That is, scientists had abandoned the knowledge and application of the doctrine of fourfold causality. To put it another way, men had lost the facility of looking at things *metaphysically*. They were content to look at them *physically*. By the seventeenth century, when Newton had begun to focus his powerful mind on natural phenomena, Aristotle's analyses had been overtaken by those of Descartes and become informed by the materialism that underlay Descartes' mechanical view of reality. The consequence was that scientists, including Newton, conceived of Aristotle's heavenly body, *aether*, as if it was a super-refined instance of common material being. But Aristotle had taught that the nature of *this* body was altogether different.

Before we go any further, let us consider the word 'space'. There is nothing wrong with the word provided we understand what it signifies. It is one of the innumerable problems mankind has inherited from Descartes that modern thinkers confuse mental being with real being and then attribute to what exists in their minds only a sort of reality. This has happened with *space*. *Space* is not a reality, but a name the mind gives to signify the mental relation of distance between (or within) bodies. The vast distances between the heavenly bodies with no elements of common material being – or very few – intervening, taken with the conclusions of science following the Michelson-Morley experiment, led scientists to the view that space was a void, non-being somehow existing. But this is impossible, for 'nothing' does not exist. The very assertion that it does is self-contradictory.

This logical error is confirmed by a consideration of the operation of the senses. Every sense is a species of touch, even the sense of sight. There must then be a material continuum between the eye

and the object it sees. If my eye can see a distant star, say *alpha centauri* some $4\frac{1}{3}$ light years away, there must be an unbroken material continuum between my eye and the star. The assertion of science that the *accidents* of light and of gravity do not need a material medium in which to operate is, as Newton was right to insist, impossible because accidental realities cannot exist *save in some substance*.

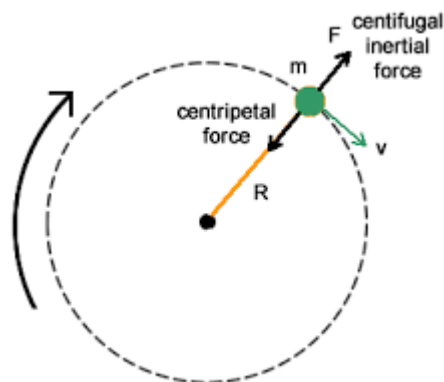
Science's conclusion that if *aether* could not be detected it must not exist is shown to be stupid from other considerations. Science is quite incapable of detecting experimentally the existence of the soul of any living thing. Remember the tale of the two rabbits, the one living the other just dead ? It is impossible to detect any material difference between them. Does it follow that because a rabbit's soul cannot be detected, it does not exist ? We conclude to the existence of the soul by intellectual deduction. (God gave us intellects for a reason !) It matters not in the slightest that the soul is not detectable experimentally. If intellect concludes to its existence, it must be admitted. The same consideration applies to *aether's* existence. Here is the challenge for modern students of science.

<u>Aristotle</u>	<u>Modern thought</u>
Profound philosophy	Poor philosophy
Poor science	Profound science

To understand how reality ultimately works we have to marry the philosophy of Aristotle with the discoveries of modern science.

Circular Motion, Mundane and Supra-Mundane

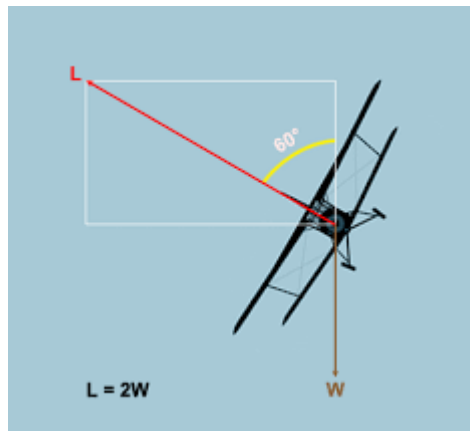
Achieving circular motion on earth differs fundamentally from the way it is achieved in space. If Catie and Naomi here were to dance in a circle, they would need to join hands. If I were to make a wheel for a cart, I would first need to secure the circle of the wheel to its centre and tie this centre to an axle with an appropriate bearing before the wheel could operate successfully. In other words, in mundane circular motion *centripetal* force, the force that ties the motion to the centre, comes first.



But observe that this is *not* how things happen with the heavenly bodies. There is no mechanical tie that secures centripetal force to enable the circular motion of the planets, moons and asteroids in the solar system or, indeed, in any of the movements of any of the heavenly bodies. There is circular motion and there is centripetal force (gravity), and the two are clearly interconnected because the

gravity associated with a circulating body is a function of its mass, but the whole business occurs in a manner *opposite to* that on Earth. This difference in mode of operation is a clue to gravity's cause.

There is a partial analogy of what happens in space among earthly activities. If an aeroplane turns in a circle with a constant angle of bank, it uses the lift in its wings, the angling of the tailplane and correction from the rudder to brace the aeroplane's weight against the air's density, the force exercised being a function of the speed and tightness of the turn. While the influence is *from within*, the manipulation of the aeroplane's control surfaces by the pilot, and centripetal force must be secured *prior to* circular motion, there is an element of *extrinsic influence* in the reliance on the ambient air. Something similar occurs when a fish turns in water.



Aristotle's Aether

Put yourself in Aristotle's place some 400 years before Christ, and ignore for the moment the remarkable discoveries of modern science. He looks up at the night sky and what does he see? The heavens rotating in a circle silently, regularly, consistently, above an immovable Earth; the stars fixed in their orbits, the planets wandering about the heavens but with a certain consistency in their wanderings; the Sun and the Moon pursuing their peculiar ordered motions also with regularity, with consistency. And all of these motions are in a matrix, some substance, which is perfectly diaphanous and whose chief characteristic seems to be the circular motion it gives to each of the heavenly bodies.

From these observations, and knowing the metaphysical truth that it is impossible that this matrix could be 'nothing somehow existing', Aristotle teases out the attributes of this extraordinary matrix, which he refers to as 'the first body', or 'the heavenly body', or *aether*. This is what he says, chiefly in his work *De Caelo (The Heavens)*, about this body. (St Thomas, in his commentary on this and other works, agreed generally with Aristotle's conclusions from his observations. Natural science had not made much progress in the 1,600 years between them !)

- Its proper motion is perfect, i.e., circular, motion ;
- it is a simple natural body distinct from the four simple natural bodies, earth, air, fire and water, and any body comprised of two or more of these ;
- it plays a part in the constitution of all other bodies *but not as a component* ;
- it is perfect, higher and nobler than other simple elements ;
- it is incapable of generation or corruption ;

- it is incapable of expulsion from its proper place by violence ;
- it has no lightness or heaviness ;
- it has no contrary ;
- it is prior to all other bodies ;
- it contains all other bodies and is to them as form is to matter and as act is to potency ;
- it moves other bodies, but cannot be moved by them ;
- it produces circular motion in other bodies not at their centre but from the periphery of their motions.

Now, of course, the heavens weren't revolving. It was the Earth turning on its axis that gave this impression. So, it is not *aether* that moves Sun, Moon and stars around the Earth, but the Earth that moves in a circle in *aether*. The Earth rotates around the Sun in *aether*. The Moon rotates around the Earth in *aether*. Indeed, all the heavenly bodies move in *aether*. Each revolving on its axis, each rotating around some other body. (Though in fact in every case the two bodies rotate about the centre of their common mass, an issue we can leave to another time.) So we can correct Aristotle and St Thomas on this issue of *aether's* motion. *Aether* has no proper motion of its own, but, consistent with the teaching that it contains all other bodies, and is to them as form is to matter, as act is to potency, *aether* produces perfect, or circular, motion in each of the heavenly bodies.



In summary then, *aether* is **utterly different from** or, to put it better, is **the antithesis of** any body of common material being, and its mode of operation differs radically from that of any body of common material being. Two characteristics isolated by Aristotle are critical to our study. The first is that because it lacks any potency to be affected by other bodies, *aether* cannot be detected by any scientific instrument. The second is *aether's* facility to move other bodies without them moving it, that is, without reciprocity of action. Newton's Third Law does not apply. The first explains why the Michelson-Morley experiment failed to detect the existence of *aether*. The second goes far to remove the scientific objection to a repulsive cause of gravitational force and suggests *aether* as the instrument.

This suggestion is reinforced if we apply Aristotle's teaching to the inter-molecular structure of bodies of common material being. Science has discovered, as we remarked above, that such bodies are largely comprised of 'empty space' ; that is, of 'nothing'. This is a metaphysical impossibility because there is no such thing as an existent nothing. We are entitled to conclude that this 'empty space' is also *aether*. This position is consistent with Aristotle's teaching that *aether* is involved in the composition of bodies of common material being *but not as component*, and with St Thomas's remark at the opening of

his commentary on Aristotle's work *De Caelo* (*On the Heavens*, Prologue), that the heavenly body (*aether*) is the first simple body *through which all other bodies are sustained*. When one adds in three other of the characteristics Aristotle identifies, namely, that *aether* is the container of all other bodies, that it produces circular motion in them, and that it does so at the periphery of their motion, the suggestion is beginning to look much more than a possibility.

A Closer Consideration of Aether

You may be familiar with the “big bang” theory concerning the origins of the universe. The underlying thesis was laid down, interestingly, by a Belgian Catholic priest, Fr Georges Lemaître, who posited a primal explosion at the moment of creation. In a televised debate in Sydney some years ago, George Cardinal Pell took the atheist and materialist, Richard Dawkins, to task for failing to consider where the material that supposedly went “bang” originated. It was a reasonable objection. Nothing comes from nothing : no thing is the cause of itself. If there was a “big bang”, the bang does not explain the provenance of material being, merely what befell it after it came into existence. Modern thinkers, whom Dawkins typifies, tend to use their imaginations instead of their intellects. If they can *imagine* something, they think it must be so, yet another of the logical failures flowing from the errors of René Descartes. Darwinian evolutionary theory relies on the same logical defect.

Now, while Cardinal Pell's complaint was appropriate, there is another and even more fundamental objection to the thesis, something neither he nor Dawkins had considered. It is this : *where* is this “big bang” supposed to have occurred ? If material being came into existence, it had to have a cause, a creator. But there must first have been a material setting, *a place*, in which things created could exist. Think of a fish coming into existence. It can only do so in a setting, the sea, which provides it with place. The sea is a precondition ; it must pre-exist the fish. So, too, there had to be a “sea”, a circumambient body, in which common material being could exist before it was created. Hence, the first question has to do with *place*.

Let us paraphrase St Thomas in the Prologue of his commentary on the *De Caelo* : “The first, simple, body, the heavenly body, the body that constitutes the universe—that body through which all others are sustained—is the first that must be considered”. This heavenly body, *aether*, provides the place where the putative “big bang” —if it did occur—could occur.



Sacred Scripture appears to confirm this thesis. The very first words of the Bible (in Latin) are *In principio creavit Deus caelum et terram...*—“In the beginning God created the heaven and the earth...” [Genesis I: 1] Notice the order : *first* the heaven, *then* the earth. Now, if by “the heaven” there is

signified not the heaven where God abides, but the first simple body through which all other bodies are sustained—higher and nobler than any other, containing all others and related to them as form to matter, as act to potency—and if by “the earth” there is signified not just the planet on which we find ourselves but the whole of common material being comprised of 118 odd elements, the stars, planets, asteroids and other heavenly bodies throughout the breadth of the universe—it seems reasonable to hold that “heaven” here signifies that matrix, the body *aether*, that Aristotle had identified and St Thomas confirmed.

Aether & Light : Aether & Gravity

Let us recall that the objection to the existence of *aether* was grounded in its failure to appear in an experiment that had to do with light, a *luminiferous aether*. ('Luminiferous' simply means 'light bearing'.) The scientists were not considering *aether* in the context of gravity. Now *aether's* function in relation to light is critical. Had the two scientists, Michelson and Morley, but known it, their experiment had not only confirmed the existence of Aristotle's *aether* (not the *materialist* model accepted by Newton and by every scientist after him), they had confirmed one of *aether's* properties.

We go forward twenty years to Albert Einstein and the formula he developed to solve disparities in astronomical observations, his *general* theory of relativity. Einstein adopted the rejection of *aether* precipitated by the Michelson-Morley experiment as part of his theses even as he relied on what the experiment had established, the fixity of the speed of light (later established precisely at 299,792,458 mps), signified by the symbol *c*. Throughout the universe time could dilate or contract, the dimensions of things could alter, but one thing was fixed : the speed of light. Einstein adopted this constant in his assessment of the speed with which gravitational force would occur, and the decision proved accurate as his *general* theory of relativity solved problems in relation to gravity that Newton's laws could not.

Now, *you* understand, as I remarked earlier, what Einstein did not understand, the distinction of corporeal being into *substance* and *accident*. Newton did not understand the distinction either, as neither did James Clerk Maxwell nor the other scientists who had discovered or ascertained the precise speed of light. None of them realised that light *is not a substance but an accident*, that light does not exist in itself, only in some substance.



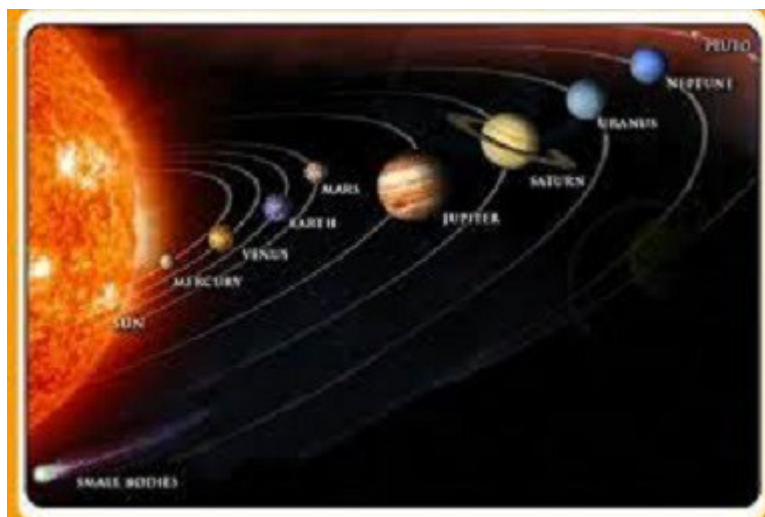
Albert Einstein

Both Aristotle and St Thomas teach that light is a *quality*, that species of accident that qualifies, that makes a substance to be 'of such sort'. This quality affects every substance of common material being to render it visible, whether in act or in potency. Light's omnipresence demands the resolution of a further question, namely the identity of the substance which is the *luminifer*, the light-bearing medium, for the discoveries of modern science make it clear that light traverses great distances in space where there are no instances, or very few, of common material being. This medium must be a substance which is completely diaphanous, that is, offering no impediment whatsoever to light's passage, and it must be as universal as is light, that is, as wide as the universe. Again, there is only one possible substance, Aristotle's *aether*.

Light is, thus, a quality common to all common material being. But observe how in *aether*—consistent with *aether's* character of being *the antithesis* of common material being—the opposite obtains. Light is invisible! Now, a moment's thought will make it clear that *invisibility* is light's proper character for we never see light, we only ever something lit. Hence, the *proper* substance of light's office as a quality is not any element of common material being, but *aether*.

Let us take this a step further. Science shows that the speed of light is fixed, determinate. If light is properly a quality of *aether* and not of common material being, the reason c is fixed is that it reflects *aether's* fixity, for a substance has itself to its accidents as cause to effect, and cause and effect are proportionate to each other. What follows? Why, c , the speed of light, is not a property of light at all. It is a property of *aether*. It is the speed at which *aether* determines light's propagation.

Einstein confirmed c to be a property of *aether* when in his general theory of relativity he showed that c is not only the speed of light's propagation, but of gravity's operation. Now gravitational force is a quality which, like light, affects every element of common material being. Einstein's discovery confirms that gravity is a quality which also has its source in *aether*. In fairness to Michelson, Morley, Einstein and all other modern scientists, it should be said that even though space is not 'non-being somehow existing' but *aether*, to the materialist mind it is liable to give that impression. Einstein later revised his views about the non-existence of *aether*, but he treated it as an adjunct to reality rather than the underlying substantial cause of the accidental effects on which he had focussed his attention.



A Little More on Circular Motion

Newton's First Law holds that an object at rest or in motion at a constant velocity, will continue in its state unless acted on by some external force. So, a moving body will continue in a straight line—rectilinear motion—unless some force is applied to it, a force which must address the body's mass and the acceleration applied (Newton's Second Law). Movement in a circle entails a constant changing of direction, that is, constant acceleration. When a heavenly body is constrained to move in a circle, therefore, the agent causing it to do so must exercise upon it a constant force.

Now the force of gravity (centripetal force), like the force exerted by the rocket engines of Einstein's space ship, involves *acceleration* at a constant rate. Clearly, the constancy of gravitational acceleration (9.8 mps² on Earth) is a reflection of the constancy of the planet's acceleration—its motion around the Sun ; its revolving on its own axis—an effect of the constant force *aether* applies. The influence that causes the planet's circular motion must also be responsible too for gravity's centripetal force.

Summarising the Argument

1. There is no such thing as a void, space conceived of as non-being somehow existing. Even though it is quite undetectable there must be a material body, a matrix, that fills any space not occupied by some element of common material being. This substance is prior ontologically to all other bodies and provides the setting, so to speak, in which they exist.
2. A repulsive, or extrinsic, agent as the cause of gravitational force makes more sense than an intrinsic agent for there is no medium known capable of coping with the immense adductive forces demanded by a thesis of attraction.
3. The circular motion and gravitational force found universally among heavenly bodies are inter-related accidental realities which must have a substantial cause as universal as are they.
4. On Aristotle's hypothesis *aether*, the body through which all others are sustained, satisfies the demands of this universal substance. It is not only prior to all other bodies but contains them all. It has no lightness or heaviness. It causes circular motion in the heavenly bodies not at the centre of their motion but at the periphery. It acts not from within but from without.
5. Einstein's *General Theory of Relativity* confirms that just as *aether* determines the speed of light's propagation, it determines the speed of gravity's operation. It follows that, whether directly or indirectly, *aether* is gravity's instrumental efficient cause.

It remains, then, for us to work out **how** *aether* produces gravitational force.

The Solution

That nature involves the interaction of opposite principles is clear. Form and matter are opposites, for while *form* causes by determining, *matter* causes by being determined. We should not be surprised, then, to discover that the *modus operandi* of *aether* is opposite to that of bodies of common material being. Aristotle's teaching is to the point : the relationship *aether* bears towards all other bodies is akin to that of act to potency, of form to matter. Now, every body of common material being acts *from within*. Nature provides it with an intrinsic principle with determinate powers enabling acts which lead to the end for which it was created. In contrast, as befits that substance which not only contains all other bodies but is intimately involved in their composition, *aether* acts *from without*. Recall the illustration of the banking aeroplane. There we found a *partial* extrinsic influence. But what if there

should exist an extrinsic influence towards circular motion which was not just partial, but *total* ?

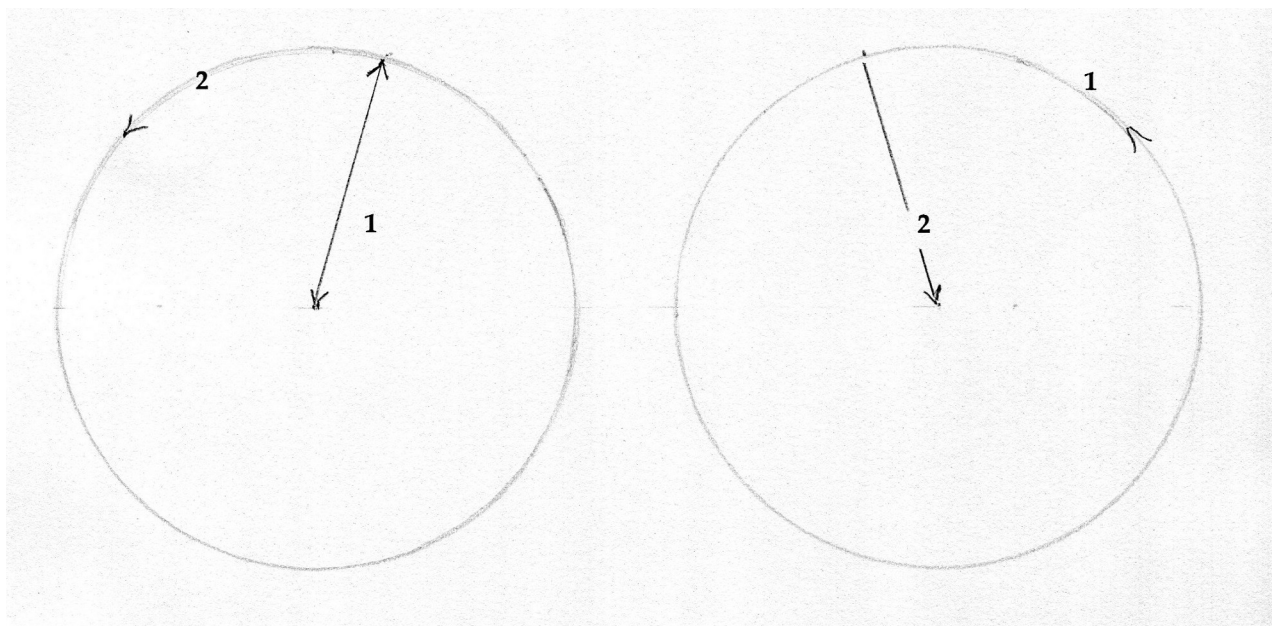


The answer to the puzzle, then, seems to be this : in *aether's* realm the ontological order that operates among bodies of common material being is reversed. *Gravity is not prior to circular motion ; circular motion is prior to gravity.* Gravity is not caused by some species of attraction of body upon body, as scientists speculate, nor does circular motion follow as an effect of this hypothetical force. What happens is the very opposite. *Aether* first produces in a heavenly body the accident of circular motion and centripetal (gravitational) force follows as an effect. Rather than gravitational force producing circular motion, circular motion produces gravitational force. And isn't this just the way it appears ?

Thus the continual influence *aether* applies to constrain a heavenly body to circular motion is measured by the body's mass and the acceleration entailed in its constant change of direction following laws discovered by Johannes Kepler. The ellipses into which most resolve are simply compounds of circular motion about more than one focus. Gravitational force is proportionate to the body's mass and acceleration towards the centre of that mass.

MUNDANE CIRCULAR MOTION

CIRCULAR MOTION IN THE UNIVERSE



Circular motion on earth can only be achieved *after* centripetal force is established. No wheel rim can turn until connected to a hub ; dancers cannot swing around each other until their arms or hands are intertwined. The order is *first* centripetal force, *then* circular motion.

But in the universe, under *aether's* influence, the opposite obtains. Each heavenly body is compelled to circular motion around some other body or around its own axis, or both. The order is *first* circular motion, *then* centripetal force, gravity.
