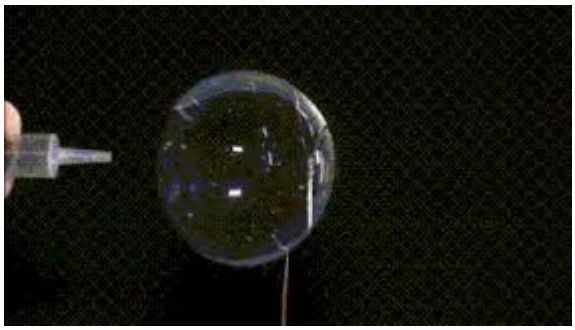
GRAVITATIONAL THEORY & WEIGHTLESSNESS

Our age has the benefit of phenomena that Sir Isaac Newton and Albert Einstein would have given anything to obtain, data showing the behaviour of bodies removed from the influence of earth's gravity. Observations in the International Space Station of what befalls fluids removed from gravity's influence are revealing. A quantity of water free of a container takes the form of a sphere—



A video clip of ths phenomenon is available on the internet[1] Someone viewing the video might reasonably ask himself why the scientist-astronaut experimenting on the sphere of water did not remark the way the tiny globe emulated in miniature the globe beneath the space-station on which he was a passenger, the greater part of whose surface is, similarly, comprised of water. Or wonder why the experimenter did not ask the question, if no more than rhetorically, whether it was possible the cause of sphericity in the one might be the cause of it in the other also.

Certainly, Newton would have seen in the phenomenon support for his thesis that, while the effects of gravity may be calculated as if they entail an intrinsic force, their cause must be some extrinsic agent. The phenomenon of sphericity is repeated in other instances. The vaporised portion of water brought to the boil in a container, without the influence of convection or buoyancy (each of which depends on gravity), remains adjacent to the heating surface. As appears from the photograph below, it, too, takes the form of a sphere.

Other emollient material also tends to mimic the form of the celestial bodies. A candle flame, for instance, becomes a globe of fire.

1 https://www.youtube.com/watch?v=ntQ7qGilqZE

Science's Considerations

Scientists explain the instances of sphericity of fluids in zero gravity as caused by surface tension of the subject materials. Unsurprisingly, this repeats the explanations they offer for certain phenomena that occur on the surface of the earth. Molten lead poured through a copper sieve and allowed to fall free in a tower 100 feet or more into a water bath forms into hundreds of tiny spheres. Air blown through a solution of water and soap precipitates the evanescent miracle of sphericity in the soap bubble. The significant issue with these earth-bound effects is that, as with the instances in the Space-station, each occurs where gravity's influence is completely, or almost completely, removed. Molten lead is freed of the effects of gravity as it falls. The soap bubble is so light gravity's influence is negligible. And let us not forget the most common of such phenomena, water condensing in the atmosphere falls as small spheres.

While it is true that surface tension in each of the liquids mentioned *disposes it* to take on spherical form, more is required than mere disposition. A house does not build itself just because there is a disposition in the materials lying around the building site to be formed into a house. Certainly, the house could never be built if that disposition did not first exist—you can't build a house from materials indisposed to the task, like glass, water or air. But more is required. A little boy in his toy car calling on his father to push him does not move himself just because he (and his car) are disposed to be moved. Without the builder building, the house is not built. Without the father pushing, the child and toy car are not moved. In each case an *extrinsic* cause—something outside the subject—is essential if the effect is to be achieved.

In the same way, notwithstanding that they are rightly disposed through the facility of surface tension, none of the material subjects mentioned above can take on spherical form unless an efficient cause, a cause from outside them (*extrinsic*), is acting to impress this form in the matter.

There is another issue. Cause and effect are proportionate. The warmth I enjoy when I enter my house is from the fire in the grate. This particular effect testifies to a particular cause. The warmth I encounter when I go outside on a clear day, however, is something I share with the whole world because it is from the sun which heats the planet and the whole solar system. The more universal the effect, the more universal the cause. Now sphericity of form is found throughout the universe. Is it not reasonable, then, to conclude that the cause that induced sphericity in the ball of water on which the scientist was experimenting in the International Space-station is identical with the cause which induced that form in the globe of our planet and in every one of the celestial bodies ?

Newton's View : Einstein's View

Newton understood gravity as an effect of attraction between bodies via their mass. The greater the mass of the respective bodies, the greater the attraction. And, conversely, the further apart they were,

the weaker the attraction. While he had no doubt that this understanding provided a means for the accurate calculation of effects, he had doubts about its causation. "Gravity must be caused by an agent acting constantly according to certain laws. But whether the agent be material or immaterial, I have left to the consideration of my readers." (*Letters to Richard Bentley)* Moreover he knew, despite his embrace of a qualified materialism, that space could not be a void but the same materialism misled him as to the nature of the ethereal body that filled the universe.

Einstein embraced the materialistic paradigm thoroughly as he immersed himself in the thought of Hume and Mach. He accepted the materialist conclusion flowing from the Michelson-Morley experiment that no ether existed. Space seemed, from observations, to exercise a certain causative faculty. Uninhibited, as Newton had been, by a residual metaphysics, he saw no difficulty in ascribing such causality to something bereft of any objective reality. Gravity was a natural outcome, he said, of the presence of the mass of a body in space. It 'warped' the space around it, impelling other bodies, should they approach too close, to depart from their rectilinear paths. The greater a body's mass, the more it 'warped' the space around it.[2] Gravity was not a force propagated between bodies but the inevitable effect of the interplay of their mass and the surrounding space.

Each of these two approaches to the issue of the causation of gravity has problems.

1. There is nothing in a body, *qua* body, which requires that it should attract another.
2. Any assertion of causes which assumes that space is a void, is grounded in an impossibility.
3. If space is a void, this "non-being somehow existing" would present an absolute barrier to transmission of gravitational force, as it would to the transmission of light.
4. If space is a void, a logical dilemma follows. Einstein's theories hold that the speed of gravity's propagation is determined at *c*, "the speed of light", 299,792,458 metres per second, a contention born out in experiment. But if space is "non-being-somehow-existing", no reason can be advanced why its speed, or that of light, is not infinite.
5. If space is a void, there is no medium whereby the immense forces of attraction at play in Newtonian theory, or the 'natural' inclination of space under the influence of mass posited in Einsteinian theory, can be conveyed—the dilemma of action at a distance.
6. Neither explanation provides an *adequate* account for the effect, as universal as is gravity, that celestial bodies are spherical in form.
7. Neither explanation provides any account at all for the effect, equally universal among the heavenly bodies, of circular motion.
8. Each explanation supposes a metaphysical impossibility, the absence of an efficient (extrinsic) cause. Newton was prepared to allow one. The need for one never entered Einstein's head.

Even as it offends common sense, each of these gravitational theories offends the metaphysical doctrine of causality.

The Metaphysical Doctrine Of Causality

If the modern reader is to gain some grasp of how this doctrine reflects the truth about reality it will

2 Expressed in technical language, it was an effect of "the curvature of space-time" because "the gravitational acceleration of a body in free fall is due to its world line being a geodesic of space-time".

be necessary to spend a little time illustrating it.

Let's take the example of the astrophysicist sitting at his computer. The machine in front of him is, patently, comprised of matter in various categories, metals, glass, plastic, elements or compounds of the elements. Without the *matter* there would be no computer. But there is something even more essential. The matter, in its sub-categories, must be ordered in a certain critical manner else he will not have a computer at all, but something less subtle. This influence is the artificial *form* that makes the thing be a computer rather than a television set, a radio, or a device for mixing cake ingredients. These two influences are referred to respectively as the *material* and the *formal* causes.

Apart from these two, two other influences are required, the maker (makers) referred to as the *efficient* cause, without whom the computer could not have come into existence, and the *final* cause, the reason for its being conceived in the first place. This last is the most important of all. It begins in the mind of the one who desires, and conceives, it, and is realised in the device produced. The first two causes are *intrinsic* ; they remain in the computer. The latter two, in contrast, are *extrinsic*, outside the thing and, once it is produced, they are no longer essential to its continuance or its operation.

	[***intrinsic***	[***formal***
	[and then	[or
Cause	[either :	[
is either :	[	[***material***
	[or	
	[***extrinsic***	[***efficient***
	[and then	[or
	[either :	[
		[***final***

Form causes *by determining,* matter by *being determined*. A little reflection makes this plain. The matter that goes to make up a computer could constitute any of a number of things. The illustration we have used assumes matter at a certain degree of refinement (referred to as 'secondary matter'). But matter simply amorphous, matter taken as the 'stuff' underlying everything (referred to as 'prime matter'), is quite indifferent. It can be anything. The *formal* cause is what makes matter be *this* particular thing.

Now, art imitates nature. As with artificial things, every *natural* thing, has four causes, formal and material, efficient and final. The *formal* and *material* are easy to see. Recognition of the *efficient* and the *final* causes of natural things brings other considerations which we will come to shortly.

Moreover, just as every *thing* (whether natural or artificial) has four causes, so too, does every *action* we perform. Consider the father pushing his little son in the toy car. The *matter* of the father's act (the one undergoing it) is his son in the car ; the *form* is the accident of *action* (in the father) which is felt as *passion* in child and car ; the *efficient* cause is the father ; the *final* cause is the desire of the child to feel the pleasure of being propelled.

It is necessary too, if the reader is to understand the argument proposed, that he have some grasp of the metaphysical doctrine of the *Categories of Being*. Some things be, other things be-long. One never sees the colour blue, for instance, by itself only in something like the sky or the sea. 'Up-side-down' is a reality never found by itself, only in a being such as a child on parallel bars or an aeroplane performing aerobatics. 'When' and 'where' can only be said about some objective thing. There is no such thing as posture in the absence of some thing posing.

This distinction of things is exposed in the categories. All material things can be reduced to one or other of ten classes as follows—

substance		a thing which exists in itself
	quantity	its spatial extension
	quality	makes it to be of such sort, in a variety of ways
	relation	its order towards some other thing
	when	in this time
	where	in this place
	action	the thing taken as producing some change in another
	passion	its suffering some change from another
	habitus	whether clothed or armed
	situs	its posture—upright, lying, sitting etc.

A dog is a substance. That it has a body is an effect of its proper *quantity*. That it is brown is a *quality*. That it is chasing another dog belongs to the accident, *action*. That it wears a collar is of the accident *habitus*. That it is sitting belongs to the accident *situs*.

The categories fall, as illustrated above, into two divisions, substance and nine accidents. A substance exists in itself ; an accident has no existence independent of a substance. In short—

substance = be-in-self : accident = be-in-other.

A note of caution. The elaboration of the reality signified by the word *substance* laid out above (taken in its true sense as *sub-stans*, *that which stands under* its accidents), is ***not*** how Newton conceived of it in the *Principia Mathematica*. His definition, derived from Descartes, was closer to the metaphysician's understanding of first accident, *quantity.* This loss of understanding was coupled with a loss of understanding of the distinction between substance and accidents. Einstein laboured under the same disabilities which led to him attribute to accidental realities, and to imaginary realities (or beings whose only reality was in the mind), burdens which could only be borne by a substance.

If one is to understand the argument that follows, it is important that the reader suspend allegiance to current preconceptions about causes. One of these preconceptions is that one should reject, as a view which is out of fashion, any suggestion that the universe might be the work of an all-seeing God. This mindset which is at the heart of the philosophy that underpins modern civilisation and modern science, is a major impediment to getting current thinkers to recognise the necessity of *efficient* and *final* causes in natural things. The one who recognises the need for them is, at least inchoately, a believer in God. The one who refuses to do so is, at least inchoately, an atheist.

It is this *moral* issue—'moral' in the sense of a man's acceptance that it is reasonable to acknowledge the influence of an *efficient* cause in nature—which grounds misunderstanding over the causes of gravitational force.

The Flaws In Gravitational Theory

Consistent with metaphysical theory, the first thing to note is that gravity is an accident, a *quality.* It does not exist in itself. It exists only in some substance, or substances. Notwithstanding that it has been superseded by Einstein's theories, Newton's assessment of how gravity works remains the practical model. Newton's gravitational theory is grounded, reasonably, in his three laws, and particularly in his second expressed in the formula $f = m\ a$; force is the product of mass and acceleration. But mass, too, is an accident, a *quality,* closely allied with the *quantity* of a substance and refers primarily to its matter.

Einstein's focus, as is the case with mathematicians generally, was with *quantity*. The closest he got to *substance* was via body, its physical manifestation.

Matter, we recall from the principles laid out above, is incapable of determining ; its function is *be determined*, as indeed, the matter of the planet and of each of its component parts—material substances such as the author (!)—*is determined* by gravity's accidental form. If the planet (and its components) is gravity's *material* cause, it is impossible that, together, it could be gravity's *efficient* cause. Moreover, an efficient cause is always *extrinsic*, that is, outside the effect (except in the case of living things which move themselves). The builder constructing a house is *extrinsic* to the form and the materials he is using to build the house. The father pushing his little son in the toy car is *extrinsic* to the motion he induces. Metaphysical principle demands that gravity's *efficient* cause, too, is something *extrinsic* to the planet and its components. This requirement resonates with four of the objections (nos. 1, 5, 6 and 7) to the premises underlying current gravitational theory set out above.

The Universe In Metaphysical Theory

Now let us look at the workings of the universe according to the mind of the philosopher who established the science of metaphysics, Aristotle, and the philosopher who adorned his teaching, St Thomas Aquinas. These teachings appear chiefly in Aristotle's *De Caelo* and Aquinas's commentary[3] and reflect the principles about causality set out above. Since, however, their teachings were matched to a limited natural science, it is necessary to adapt them to the demands of modern discoveries, while ignoring modern science's materialistic preconceptions.

We should first note the circumspection with which the two philosophers regarded their subject. Aristotle says this :

> "We are far removed from the things we are trying to enquire into, far away not only in place but more so in that we have sensation of exceedingly few of their accidents." *De Caelo* 2.3.286a 14-18

And St Thomas adds—

> "that the accidents of the celestial bodies are of a different notion altogether [*alterius rationem*] and

3 The author's elaboration of their views may be found at http://www.superflumina.org/PDF_files/aether_gravity.pdf

are wholly disproportionate to the accidents of inferior bodies." *In II De Caelo* l. iv, n. 3

Aristotle observed that the heavens rotated with circular motion, a motion which contrasted dramatically with the rectilinear or somewhat curved movements, often in staccato succession, found on earth. It is opposite to the motions we are familiar with. There is a perfection associated with circular motion—it is continuous, never interrupted, eternal. Since effects must reflect their cause, this led Aristotle to the view that the body which was its cause must enjoy greater perfection than any earthly body. Circular motion was the motion proper to the body that sustained the heavens. Aristotle referred it to as "the heavenly body", "first body", or *aether.* St Thomas called it "the first altering body", the body "through which all other bodies are sustained". We will refer to it as *aether,* purposely adopting the Latin spelling to distinguish it from the ersatz reality scientists since Newton have referred to as 'ether'.

Consistent with its perfection this body, *aether,* lacked the indicia of the material beings with which we are familiar, notably tangibility and mutability. Yet it was material, for what occupied the heavens in which sun, moon and the stars rotated, though invisible in itself, must be some thing, for a void, non-being, is impossible.

Now we, beneficiaries of the discoveries of modern science, know that the circular movement of the heavens is but an effect of the planet's rotation in an otherwise immobile sea we refer to as 'space'. It seems reasonable, then, to amend Aristotle's conclusion and assert that circular motion is not the proper motion of *aether* but the proper effect it induces in celestial bodies throughout the universe.

But where does gravity come in ?

Though they understood its effect, heaviness, which they characterised as a *quality* attaching to things, the two philosophers had no notion of gravity as centripetal force associated with a celestial body. Let us pause and note the contrariety, the opposition, in thinking of the processes adopted respectively by the metaphysicians and by modern scientists under materialism's imperatives. Modern science addresses gravity first, and circular motion and the sphericity found in celestial bodies secondarily, as little more than incidents of gravity's centripetal force. The two philosophers, in contrast, considered circular motion as primary and essential, the signal characteristic of the heavenly substance through which it exercises its causality.

What attitude would the two take if they were alive now and possessed of the riches of the discoveries of modern science ? The answer is they would not change their position one wit. They would see gravity as but the centripetal force which is the natural consequence of the circular motion *aether* induces in the planet and in every celestial body throughout the universe. That is, while on earth circular motion is dependent on centripetal force, and derivative, outside the realm of earth's gravity, the opposite obtains. Centripetal force depends on circular motion in the celestial body, and its measure derives from the force *aether* exercises in constraining the body to that motion consistent with Newton's Second Law.

The implications of this metaphysical thesis appear to be supported by the spontaneous behaviour of fluids in the International Space-station referred to above.

Spelling Out The Implications

The metaphysical thesis is the very opposite of that adopted in current scientific theory. It insists that there is an agent that produces gravitational force in a celestial body, an efficient cause, *extrinsic* to it. The agent is universal—as extensive as the universe. It is material. It is powerful, immensely so ; nothing is more powerful. Its presence is invisible, undetectable by the senses, yet deducible from phenomena which manifest its properties. (Modern scientists, did they but realise it, are continuing to uncover these properties.) This, the heavenly substance, is the container of all other material being as the sea is the container of all sea creatures. Indeed, *aether is* the universe. The "default setting" of reality—to adopt modern computer jargon—is not a void, or vacuum, but *aether*. Where there appears nothing else, there is *aether*.

Space, void, "non-being somehow existing", is impossible. Common sense agrees with ontological and logical principle. Every sense is a species of touch requiring physical contact with the object of its power for it to operate. Accordingly, the eye must have physical contact with the object of its vision. Therefore, there must be a material continuum carrying the light ray between the eye of the viewer and a star such as *alpha centauri* some 4.3 light years distant and, even though it be undetectable, the 'space' between the two must be replete with some material body. A moment's thought will show why this transparent body must be undetectable. If it were otherwise, it would impede the vision of what it conveyed, a facility remarked by Christian Huygens in 1678.

> "I do not find that anyone has yet given a probable explanation of the first and most notable phenomena of light, namely, why it is not propagated except in straight lines, and how visible rays, coming from an infinitude of diverse places, cross one another without hindering one another in any way... (*Treatise on Light*, Ch. 1)

From the discoveries of modern science, it would appear that *aether*, the heavenly substance in metaphysical theory, exercises two offices or functions. First, it is the orderer of the universe and its component parts achieved by its generation of circular motion, centripetal force (gravity) and sphericity of form in each celestial body. Second, it is the means whereby light and electromagnetic energy generally is conveyed (*lucifer*). Its properties would seem to be the following, at least :

- it is transparent by essence ;
- it determines *c*, 'the speed of light' (299,792,458 mps), the speed at which light and electromagnetic energy is propagated, and the speed at which (so Einstein has shown) gravitational force is propagated. Moreoever, since gravity is (in metaphysical theory) centripetal force that follows upon circular motion, it seems reasonable to conclude also that it is the speed at which *aether* invests a body with circular motion and, in the case of emollient materials, with sphericity of form.
- it establishes, through *c*, the ground in which *time*, the measure of change, is established.
- it is convertible with what we call 'space'.
- (though this is not within the contemplation of this paper) it is the catalyst—with its proper *quantity* (primarily) and its proper *qualities* (consequently)—in the constitution of each material substance

Einstein regarded *c,* 'the speed of light', as the one constant in the universe but *c* is an accident, a *quality,* not a *substance*. Had he understood its reality as Aristotle expounded it, rather than in the stilted version passed via Descartes to Newton, Einstein would have acknowledged that *aether* is the one constant in the universe. Had he done so, this understanding would also, we suggest, have altered his whole conception of the causes and effects at work.

An Experiment

Here is a suggested experiment to test the thesis we have advanced about the ontological order that obtains outside the influence of earth's gravity, one beyond the means or the facilities available to the author.

Fashion a hollow, clear plastic, discus. A central pin, or axis, may be inserted but it is unnecessary. Make the whole sufficiently strong to cope with changes in pressure. Import some fluid into the hollow body, pure water, alcohol, or oil, and seal it at standard atmospheric pressure so that it is, perhaps, $1/8^{th}$ filled. In the space-station, where a similar ambient pressure obtains, in a condition of weightlessness, have one of the crew agitate the discus so that the liquid is dispersed throughout its internal volume then, using both hands, have him spin the discuss around its central axis and allow it to hang spinning in the cabin space. Observe what happens to the fluid.

Prediction : the fluid will migrate to the axis and collect in a sphere.

Conclusion : circular motion produces centripetal force, and the cause of circular motion is the cause of gravity.

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29th July—*Feast of St Martha*