

There Goes the Sun...

A detailed rebuttal to Alec MacAndrew's critique of Geocentrism



Alec MacAndrew

(taken from his Twitter page)

R. Sungenis: Alec MacAndrew and I have sparred many times over the years. In our last bout, MacAndrew abruptly left the discussion. Presently, he has been enlisted by either Karl Keating or David Palm to once again enjoin the battle against geocentrism. Earlier I rebutted Keating's comments he made at (<http://forums.catholic.com/showthread.php?t=851392&page=2>), and it appears MacAndrew has been hired to answer for Keating. Keating and Palm are Catholic, but know very little science. MacAndrew has a Ph.D. in physics, but is an avowed atheist. This is apparently what Karl Keating's efforts have been reduced to: instead of honestly and openly debating his Catholic opponent in a public forum, he enlists the views of atheists to help set aside the traditional beliefs of Catholicism and those who wish to promote them.

MacAndrew: "Here Comes the Sun": How the new geocentrists persist in scientific and logical errors by Alec MacAndrew. Introduction: Karl Keating, founder of Catholic Answers, posted a short piece at Catholic Answers Forum in a thread about geocentrism, discussing the difference between kinematics - calculating motion as viewed from different viewpoints without regard for causes of motion - versus dynamics - calculating the motion of bodies by considering the forces acting on them - as a basis for thinking about and calculating the motion of celestial bodies. Bob Sungenis, who is a prominent proponent of geocentrism [FN: The new geocentrism is a religiously motivated belief that the earth is completely static and located at the exact centre of

the universe], replied with a long article posted on his website attempting to refute Keating's argument. This gives us a good opportunity to discuss some of the scientific and logical errors that Sungenis and some of the other new geocentrists have been making for years.

R. Sungenis: Speaking of "opportunities," this is a good one to state that MacAndrew's position is just as "religiously motivated" as he purports mine to be. As ironic as it may sound, MacAndrew's "religion" is atheism. As such, every piece of scientific data he examines is viewed through his wish to keep God and Christianity out of the picture. MacAndrew will claim that in leaving God out, he is being a "true scientist" and that he isn't influenced by a godless motivation. But he is. He will lie to himself, especially when it comes to interpreting the scientific data to support his atheism. Of course, Karl Keating and David Palm, being modernist Catholics who have made their bed with atheistic modern science, have no qualms enlisting MacAndrew, even though MacAndrew despises Catholicism. This is only going to come back to haunt both Keating and Palm.

MacAndrew: The first part of Sungenis's article is a discussion in his own words of Keating's post. The second longer part is a series of loosely connected papers written, at least in part, by other people. They contain mathematical treatments of various aspects of Newtonian celestial mechanics which purport to show the dynamic as well as the well-accepted kinematic equivalence of heliocentric and geocentric descriptions of the solar system. I show that not only does Sungenis fail to demonstrate this dynamic equivalence in the first part of the paper, but that the second part, mainly written by others, also fails to show it, and moreover contains several substantial but basic errors. I also point out that moving from a Newtonian to a General Relativity framework, as the geocentrists must do if they are to demonstrate the dynamic equivalence of Earth-static and Earth-moving systems, results in the concepts of being central and absolutely static becoming meaningless, thereby completely undermining their basic claims.

R. Sungenis: And I will show that MacAndrew's claims are completely baseless.

MacAndrew: Kinematics and Dynamics: The discussion point between Keating and Sungenis centres on whether both kinematic and dynamic descriptions of celestial motions are equivalent. Keating's point is that, although you can view any motion from the point of view of any arbitrary frame of reference by applying a co-ordinate transformation (this kind of calculation is known as kinematics), the actual causes of motion (forces leading to accelerations and so on) are not revealed by these co-ordinate transformations. They do not tell us anything about why the body is moving as it is nor allow us to predict its motion. For that you have to turn to the science of dynamics in which the motion is derived by using particular physical laws, such as the inverse square law of gravity.

Sungenis disagrees and attempts to demonstrate that the geocentric claim (that the Earth is completely static at the centre of the universe) is both kinematically and dynamically equivalent to the situation in which the Earth rotates daily on its axis and revolves annually around the Sun. His arguments in this paper fail because they are mainly based on classical mechanics, in which there is no such dynamic equivalence. In classical mechanics, rotating and accelerating frames can be absolutely distinguished from non-accelerating or inertial frames, and according to classical mechanics, the Earth is unambiguously rotating and accelerating.

R. Sungenis: So notice that MacAndrew is going to set the rules of the game. He will determine who and who cannot use Newtonian mechanics. I guess what he is trying to say is that Newton can only be used by heliocentrists like him.

MacAndrew: But there's more – in pushing his point Sungenis makes several elementary errors. For example he is wrong about the strength of the gravitational attraction of various celestial bodies at the Earth,

R. Sungenis: MacAndrew no more knows the “strength of the gravitational attraction of various celestial bodies” than I do. No one really knows how far away the stars are from us. The empirical evidence only takes us out as far as 300 light years, and even that is a stretch.

MacAndrew: and he confuses two different physical concepts – the centre of mass of a system of bodies and a point in space with zero gravity.

R. Sungenis: As we will see, I don't confuse them at all. The real truth is that MacAndrew is desperate to make Newtonian mechanics deny geocentrism, since he will later admit that both Machian and General Relativity permit geocentrism.

MacAndrew: A potentially successful way to arrive at a physical equivalence between an Earth-static geocentric frame and a rotating, orbiting Earth frame is by invoking Mach's Principle which states that inertia is determined by some influence of the cosmic matter and energy. A consequence of Mach's Principle is that rotation is relative and not absolute. According to Mach, it is as valid to say that the universe rotates around the Earth once a day as it is to say that the Earth rotates once a day on its axis; they are equivalent and the choice is arbitrary.

R. Sungenis: So there we have it. According to MacAndrew, one of the current major theories of modern physics allows a geocentric universe. At this point the discussion should be over, since we have shown, by MacAndrew's own admission, that at least one branch of modern physics supports geocentrism. But it will be interesting for you to see how MacAndrew attempts to downplay this reality. Here's the first attempt...

MacAndrew: The same could be said not just for the Earth but for any object in the universe.

R. Sungenis: Not so. Since everyone must explain the day/night sequence and the seasons, then either the sun is daily revolving around the Earth, or the Earth is daily rotating on a 23.5 degree axis and revolving around the sun in a year. As such, we cannot have a third option in which, for example, the sun would be going around Jupiter, for then we would not have a day/night sequence on Earth unless the Earth were rotating, but it doesn't rotate in a geocentric system. Let me repeat: there are only two systems that can explain what we see: the heliocentric, which requires the Earth to be rotating on an axis of a 23.5 degree incline and revolving around the sun in 365.25 days. Both the rotation and the revolution are required. Conversely, geocentrism requires only that the universe rotate around the Earth on a sidereal rate of 23hrs, 56 min, 4.1 sec, and the sun to revolve around the Earth on a solar rate of exactly 24 hours.

MacAndrew: General Relativity is the current best physical theory of gravitation and it might incorporate Mach's Principle, although this is still a matter of debate.

R. Sungenis: No, General Relativity is not the "current best physical theory of gravitation." It is full of contradictions, not the least of which is its contradiction against Special Relativity. For example, Special Relativity says the speed of light is constant, but General Relativity says the speed of light is not constant and can assume any value. Special Relativity was invented to keep the Earth moving in the face of experiments that showed it wasn't moving, but General Relativity allows the Earth to be non-moving and the center of the universe. Special Relativity says there is no aether, but General Relativity says there is an aether, and even uses this acknowledgment to explain the 1925 Michelson-Gale experiment that showed almost a 100% relative rotation between the Earth and the universe by measuring aether drift. General Relativity limits the speed of gravity to c (186,000mph), but then says that light can travel at any speed below or beyond c in a gravitational or inertial field.

As for Mach's Principle, Relativists must accept it in principle because it says basically the same thing that Einstein's relativity theory says, namely, all motion is relative. The reason Relativists are hesitant to fully embrace Mach's Principle is because it requires an instantaneous gravitational/inertial relationship between us and the stars. Since General Relativity often limits the speed of gravity by Special Relativity's rule of 186,000mph, then gravity cannot be instantaneous. Yet, by the same token, Big Bang theorists use General Relativity to say that, at the outer rim of the universe, space is expanding way beyond the speed of light, but apparently, the matter that fills this space cannot be interacting with itself by means of gravity since gravity travels many magnitudes slower than the space expands. They had the same problem with the Big Bang, since if the explosion was as big as they needed, then light and gravity wouldn't be able to communicate from one side of the Big Bang to the other. So they allowed light to exceed

c by claiming there was a super rapid “inflation.” Of course, there is not the slightest proof for these things, but they are needed to keep the theory propped up.

Incidentally, the BICEP2 program, which was supposed to have given evidence of “inflation” by the appearance of “gravity waves” from the Big Bang, was recently shot down in a big way.

See Gravitational Wave Discovery Challenged By Two New Studies

http://www.huffingtonpost.com/2014/06/04/gravitational-wave-discovery-challenged_n_5440197.html?ir=Science&utm_campaign=060414&utm_medium=email&utm_source=Alert-science&utm_content=Title

MacAndrew: However, invoking General Relativity, as geocentrists do to attempt to get the equivalence they need, makes meaningless the concepts of being absolutely static and of a centre to the universe, thus demolishing the fundamental hypothesis they are trying to prove. So, depending on which argument they use, their claims are either wrong or meaningless.

R. Sungenis: This only shows how desperate MacAndrew is. He has been told many times in our debates that the only reason we appeal to General Relativity is to expose the fact that the very science MacAndrew says is “the current best physical theory of gravitation” is the very theory that cannot discredit geocentrism.

MacAndrew: The relationship of maths and physics. In an attempt to demonstrate the equivalence of Earth-static and Earth-rotating systems, Sungenis begins his paper with some thoughts on the relationship between mathematics and physics, making assertions that could not possibly be made by a professional physicist or mathematician: “If the math of either system works, it is because the physics of either system works, for physics is measuring how things move by using mathematics, not intuition or magic.” [My emphasis]. The bolded part of the statement depends entirely on what he means by “works”. Maths is a tool in physics – it is used to describe and model the behaviour of the world. It is trivially easy to write down perfectly acceptable mathematical expressions which “work” as far as mathematicians are concerned, but which do not describe the physical world correctly, and which are therefore wrong, as far as physicists are concerned. (For example, an expression that gives the gravitational field magnitude of a body decreasing as the cube of the distance from it, $g = Gm/r^3$, is perfectly good mathematically, but is demonstrably wrong as a physical description of reality.) The maths of kinematics (co-ordinate transformations) “works” perfectly to describe the motion of bodies from different perspectives, but tells us nothing about the underlying causes for the motion, just as Keating stated.

R. Sungenis: Karl Keating knows nothing about dynamics or coordinate transforms. All he knows is what he has been taught by the science textbooks he read in high school that limit the issue to two-body mechanics.

MacAndrew: Sungenis continues: “Physics is little more than math. If the math doesn’t work, then neither will the physics. The problem with physics is that it can provide more than one viable math solution, and different math solutions yield different physical explanations.” “Physics is little more than math” – this is a grotesque misunderstanding of the scope of physics.

R. Sungenis: I wasn’t talking about the “scope” of physics. I was only talking about the relationship between physics and math.

MacAndrew: Physics is substantially different from maths – as we have seen, maths is used as a tool in physics to describe the behaviour of the world, but physics involves much more than writing down descriptions. The fact that physics descriptions are usually mathematical doesn’t mean that “physics is little more than math”. Historically, it has often been the case that existing mathematical techniques don’t “work” to correctly describe various aspects of the way the world behaves and then new maths needs to be created, or adopted into physics.

R. Sungenis: This is a classic case of putting the cart before the horse. When Hubble found the galaxies had redshift and no blueshift, it put the Earth in the center of the universe. The only way out of that dilemma was to make space curved rather than flat. This would mean they had to reject Euclidean geometry in favor of Reimann geometry. Here are Hubble’s own words:

“Such a condition would imply that we occupy a unique position in the universe, analogous, in a sense, to the ancient conception of a central earth. The hypothesis cannot be disproved but it is unwelcome and would be accepted only as a last resort in order to save the phenomena. Therefore, we disregard this possibility and consider the alternative, namely, a distribution which thins out with distance....The unwelcome supposition of a favored location must be avoided at all costs.”

“Such a favored position, of course, is intolerable; moreover, it represents a discrepancy with the theory, because the theory postulates homogeneity. Therefore, in order to restore homogeneity, and to escape the horror of a unique position, the departures from uniformity, which are introduced by the recession factors, **must be compensated by the second term representing effects of spatial curvature**. There seems to be no other escape.”¹

¹ *The Observational Approach to Cosmology*, pp. 51-59.

In other words, in order to avoid the clear implications of a geocentric universe that the redshift of galaxies was giving them, they, as MacAndrew slyly puts it, “adopted” a new math to prop up an *ad hoc* anti-geocentric theory. In other words, the math is invented or adopted in order to give credibility to the physical theory they want to promote. So, if you want to promote acentrism or heliocentrism, you merely invent or adopt a math that will allow you to change the physical world (e.g., curved space). You then present it to the public as if the physical world you invented is the reality, and the math was only added afterward to show that the physical world you invented works.

The same thing was true when Einstein invented Special Relativity (SRT). The backbone of SRT is the Lorentz transform ($L' = L \sqrt{1 - v^2/c^2}$). The Lorentz transform was foisted upon physics because they needed an answer to the 1887 Michelson-Morley experiment that showed the Earth wasn't moving in space. The Lorentz transform was the mathematical brainchild of Hendrik Lorentz. He claimed that the reason the Earth appeared not to be moving was that the apparatus of Michelson's experiment shrunk. How much did it shrink? Just enough to mask the movement of the Earth around the sun, of course!

How can one then put that amount of shrinkage into a mathematical equation to give it an air of credibility? Very simple. You invent an equation using the speed of light that is always less than 1, which is $L' = L \times \sqrt{1 - v^2/c^2}$. And if anyone asks any questions, such as “Hey, aren't you merely hypothesizing a physical alteration of length just to make it look like the Earth is moving so that you can support your acentric or heliocentrism system?” the answer will be the same as MacAndrew's: “Who are you going to believe? Me or your lying eyes?”

MacAndrew: The fact that Newton was obliged to invent differential calculus in order to derive elliptical orbits using his law of universal gravitation is a classic case. There are many more examples in modern physics, including the adoption of tensor analysis in GR and the development of gauge theories in particle physics. In any case, it is wrong to equate physics and maths.

R. Sungenis: The invention of calculus was far different than what MacAndrew is trying to portray. Calculus is really nothing more than a hypersensitive arithmetic. Whether differential or integral, one just adds up the minute increments with the illusion that one has done so an “infinite” amount of times. We use it to deal with curved objects as opposed to straight ones.

As regards “tensor analysis,” it is useful when one is dealing with non-solid objects, such as elastic material and fluids. It involves vectors and forces in combination. The only reason that GRT must appeal to it is because the so-called “space-time” that it believes is the physical reality of the universe is a flexible space due to the bending of it by gravity. But tensor analysis doesn't prove that GRT is correct. It is merely a math tool to describe what the Relativist envisions

(without proof) as the physical reality of the world. In other words, a Relativist begins with a certain unproven physical construct of the universe, and then sets about trying to show how this construct will make itself viable by making it balance both sides of an equal sign.

And where did the Relativist get the idea that “space-time” is the physical reality? From Einstein’s Special Relativity, which, as noted above, was invented to keep the Earth moving when the empirical evidence showed it wasn’t moving. Here’s how it happened. When Einstein borrowed Lorentz’s transform equation ($L' = L \sqrt{1 - v^2/c^2}$), he not only kept the idea that the length of Michelson’s apparatus shrank, he realized that he would also have to make time itself shrink (or dilate if measured from the receiver) by the same proportion. After all, if a moving object is supposed to pass point A in a certain time, but it can’t because it’s length has been shortened, this means that the time period of its travel must also be altered by the same amount. So Einstein said that $T' = T \sqrt{1 - v^2/c^2}$. This meant that time itself was malleable, just like material objects. It became a haunted house of mirrors where nothing was as it appeared to be – and all to make people believe the Earth was moving when it actually wasn’t. Magicians couldn’t have planned it better.

MacAndrew: So just because the “maths works” doesn’t necessarily mean that it provides a good explanation of reality. Syntactically valid maths which follows correctly from its axioms does not, on its own, tell you whether it accurately describes reality –

R. Sungenis: MacAndrew is stealing my point. I was the one who said that math doesn’t prove the physical reality.

MacAndrew: for that you have to turn to the physics and to Nature herself – does the model, i.e. the maths, accurately describe and explain the physical behaviour? Nature is the arbiter.

R. Sungenis: MacAndrew (like many scientists), attempts to make it sound as if they are totally open to the empirical evidence. They are not. Their presuppositions and philosophies consistently get in the way of an honest appraisal of the data. Hubble and Einstein, noted above, are good cases in point. It is simply facile for MacAndrew to claim “Nature is the arbiter,” since he knows very well that the data Nature gives us needs an interpretation, and that interpretation can only come from a thinking personality, whose thinking is often polluted by his ideological position.

MacAndrew: Does the Earth orbit the Sun or vice versa? Sungenis, using entirely classical, Newtonian arguments, claims that the Earth can be static and orbited by the Sun because of the influence of the rest of the universe.

R. Sungenis: First, I don't use "entirely classical, Newtonian arguments." MacAndrew knows very well that I use the three known branches of physics: Newtonian, Machian and Einsteinian. The reason I do so is that they show that modern science can have no rebuttal against geocentrism, except on philosophical grounds. Allow me to quote from one of the most esteemed physicists in the world today, George F. R. Ellis, to settle the matter:

"I can construct [for] you a spherically symmetrical universe with Earth at its center, and you cannot disprove it based on observations. You can only exclude it on philosophical grounds. In my view there is absolutely nothing wrong in that. What I want to bring into the open is the fact that we are using philosophical criteria in choosing our models. A lot of cosmology tries to hide that." ("Profile: George F. R. Ellis," W. Wayt Gibbs, *Scientific American*, October 1995, Vol. 273, No. 4, p. 55).

MacAndrew: Let's see why that is false. He writes:

Notice how Keating seeks to limit that issue [the Sun-Earth dynamic system] to "the Sun and the Earth." If the issue were limited to the Sun and the Earth, Mr. Keating would be correct. That is, the Earth, being the smaller body, would necessarily orbit the Sun, which is the larger body. This is precisely what led Galileo to surmise that if small moons are orbiting Jupiter, then the smaller Earth should orbit the Sun, and thus the Earth moves.

Remember what Sungenis asserts here, because it is very important for our discussion – it is an admission that if the Sun-Earth orbital system can be approximated to a two-body system (as Luka Popov does in a paper extensively cut-and-pasted later in Sungenis's article) then the Earth would necessarily orbit the Sun. I am going to show that the Sun-Earth system can be approximated very closely to a two-body system and therefore that Sungenis's claims that it can't be treated that way are wrong.

R. Sungenis: So, remember what MacAndrew asserts here, because it is very important for our discussion – it is an admission that if the Sun-Earth orbital system cannot be approximated to a two-body system, then the Earth will not necessarily orbit the Sun.

MacAndrew: He continues:

Where Mr. Keating goes wrong is precisely his attempt to limit the issue to a two-body system, the Sun and the Earth. I'm sure Mr. Keating has noticed that each night we see that there are countless stars the circle the Earth. Each of those 5 sextillion stars have gravity, and that gravity will affect how the Sun and Earth react to one another, especially if the Earth is put in the center of that gravity.

So Sungenis's explanation for why he believes the Sun-Earth system cannot be treated as a two-body system is because of the gravity of the "5 sextillion 'countless' stars". Presumably, in his mind, this somehow forces the Earth to be at rest while the Sun revolves around it.

R. Sungenis: No, I didn't say that it "forces" the Earth to be at rest. I merely said that the stars will affect any system.

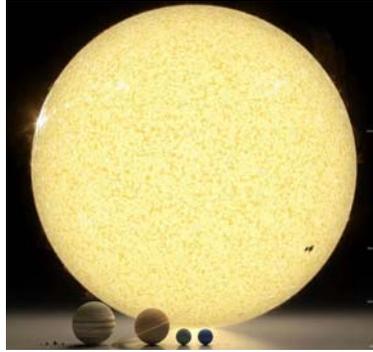
MacAndrew: To see whether he is even in the right ballpark, let's put some numbers on the magnitude of the gravitational field [FN: In classical mechanics, the magnitude of the gravitational field of a body is proportional to how strong the gravitational attraction of that body is at any point in space; it is the force per unit mass that would be felt by a second body at that point.] at the Earth for various celestial bodies; i.e., let's calculate the gravitational attraction of these bodies as experienced by the Earth. If Sungenis is right we should expect the gravitational field of the Sun at the Earth to be at least matched by that of the other bodies.

R. Sungenis: This just shows the fallacy of MacAndrew's whole analysis. The discussion should stop right here, since MacAndrew has made a fatal mistake by stating "If Sungenis is right we should expect the gravitational field of the Sun at the Earth to be at least matched by that of the other bodies." Not at all. In fact, what I am saying via Newtonian mechanics, is that we start with NO Earth in the center of the universe. We only place Earth in that position once we establish that Newtonian mechanics allows us to do so.

If the universe is rotating, it will rotate around a center of mass. I hope we can all agree on that point, because if we can't, then no further discussion is possible. As such, we then place the Sun 93 million miles from the universe's center of mass. The universe will rotate and carry the Sun with it, and both will revolve around the universe's center of mass.² Note that in this arrangement there is no gravitational attraction between the center of mass and the Sun. That is, the Sun is not being pulled into the center. The only gravitational attraction the Sun might experience is from the other celestial bodies – bodies that are not at the universe's center of mass.

Now, let's put Earth right at the center of the universe's center of mass. Will there be any gravitational attraction between the Sun and the Earth? Well, since the Earth is so much smaller than the Sun, there will not be any appreciable gravitational attraction from the Earth on the Sun.

² If MacAndrew tries to contest that the Sun will move with the universe, he must then explain how this could be so, since the universe is the only environment the Sun is in.



In the above image, at the bottom, look at the third body from the left, which represents Earth. Do you think that tiny body is going to have any gravitational effect on the Sun? Hardly. Hence, in the geocentric universe in which the rotating universe carries the Sun around the universe's center of mass, the Sun will revolve around the Earth without any noticeable effect at all.

So Alec MacAndrew's whole thesis has just been neutralized. He will proceed to go on to argue that the great gravity of the Sun is somehow going to make the geocentric universe impossible. As we can easily see, he is barking up the wrong tree, and I think even those who have even an elementary knowledge of physics will see the futility of his argument.

MacAndrew: I have normalised the universal gravitational constant, G , to unity so that the gravitational field of the Sun at the Earth is normalised to 1 in the table below in order to easily compare it with other bodies. [FN: I use the well-known equation for the gravitational field, where is the magnitude of the gravitational field, is the universal gravitational constant (normalised to unity in the table below), the mass of the celestial body and its distance from Earth]:

Body	Mass - solar masses	Distance from Earth - astronomical units (light-years)	Gravitational field magnitude at Earth
Solar System bodies			
Sun	1	1	1
Moon	3.68×10^{-2}	2.7×10^{-3}	5.04×10^{-3}
Venus ^a	2.45×10^{-5}	0.277	3.2×10^{-5}
Jupiter ^a	9.5×10^{-4}	4.95	3.8×10^{-5}
Extra-solar bodies			
Proxima Centauri	0.123	2.68×10^2 (4.24 light years)	1.71×10^{-12}
Sgr A* black hole ^b	4.2×10^6	1.84×10^{16} (25,900 light years)	1.57×10^{-14}
Milky Way ^c	1.25×10^{12}	1.64×10^{16}	3.19×10^{-8}
Andromeda galaxy	1×10^{12}	1.61×10^{11} (2.54 $\times 10^6$ light years)	3.88×10^{-11}
Virgo supercluster	1.2×10^{15}	3.40×10^{12} (5.38 $\times 10^7$ light years)	1.84×10^{-10}
Virgo-like supercluster at z=0.1	1.2×10^{15}	8.22×10^{13} (1.3 $\times 10^8$ light years)	1.77×10^{-13}

MacAndrew: a) The gravitational field of the most influential planets – Venus because it is close and Jupiter because of its relatively large mass: the gravitational field of planets varies greatly depending on their distance from the Earth as a consequence of the Earth’s and planets’ orbits. The calculations here represent the closest approach of these planets to the Earth, i.e. their maximum gravitational influence.

R. Sungenis: As we have stated above, all these calculations are superfluous since none of them include the fact that the center of mass of a rotating universe will experience no gravitational or inertial forces. The planets will revolve around the Sun because, not being in the center of mass, they must deal with the Sun’s gravitational force. The moon will revolve around the Earth for the same reason the Sun does – both are being carried by the daily rotating universe.

As for the stars, it is their collective mass which contributes to determining the universe’s center of mass, so, contrary to the conclusions MacAndrew wishes to draw from his above chart, it makes little difference what their gravitational contribution is. The fact remains that, whether their contribution is large or small, it will create a center of mass for the universe, and Earth, because it is so small compared to the rest of the universe, can occupy that center of mass without any appreciable difference in the force balance.

MacAndrew: b) Sgr A* is the location of the supermassive black hole at the centre of the Milky Way which has a mass of over 4 million Suns. We can see that its gravitational field at the Earth is only slightly more than a hundred trillionth that of the Sun’s. c Calculated by the ratio of the centripetal acceleration of the Earth around the Milky Way (period 240 million years, radius 2.57×10^{20} m) to centripetal acceleration of Earth around the Sun (period 1 sidereal year, radius 1.5×10^{11} m).

R. Sungenis: MacAndrew doesn’t know if there is a “supermassive black hole at the center of the Milky Way,” anymore than he knows there is Dark Matter that allows the Milky Way to rotate in accordance with Newton’s laws. This is just more speculation from the already bankrupt theory of General Relativity, which requires blackholes to exist due to the “tensor analysis” that MacAndrew was previously touting as “the best math in physics.”

Here are a few comments on Einstein’s blackholes:

After all, relativity is riddled with holes – black holes. It predicts that stars can collapse to infinitesimal points but fails to explain what happens then. Clearly the theory is incomplete (George Musser, “Was Einstein Right,” Scientific American, Sept. 2004, p. 89.)

“Thus, general relativity brings about its own downfall by predicting singularities” (Stephen Hawking, Black Holes and Baby Universes, p. 92).

Time magazine: “these inkblots of space are mere mathematical figments. So far, they can be shown to exist only as solutions to the complex equations of general relativity—Einstein’s theory of gravity—and very troubling solutions at that” (“Those Baffling Black Holes,” September 4, 1978, pp. 56-62);

John Moffat: ‘Einstein didn’t like black holes. The real motivation for “generalizing” his gravity theory was to see if he could find, as he called them, “everywhere regular solutions” that fit the equations.’ Tim Folger, “Einstein’s Grand Quest for a Unified Theory,” Discover, September 2004, p. 64.

MacAndrew: As you can see, because of the inverse square relationship of gravitational field magnitude with distance, the Sun has by far the largest gravitational attraction at the Earth compared with all other bodies in the universe. Even the closest galaxy cluster, which consists of hundreds of galaxies (the Virgo cluster with the mass of a thousand trillion stars), has a gravitational field at the Earth of less than a billionth that of the Sun. The gravitational effects of extrasolar bodies are so low that it is quite acceptable to regard Sun-Earth as an isolated two-body system with small perturbations from the other solar planets. The gravitational influence of the universe at the Earth is completely dominated by the Sun.

R. Sungenis: As we have seen, MacAndrew’s argument is actually a misdirection, since he hasn’t understood the center of mass of a rotating universe.

MacAndrew: Geocentrists might argue that although the attraction of individual entities (even entities like galaxy superclusters that contain the mass of a thousand trillion stars) is vanishingly small, the sheer number of stars in the universe can compensate for this. But this argument doesn’t work. Let’s combine the total number of galaxy clusters within 2.5 billion light years which is about 16,000 clusters⁶, average richness $7 \sim 17$, each of average mass $\sim 2.4 \times 10^{13}$ solar masses. Let’s suppose that we put them all at the distance of the Virgo cluster—which is closer than any of them and 50 times closer than the furthest of them. And let’s put them all in the direction of Virgo so their gravitational fields add, rather than spreading them all around the sky to cancel each other out, as they actually do. The total gravitational field of all these clusters, placed much closer to the Earth on average than they really are, and all acting in the same direction, is still 30 million times less than the Sun’s gravitational field at the Earth⁸. And the further out you go, although the total number of galaxies that we have to consider is still larger, their gravitational attraction becomes even less because of the inverse square law.

R. Sungenis: Again, all this is superfluous, since MacAndrew has missed the meaning of what a center of mass means in a rotating universe.

MacAndrew: Furthermore, Sungenis’s claim that the stars have “gravity [that] will affect how the Sun and Earth react to one another, especially if the Earth is put in the center of that gravity” [my bolding] is wrong, not just because the gravitational field at the Earth of all these stars is

vanishingly small compared with that of the Sun, as we have seen, but because gravitational fields of individual bodies are vector-additive—that is, they can cancel each other out if they act from opposite directions—so that if the Earth were to be at the centre, these already minuscule gravitational fields from the stars would tend to sum to zero.

R. Sungenis: This is the first thing that MacAndrew has come close to getting correct, but it only proves my point and brings us closer to geocentrism. That the sum of star gravity is zero is the very reason the universe's center of mass doesn't feel any gravitational or inertial forces. Moreover, the Sun doesn't exert any gravitational field on the center of mass either. Even if the Earth were a smidgen off-center, the inertial forces that are created by a rotating universe on the Sun would counterbalance any gravitational forces the Sun might exert on a slightly off-center point.

MacAndrew: Sungenis has already been shown by Gary Hoge⁹, that there are no observable motions in the universe that could offset the overwhelming gravitational attraction of the Sun, moon, and planets on the Earth.

R. Sungenis: As far as I know, Gary Hoge has closed up shop and conceded that he was wrong. Mark Wyatt did a good job of showing Gary that he forgot about the principle of relative motion. Perhaps Mr. MacAndrew should close up shop as well, since it is painfully obvious he has missed the major Newtonian argument of the geocentric universe, and admitted that both Mach and Einstein allow for geocentrism. FYI, we now have an animation that shows that the geocentric-oriented satellite will make the same figure-8 as the heliocentric-oriented satellite, and thus Hoge's objections have been completely answered. (See GeoSync3 on the new 10th edition GWW CDROM).

MacAndrew: Why do the new geocentrists and Bob Sungenis in particular constantly repeat the same old errors? Not only is he often wrong, but he is incorrigibly wrong. Even when he has been corrected about his errors, he persists in wheeling them out. It suggests either unwillingness or an inability to learn - or a determination to use arguments that appear to support his case, even if they are based on a fundamental misunderstanding of physics.

R. Sungenis: As we have seen, it is MacAndrew who is in error, since he has missed the fundamental issue concerning the rotating universe's center of mass. I understand MacAndrew's problem, for MacAndrew has never thought about the universe in these terms before. It is hard for someone so entrenched in the modern physics establishment to be open to a new way to view things.

MacAndrew: Let's consider two further arguments which Sungenis has made elsewhere¹⁰ to attempt to counter the fact that the Sun overwhelmingly dominates the gravitational field at the

Earth: In the first one, he points to the fact that the solar system orbits the Milky Way galaxy, and implies that the gravitational attraction required to be the cause of this motion must be enormous. But we have seen that the gravitational field of the rest of the Milky Way at the Earth required to balance the centrifugal force arising from the orbit around the Milky Way (period 240 million years, radius 2.57×10^{20} m) is some 31 million times less than the gravitational field of the Sun at the Earth¹¹, so he is mistaken in this respect.

R. Sungenis: The fact remains that, in the heliocentric system, the Milky Way imposes a gravitational attraction on the Sun, and thus the Sun-Earth is not an “isolated system.” What precisely that gravitational attraction is, MacAndrew doesn’t really know, since it is all speculation as to where the Sun is placed in the Milky Way; how fast it is supposedly going, and just how big the Milky Way really is. But it doesn’t really matter at this point, since MacAndrew has missed the essential argument of geocentrism from the beginning, namely, a rotating universe has a center of mass that makes the gravity of the celestial bodies a non-issue.

MacAndrew: Second, he claims that Mach’s Principle, the conjecture that the influence of the mass-energy in the universe determines the compass of inertia at a local frame, shows that the gravitational influence of the rest of the universe is not minuscule compared with that of the Sun, but significant. He confuses central forces, which act purely in the direction of the relevant mass, with off-centre forces which appear only in General Relativity where, in addition to the central attractive forces directly analogous to Newtonian gravity, Coriolis and centrifugal-like off-centre forces appear in the presence of rotating masses. This effect is extremely small compared with the central forces – for example the frame dragging effect at the earth is only 220 milli-arcseconds per year. So it’s the central forces that are relevant to calculating orbits, and in GR the central forces are of the same magnitude as I quote in Table 1 (at the Earth they are overwhelmingly dominated by the Sun’s gravitational field as I have shown above).

R. Sungenis: That’s because GR can be used for either a heliocentric or geocentric universe. But the instance in which, as MacAndrew asserts, “the central forces that are relevant to calculating orbits, and in GR the central forces are of the same magnitude as I quote in Table 1 (at the Earth they are overwhelmingly dominated by the Sun’s gravitational field as I have shown above)” is when GR is dealing with heliocentrism. When GR deals with geocentrism, then it must adjust its calculations to accommodate a fixed and non-moving Earth.

MacAndrew: This is necessarily so, because in low gravitation regions such as exist in the solar system GR must be closely approximated by SR and Newtonian mechanics. In other words, the acceleration of the Earth as a consequence of central gravitational fields is overwhelmingly dominated by the Sun, and this is true both in classical and GR cases.

R. Sungenis: But, of course, MacAndrew conveniently leaves out the instance when the “central gravitational fields” are neutralized at the center of mass for a rotating universe. The name of the game for MacAndrew seems to be that as long as he can avoid dealing with a rotating universe and its center of mass he can make it appear that the Sun is the “dominant” force and thus make it appear that the Earth must revolve around the Sun.

MacAndrew: The next quote from Sungenis’s paper takes us briefly beyond classical mechanics into General Relativity. In his writing, Sungenis often drifts from a classical to a relativistic framework and back again without acknowledging the profound consequences of doing so.

R. Sungenis: MacAndrew simply doesn’t like the fact that geocentrism is supported both by Newtonian and Einsteinian mechanics.

MacAndrew: Here he is quoting Fred Hoyle:

“...we can take either the Earth or the Sun, or any other point for that matter, as the center of the solar system. This is certainly so for the purely kinematical problem of describing the planetary motions. It is also possible to take any point as the center even in dynamics, although recognition of this freedom of choice had to await the present century”

When Hoyle talks about awaiting the present century to take any point as the centre of the solar system in dynamics, he is, of course, referring to the development of Einstein’s General Relativity. And GR is fatal to any project which seeks to make any point or object in the Universe privileged in an absolute sense.

R. Sungenis: Yes, if you want to play for a tie, use General Relativity, since it admits it has no way of determining what the true physical reality is. It can only give us options, or say that both are justified, as in this quote from Einstein’s book:

The struggle, so violent in the early days of science, between the views of Ptolemy and Copernicus would then be quite meaningless. Either coordinate system could be used with equal justification. The two sentences: “the sun is at rest and the Earth moves,” or “the sun moves and the Earth is at rest,” would simply mean two different conventions concerning two different coordinate systems. (*The Evolution of Physics: From Early Concepts to Relativity and Quanta*, Albert Einstein and Leopold Infeld, 1938, 1966, p. 212.)

MacAndrew: Einstein aimed his programme, which culminated in his famous 1915 series of papers in which he presented the Einstein field equations¹², at a formulation in which the forms

of the laws of physics are the same in all frames of reference, whether they are translating, accelerating or rotating. In Newtonian mechanics and Special Relativity, there are universal privileged frames of reference, called inertial frames, which are the only frames in which the so-called fictitious forces to explain the apparent accelerations of bodies in the universe (when observed from non-inertial accelerating or rotating frames) do not appear. General Relativity however does away with universal frames altogether, since in GR all motion can be described by reference to a local curved spacetime in which all frames are equivalent and no frame is privileged (this property of GR is known as general covariance).

R. Sungenis: Here's what really happened. Einstein needed to answer the 1887 Michelson-Morley experiment that showed the Earth wasn't moving. So he invented Special Relativity which made all motion relative (since it denied there could be any fixed point). He did so by saying that the length and time of Michelson's apparatus shrank. The shrinkage would necessitate that the light used in Michelson's apparatus in order to measure the shrinkage had to move at a constant speed so that it could serve as an unaltered measuring stick. Since Special Relativity thus allowed the Earth to move at 30km/sec around the Sun, this was called an "inertial frame" because the Earth was moving at a constant speed. [An inertial frame is one that is at rest or moving at a uniform speed]. Of course, this is a curious application of SRT, since an Earth revolving around the Sun does so in a circle, which requires it to be classed as an acceleration and not an inertial frame, but they didn't let little details like that get in the way. What did get in the way is when Einstein forgot to take into account the effect of gravity in Special Relativity. So he needed to invent an additional theory, one that superseded the missing pieces of Special Relativity. It was called General Relativity. Lo and behold, General Relativity led Einstein back to the very thing he had tried to avoid – a non-moving Earth. General covariance forces Einstein to admit that the universe could be rotating around a fixed Earth as opposed to an Earth rotating in a fixed universe. So there you have it. Einstein was hoist by his own petard. The whole world has been bamboozled by this amazing contradiction.

MacAndrew: Furthermore, because the curvature depends on the presence of mass-energy, it is no longer possible to refer to universal unchanging co-ordinate systems. This is what Hoyle is referring to when he says that we can take any point as the centre even in dynamics. The GR concept of the equivalence of all frames of reference, the principle that the forms of the laws of physics are the same in them all, and the idea that there is no privileged frame undermines the geocentric proposition of a single absolute special frame.

R. Sungenis: And thus, as he did with Machian physics earlier, MacAndrew now admits that General Relativity allows for a geocentric universe. This discussion should end right here, since MacAndrew has now admitted that at least two systems in modern physics – the Machian and the Einsteinian – allow for a geocentric universe.

MacAndrew: (However, see the following section on Earth versus universe rotation for a discussion about whether we must regard rotation as purely relative or whether it can be defined absolutely even within General Relativity; and what we are able infer about phenomena by considering causation and non-local evidence.)

R. Sungenis: So now MacAndrew is setting us up for the inevitable exceptions to covariance so that he can at least have some pie in the sky concept to deny the geocentrism that is latent within General Relativity. These are similar to the “exceptions” modern Big Bang theory makes for the limited speed of light and gravity at both the beginning of the Big Bang and at its outer rim.

MacAndrew: Next, Sungenis suggests that classical mechanics can only deal with two bodies at a time. This is hilariously wrong. Sungenis writes:

Newton’s laws work fine if we limit the components to two bodies, but when we have three, four or billions of them, Newton’s laws are quite limited in their scope and need to be supplemented. Newton was supplemented by Mach and Einstein

Newtonian mechanics is not limited by the number of bodies for which it is valid. You can write down the equations of motion using Newton’s laws for any arbitrary number of bodies¹³, and although analytical solutions (i.e. exact mathematical expressions describing the answer) are not generally to be found for more than two bodies¹⁴, it is perfectly possible to solve the equations numerically and get results which match reality to a very high degree of precision.

R. Sungenis: Can you make sense out of what MacAndrew just said? He says: “although analytical solutions are not generally to be found for more than two bodies, it is perfectly possible to solve the equations numerically and get results which match reality to a very high degree of precision.” His footnote in #14 is even more problematic. He states:

“The accuracy of the theory is not determined by whether analytical solutions can easily be found. In fact, in GR, exact analytical solutions are even more restricted than in Newtonian mechanics and there is no general analytical solution even to the two-body problem. The analytical solutions to the GR two-body problem are valid only when one body is much more massive than the other.”

Yes, we see. According to MacAndrew’s earlier boast that “General Relativity is the current best physical theory of gravitation,” we now find that it can’t even solve a two-body problem.

MacAndrew: Where GR predictions differ significantly from those of Newtonian mechanics is in the vicinity of massive bodies with strong gravitational fields, and where bodies have relative velocities which are a significant fraction of the speed of light. In low-gravity, low-speed

situations, GR reduces to Newtonian mechanics for any number of bodies. The rather complicated calculations that are required to plan satellite orbits and other space missions¹⁵ are based on Newtonian mechanics and treat many more than two bodies. Sometimes relativistic corrections are applied, not because of the number of bodies in the calculation but because that specific analysis requires very high precision and the tiny differences between purely classical treatments and those with relativistic corrections matter – and this would be true even when calculating the solution to a two-body problem that requires extreme precision.

R. Sungenis: No, the reality is that every time they try to use General Relativity to calculate orbits it produces anomalous results. The only way they can get GRT to even come close to Newtonian mechanics is to work backwards, which, incidentally, was the way Einstein arrived at his tensor equation in the first place – he worked backwards from Newton’s $F = ma$.³ The footnote MacAndrew gives (<http://gmat.sourceforge.net/docs/R2013a/GMATMathSpec.pdf>) is nothing more than a 200-page obtuse and pedantic display of mathematic gobbledygook that proves my point about what GRT actually produces.

MacAndrew: Now Sungenis introduces a centre-of-mass argument based on a cosmological model which is naïve and physically problematic – a ball of stars with a spatial boundary: ...we can envision a universe of stars spaced all over the sphere of the universe, and somewhere in the middle of all those stars will be a “center of mass” around which those stars will revolve.

R. Sungenis: Notice how MacAndrew tries to set the rules again.

MacAndrew: Let us ignore, just for the moment, the fact that the universe is unlikely to be a sphere or any other shape with a spatial boundary, and grant for the sake of argument, over the next few paragraphs, the idea that the universe is spatially finite, flat, Euclidean and spherical with a spatial boundary (i.e., a ball) and therefore in possession of a definable and unique centre of mass. Let’s also note that Sungenis is attempting a classical (Newtonian) analysis. Then “those stars” will revolve around the Earth only if they are gravitationally bound and the universe as a whole has non-zero angular momentum. Moreover they should revolve in a way that is predictable by the laws of celestial mechanics. What do we observe? In the first place, we see that the universe as a whole is not gravitationally bound (the expansion of the universe is accelerating and parts of the universe are moving apart at greater than escape velocity which means they are not gravitationally bound);

³ The 8π component in Einstein’s field equation, $G = 8\pi T$ (in which G is the Einstein tensor and T is the stress or energy-momentum tensor), was added by determining what factor was necessary in order to make Einstein’s equation equal to Newton’s equation. This is why General Relativists, such as Misner, Thorne and Wheeler, can say: “The field equation [$G = 8\pi T$] even contains within itself the equations of motion (“Force = mass x acceleration”) for the matter whose stress-energy generates the curvature.”

R. Sungenis: What do we observe? Alec MacAndrew using a mere theory as a fact. His assertion is that the universe is not gravitationally bound. Says who? Only those who believe in the Big Bang. And of those who say so, who of them has said that a gravitationally bound universe is not possible? None. Let me quote from George F. R. Ellis once again (who is a firm believer in General Relativity):

“I can construct [for] you a spherically symmetrical universe with Earth at its center, and you cannot disprove it based on observations. You can only exclude it on philosophical grounds. In my view there is absolutely nothing wrong in that. What I want to bring into the open is the fact that we are using philosophical criteria in choosing our models. A lot of cosmology tries to hide that.” (“Profile: George F. R. Ellis,” W. Wayt Gibbs, *Scientific American*, October 1995, Vol. 273, No. 4, p. 55).

Incidentally, those, like MacAndrew, who believe “the expansion of the universe is accelerating,” have no mechanism for this acceleration, since there isn’t enough mass and energy in the universe to propel it. In fact, there is so little mass and energy in the universe as a whole that it is much more likely the universe is not expanding. But they need an expansion because they already adopted the primordial explosion of the Big Bang (as opposed to the Steady State model of Hoyle that does not expand) in order to escape the geocentric implications of redshift. Note here that, while thinking they escaped geocentrism by inventing their expanding “balloon” universe, they created more serious problems. First, they didn’t have enough mass and energy for the expansion. Second, the expansion had to be isotropic and homogeneous. But they didn’t find either of these two requirements.

So what do they do? As they always do. They invent what they need to make it work. That is why you hear all the talk about Dark Energy in the popular science magazines and science television shows. Dark Energy is now said to make up about 70% of the universe. But they have one big problem. No one has ever discovered this so-called Dark Energy. Moreover, when they discovered through COBE (1990), WMAP (2001) and Planck (2009) that not only was a significant portion of the universe anisotropic and inhomogeneous but that it aligned the Earth in the virtual center of the universe (otherwise known in the scientific literature as the Axis of Evil), they now refer to this stupendous evidence for geocentrism as a mere “anomaly” that they can’t yet explain. So much for scientific honesty.

So, the whole thing is nothing more than patchwork physics, and Alex MacAndrew has bought into it because he is part of the science establishment that needs such props in order to avoid the very universe that Ellis said he could make quite easily – a geocentric universe.

MacAndrew: furthermore we do not measure a non-zero angular momentum for the universe (i.e. it does not measurably rotate)¹⁶ [S.-C. Su and M.-C. Chu, Is the universe rotating?, 2009 ApJ 703 354].

R. Sungenis: The paper MacAndrew references has nothing to do with what we are talking about. The fact that MacAndrew would attempt to use such a paper as proof against geocentrism shows how desperate he is, in addition to the fact that he is trying to pull a fast one on the uneducated audience. Su and Chu are talking about the same thing that Birch, et al, mentioned in the 1980s (Paul Birch, “Is the Universe Rotating?” Nature, vol. 298, 29 July 1982, pp 451-454; Mitchell M. Waldrop, “The Currents of Space,” Science, vol. 232, April 4, 1986, p. 26). After examining 132 radio sources, Birch determined that the polarization angle translated into the universe rotating at a rate of 10^{-13} radians per year. See also M. Surdin, “The Rotation of the Universe,” *Physics Essays*, vol. 8 #3, 282-284. Yu Obukhov, “Gauge Theories of Fundamental Interactions,” 1990, Singapore, World Scientific). In other words, Su and Chu are talking about a very slight rotation of the universe in a heliocentric model, and nothing about the geocentric system in which the universe rotates 2π radians per day.

MacAndrew: and finally the motion of the galaxies and galaxy clusters looks nothing like they would look if the universe were a gravitationally bound set of free falling bodies revolving around a centre of mass, in which the angular velocity of galaxies should decrease as a function of distance from the centre of mass.

R. Sungenis: Says who? MacAndrew makes up the rules as he goes along. Notice that he provides no reference for this *ipse dixit* assertion. MacAndrew is making the same mistake other critics of geocentrism have made. They assume that the galaxies are moving independently of the universe. They are not. They revolve around Earth because they move with the entire universe’s rotation around the Earth. The galaxies have slight proper motion in addition, but those motions are negligible. In a geocentric universe, the galaxies revolve around the Earth like a phonograph record spins on a turntable.

MacAndrew: Sungenis suggests that the Earth could “occupy” the centre of mass as though the centre of mass is a house where the Earth lives.

R. Sungenis: I made no such assertion. I merely said the Earth could be placed at the universe’s center of mass.

MacAndrew: Then he proceeds to make one of his more egregious errors whereby he confuses the centre of mass with a point of zero gravitational field:

Logically, there is no reason why the Earth cannot occupy that center of mass. **If the Earth occupies the center of mass, then according to Newton's laws, there are no gravitational or inertial forces at that point**, and thus there is no force with which the Sun needs to interact¹⁷. The Earth is neutral. [My emphasis]

Sungenis speculates about the physics at his hypothetical centre of mass, relying on purely classical mechanics.

R. Sungenis: False. We have already seen that MacAndrew himself admits that both Machian and Einsteinian physics allows Earth to occupy the center of a rotating universe. If MacAndrew has another name for this center of the universe other than “center of mass,” then he needs to tell us. As regards “classical mechanics,” otherwise known as Newtonian mechanics, if Machian and Einsteinian mechanics allows Earth to be the center of the universe, why wouldn't Newton? Or is MacAndrew trying to make the astounding claim that Newton is actually opposed to Mach and Einstein instead of just incomplete?

MacAndrew: He claims that there is no reason that the Earth should not coincide with the centre of mass, and in his ball-universe model, indeed there isn't, temporarily.

R. Sungenis: So now MacAndrew has not only given geocentrism approval from Mach and Einstein, he has partially admitted that even Newton would allow geocentrism.

MacAndrew: But he fails to recognize that there is nothing to keep the Earth there. The centre of mass of a system is a point in space and there is no reason to identify it with a particular body – no physical body has to “act as the centre of mass” or “be it” or “occupy it”, all phrases that Sungenis has used in various places in the past, and which show that he fails to understand the concept.

R. Sungenis: Says who? This is just another *ipse dixit* from MacAndrew. Note this. If the universe is, as Big Bangers believe, 93 billion light years in diameter, let's compare that to the Earth which is only 8000 miles in diameter. That means the Earth is 0.000000000000000001 the size of the universe. That is 10,000 times smaller than the electron compared to one centimeter. In other words, being so small compared to the universe, the Earth's occupation of the universe's center of mass has no dynamic significance. In fact, it was MacAndrew himself who said the GRT frame dragging on Earth, if it actually existed, is miniscule. He wrote above: “This effect is extremely small compared with the central forces – for example the frame dragging effect at the earth is only 220 milli-arcseconds per year.” So, even if we use covariance and apply MacAndrew's “220 milli-arcseconds” to a fixed Earth in a rotating universe, the latter will have no appreciable effect on the former; and that is even when frame dragging is not “perfect.”

MacAndrew: His most serious mistake is that the bolded statement above is wrong. Sungenis is conflating the centre of mass with a point where the gravitational field is zero.

R. Sungenis: Perhaps MacAndrew should check his statement against what others are saying, for example, Wikipedia states:

“Center of gravity is the point in a body around which the resultant torque due to gravity forces vanish. Near the surface of the earth, where the gravity acts downward as a parallel force field, the center of gravity and the center of mass are the same.”

MacAndrew: A body at the centre of mass is still subject to the gravitational fields of other bodies

R. Sungenis: But we aren't talking about “other bodies.” We are talking about the center of mass of the universe that the Earth can occupy and thus assume all the privileges of the universe's center of mass. MacAndrew wants to keep throwing “other bodies” into the mix because he wants at least some force to knock the Earth out of the universe's center of mass.

MacAndrew: – and in general, contrary to Sungenis's claim, the gravitational field is not zero at the centre of mass (it can be zero in certain symmetrical systems, such as a uniform spherical shell or a spherical ball of perfectly uniform density, or a two body system of exactly equal masses - but it is not generally so). See Appendix 1.

R. Sungenis: MacAndrew just defeated his own objection. He said that the “gravitational field can be zero at the center of mass if we are dealing with a uniform spherical shell or a spherical ball of perfectly uniform density.” Well, guess what? The geocentric universe is a “spherical shell or a spherical ball of perfectly uniform density.” That's why we see stars in every quadrant of the universe. They are equally distributed, as was shown by the Sloan Digital Sky Survey of 2005. Even the cosmic microwave radiation is evenly distributed (i.e., isotropic and homogeneous). The only place it isn't is the Axis of Evil, but that just happens to be a thin plane of anisotropic and inhomogeneous radiation that is aligned with the Earth's equator and the ecliptic. (Imagine that. The little Earth that is 0.000000000000000001 the size of the universe is aligned by X and Y axes with the rest of the universe! But all this goes right over the head of MacAndrew, since he is wedded to the Copernican Principle).

MacAndrew: And the Earth is not near to being in a gravitationally symmetric situation – it is not, even in Sungenis's “ball universe” model, positioned in the centre of a ball of uniform density and gravitational attraction, because it is relatively close to a massive body (the Sun) with the next equivalently massive body, Proxima Centauri, ~270,000 times further away – and,

remember, gravitational field goes as the inverse square of the distance. The Earth is primarily subject to the relatively enormous gravitational field of the Sun;

R. Sungenis: What MacAndrew doesn't understand is that the center of mass for the universe already incorporates the mass of the Sun and Proxima Centauri, as it does every other celestial body, including whatever space is composed of, according to Quantum Mechanics. In order for MacAndrew to counter this, he would have to show that it is impossible for there to be a center of mass for all the celestial bodies and space, which he will not be able to do. The center of mass for any object or class of objects is a fact of nature, and facts are hard to refute.

Moreover, per Wikipedia,

“if the reference point **R** is chosen so that it is the center of mass, then

$$\int_V \rho(\mathbf{r})(\mathbf{r} - \mathbf{R})dV = 0,$$

which means the resultant torque **T**=0. Because the resultant torque is zero the body will move as though it is a particle with its mass concentrated at the center of mass. By selecting the center of gravity as the reference point for a rigid body, the gravity forces will not cause the body to rotate, which means weight of the body can be considered to be concentrated at the center of mass.”⁴

In other words, not only will the Earth remain at the center of mass, there will be no torque to make it rotate with the universe. Or, we can say that the rotation of the universe is slow enough that no torque will be created at the center of mass to rotate the Earth.

MacAndrew: secondarily to the gravitational field of other solar bodies which are about 1,000 (for the moon) – ~30,000 (for Venus and Jupiter) times less than the Sun; and then to the gravity of the entire Milky Way galaxy of a trillion stars which, in spite of its immense mass and because of its vast distance from the Earth, is 31 million times less than that of the Sun, as we have seen in Table 1 above. All of these bodies cause some acceleration of the Earth – in the case of the Sun, its gravity results in the acceleration of the Earth which keeps the Earth in orbit around it; the moon's gravity causes an acceleration of the Earth that results in a monthly perturbation or wobble on the Earth's annual orbit (the gravity of the other planets cause further perturbations). The acceleration due to the gravitational field of the Milky Way explains the orbit of the Earth, Sun and other planets of the solar system round the galaxy at a radius of 25,900 light years) and so on. The gravitational fields (and Earth's resulting accelerations) of the rest of the galaxy are very small compared to the Sun's field, but are sufficient to explain the orbit of

⁴ http://en.wikipedia.org/wiki/Center_of_mass

the solar system around the galaxy because of the very large period of the solar system's galactic motion as we have seen above.

R. Sungenis: Again, MacAndrew failed to realize that the center of mass is determined by incorporating all these celestial bodies, not by ignoring them. And the fact remains (unrefuted by MacAndrew) that the center of mass will experience no gravitational or inertial forces, and will experience no torque to turn it.

MacAndrew: Together with the Sun's field, the accelerations caused by these bodies, all in constant motion, result in time-changing velocities so that the Earth cannot be stably at rest in an inertial frame.

R. Sungenis: Says who? The only way for MacAndrew to prove his assertion is to show that the rotating universe of celestial bodies has a varying center of mass, which he hasn't, and actually has no way of showing.

MacAndrew: A finite acceleration, which the earth must have because it is in a non-zero gravitational field, is the same as a time-varying velocity – that's the definition of acceleration–

R. Sungenis: But MacAndrew hasn't proven that the Earth has a "finite acceleration" or that it has a non-zero gravitational field. Wikipedia stated that there is no external gravity and no torque at the center of mass, contrary to MacAndrew. The truth is, MacAndrew simply cannot accept the Earth as the universe's immovable center of mass, since that would allow geocentrism, which he despises.

MacAndrew: and if a velocity is time-varying it cannot be zero indefinitely, even if it is zero for a moment. Even if at one instant in time the Earth just happens to coincide with the centre of mass, it cannot remain so¹⁸.

R. Sungenis: And none of this has MacAndrew proven. It's all *ipse dixit*.

MacAndrew: Sungenis speculates about the differences between systems near to and far from the universe's hypothetical centre of mass and asserts that small bodies orbit big ones except at the centre of mass where big orbits small:

We can certainly grant to Mr. Keating that, with local systems that are far away from the universe's center of mass, it will always be the case that the smaller revolves around the larger, such as is the case of smaller moons orbiting the larger planet Jupiter. But if we include the whole universe, then there is one place in which the larger will revolve

around the smaller. The smaller, in this case, is at the universe's center of mass, which the Earth occupies.

Apart from obviously Begging the Question, what do we have here? It's an assertion that less massive bodies orbit more massive ones, unless they are at the universe's hypothetical centre of mass when the opposite is true. So let's ask: does this supposed inversion of normal orbital mechanics occur only at the exact centre of mass? If so, why do satellites and the moon orbit the earth? Or does this inversion occur in an extended region near the centre, with a gradual transition to a normal state of affairs? In that case how big would the transition region be? What happens in the transition region as we move from anomalous to normal physics – is there a zone where neither more massive nor less massive body orbits the other? Can we see the mathematical treatment in support of this hypothesis? Such a treatment is unlikely to be forthcoming as we have seen that the second part of Sungenis's assertion is entirely a figment of his imagination and has no basis in physics.

R. Sungenis: For those of you not familiar with physics, what MacAndrew wrote above is nothing more than a White Flag of surrender. It is painfully obvious that he has no answer. Instead, he tries to nit-pic by inserting imaginary problems (e.g., “What happens in the transition region as we move from anomalous to normal physics – is there a zone where neither more massive nor less massive body orbits the other?”).

First, it is not “anomalous physics” versus “normal physics.” It's all the same physics, which is physics based on the center of mass (which is apparently something MacAndrew doesn't comprehend very well or is purposely ignorant of). It is not “anomalous” for a rotating universe to have a center of mass around which it moves, which MacAndrew himself already admitted was possible in Machian and Einsteinian physics (but is fighting hard not to allow in Newtonian physics, of all things!). I simply made the contrast, in the macro-sense of the terminology, that only in one place would we see the larger (the universe) revolve around the smaller (the Earth). In the micro-sense, however, planets with revolving moons and the Earth with a rotating universe follow the same Newtonian law – the law of the center of mass, which MacAndrew simply cannot refute.

MacAndrew: You will remember that I have temporarily granted for the sake of argument the hypothesis of a spherical universe with a boundary and a centre of mass. Enough of that – let's revert to physically feasible universe models.

R. Sungenis: You mean the one that had to invent Inflation, Dark Matter, Dark Energy and allow light and gravity to exceed c in order to make the Big Bang work? Do you mean the one in which they had to change the Hubble “constant” three times? Do you mean the one in which they tried to make a homogeneous universe to support the Big Bang but found that a significant

portion was inhomogeneous? Do you mean the one that Einstein said was static but changed his mind and said it was dynamic? Do you mean the one in which Quantum mechanics totally contradicts General Relativity? Do you mean the one in which General Relativity allows a geocentric universe, but Special Relativity doesn't?

In a geocentric universe we don't need any these *ad hoc* inventions to prop up our model.

MacAndrew: Sungenis now suggests that Newtonian physics is invalidated by the universe outside the solar system:

[Newton's] only problem was that in the 1600s when he developed his gravitational equations, he didn't realize what part the stars and the rest of the universe played in the calculations.

What part do they play? I have shown in some detail above what part the rest of the universe plays in the calculations; I have done the calculations (and shown them above) and Sungenis obviously has not. If the reader takes one thing away from this paper, it should be that the gravitational field of the Sun at the Earth is 200 times bigger than the next most influential object (the moon) and 31 million times bigger than the most influential extra-solar object (the entire Milky Way galaxy). We have seen that the Sun's gravity vastly dominates the Earth's motion and to that extent the Sun-Earth can be regarded as a two-body system (in fact because the Sun is so much more massive than the Earth, the calculation of the Earth's orbit can be reduced to the one-body problem as an excellent approximation).

R. Sungenis: If you want to take one thing away from this paper, realize that Alec MacAndrew, Ph.D. in Physics, failed to realize that the center of mass is determined by incorporating all the celestial bodies, not by ignoring them. And the fact remains (unrefuted by MacAndrew) that the center of mass will experience no gravitational or inertial forces, and will experience no torque to turn it. Such is the case with the Earth that occupies the universe's center of mass, and MacAndrew has nothing with which to refute it.

MacAndrew: Remembering Sungenis based this discussion on the framework of Newtonian mechanics, let's remind ourselves that Sungenis granted that if the Sun-Earth system could be regarded as a two-body system, then the much less massive Earth would orbit the much more massive Sun ("If the issue were limited to the Sun and the Earth, Mr. Keating would be correct. That is, the Earth, being the smaller body, would necessarily orbit the Sun, which is the larger body.") Well, I have demonstrated, with detailed quantified reasoning, that it is the case that we can regard the Sun-Earth system as a two-body system, because of the overwhelmingly dominant gravitational field of the Sun at the Earth, and therefore Sungenis should accept that the Earth orbits the Sun¹⁹.

R. Sungenis: When I said “Sun-Earth” system as a two-body system I was referring to just having the Sun and the Earth and no other celestial bodies in a non-rotating universe. In THAT system only, the Earth will revolve around the Sun. What MacAndrew did was slyly try to make a geocentric universe into an isolated Sun-Earth system, which simply cannot be done. As a result, MacAndrew totally failed in trying to make classical physics go against geocentrism.

MacAndrew: But what about General Relativity and Earth/Sun orbits? So let’s leave classical mechanics temporarily and move on to General Relativity. Surely, everyone has been taught that in GR all motions are relative and the descriptions, “Earth orbiting Sun” and “Sun orbiting Earth”, are equivalent? It is true in GR that local experiments cannot distinguish between the cases, but we are also allowed to invoke non-local observations and causation to make reasonable inferences.

R. Sungenis: Huum. Wait until you see the contortions that MacAndrew manufactures for this.

MacAndrew: So for example, let us consider an observer at rest relative to the surface of a planet. If the observer is in a box and able to perform only local experiments within the box he cannot say whether the constant force that he feels on the soles of his feet is because he is standing in the gravitational field of a planet, or because he is undergoing constant acceleration by the application of an external non-gravitational force to the box – this is completely compatible with the GR equivalence principle. But let him make non-local observations and consider causation: he will observe that the planet is not expanding ever more rapidly, his colleague on the opposite side of the planet tells him that she is feeling a force on the soles of her feet of similar magnitude and he can see that he is on the surface of and at rest with respect to a massive body – he can therefore reasonably infer that the force on his feet is mainly because he is in the gravitational field of the planet and not because he is being accelerated. Similarly, considering non-local observations and causation can justify inferences about relative rotation and revolution.

R. Sungenis: So perhaps MacAndrew should invent a new and improved GRT to allow him to speculate based on “reasonable inferences,” since GRT is not a non-local physics. Then again, MacAndrew will need to figure out a way to distinguish between the Earth sitting on the back of successive turtles as opposed to what he proposes above.

MacAndrew: Let us look at just one of those observations²⁰. [FN: 20 Another observation which supports the dynamical proposition of Earth’s annual orbit is the measurement of stellar aberration.]

R. Sungenis: No, stellar aberration does not “support the dynamical proposition of the Earth’s annual orbit,” at least not unless MacAndrew has disproven the fact of relative motion. Stellar aberration is easily demonstrated in the geocentric system. (See Aberration animation on the CDROM of GWW or see the videos at www.galileowaswrong.com).

MacAndrew: We observe that the light of the Cosmic Microwave Background which arose in the very early universe and the light from other very distant celestial bodies is Doppler shifted annually by just the right amount that we can conclude that this is caused by the Earth’s annual orbit²¹. [FN: 21 G. Hinshaw et al., Five Year WMAP Observations: Data Processing, Sky maps and basic results, 2009 ApJS 180 225]. This phenomenon is called the annual Doppler shift modulation and has to be corrected in all earth station based astronomy where accurate spectral characteristics matter. A Doppler shift is caused by the relative velocity between source and observer arising either by motion of the source, motion of the observer or both.

Geocentrists will tell you that the annual modulation can be interpreted by the annual revolution of the Earth around the Sun, but equally (and preferably as far as they are concerned) by a static Earth around which the entire universe, centred on the Sun, revolves once per year (in their neo-Tychonian model, the mass-energy of the universe is centred on the Sun which revolves around the Earth annually taking the cosmic matter with it). They will propose that given a static Earth, it is the annual motion of the CMB and other celestial bodies that causes the observed annual Doppler shift modulation.

That’s fine so far as it goes until one considers the finite speed of light and causation.

R. Sungenis: So notice MacAndrew admits that, barring his stipulation about the “finite speed of light,” he sees no problem in the geocentric explanation of the Doppler shift of the CMB.

MacAndrew: The light from the CMB was emitted from the post-Big Bang plasma 13.8 billion years ago, and from quasars between 0.5 and 12.5 billion years ago.

R. Sungenis: Whao, Nellie. MacAndrew is only presenting a theory, and a dubious one at that considering all the patchwork physics it has been forced to use (e.g., Inflation, Dark Matter, Dark Energy, contradictions between QM and GRT, contradictions between SRT and GRT, etc.). MacAndrew has not the slightest proof that the CMB is from the Big Bang. All he knows is that he sees a 2.75Kelvin temperature everywhere he looks in the universe. For all he knows, it may be the residual temperature of space, or of the celestial bodies. Currently, there are about five dozen theories as to why we see redshift. Moreover, since the CMB is not totally homogeneous then the CMB could not be from a Big Bang, since then the Big Bang would have to have know of an Earth that would be coming 8.5 billion years later and that it would be aligned with the rest

of the universe via the Axis of Evil. The Big Bang is not a mind-reader and cannot predict the future, especially something as fine-tuned as the Earth and the Axis of Evil.

MacAndrew: So the geocentrists are asking us to believe that the motion of all of these bodies, including the CMB plasma, the quasars and every other extra-terrestrial body, at the time the light was emitted, was an ellipse of the same dimensions as the Sun-Earth orbit, and which has all its characteristics, local features and variation, such as variations in the orbital eccentricity and ecliptic obliquity, apsidal precession and ecliptic precession. In some cases such as the CMB and the more distant quasars, the light was emitted at a time long before the formation of the solar system. How can that be? How can the current Sun-Earth orbital characteristics reach out backwards in time to the source of the CMB and to the early, distant quasars to cause a corresponding motion of the CMB-emitting plasma and the quasars more than ten billion years ago, before the sun had even condensed?

R. Sungenis: Obviously, we don't believe that either the CMB or quasars are "more than ten billion years old," but MacAndrew acts as if that is not even a possibility. As my book *Galileo Was Wrong* shows, if we use the same formula that Big Bangers use but with figures for a young universe, we can do the same thing they do. The age is calculated by the formula $t = t_0 (1 + z)^{-3/2}$, where t_0 is the current age of the universe and z is the redshift factor of the object. Let's say NASA finds a distant object in the sky and assigns it a z -factor of 1. NASA will then plug in the value for t_0 as 13.7 billion years and will compute a value for t , which is understood as the age of the universe when the radiation emission of the distant celestial object took place. In the case where $z = 1$ then $t = 4,844,413,013$ years. Since using the number 13.7 billion years is completely arbitrary (for it is based on the unproven Big Bang assumptions of the universe), let's say we assume t_0 is 10,000 years instead of 13.7 billion. In this case, where $z = 1$ then $t = 3,536$ years. In other words, when an astronomer sees a star with a z -factor of 1, he might just as well assume the universe was 3,536 years old rather than 4.8 billion years old, since the z -factor is only a function of one's assumption regarding the beginning of the universe. If an astronomer finds an even more distant object that correlates to a z factor of 2, then the age of the universe when the object began radiating was 1,924 on our scale but 2.6 billion years on the Big Bang scale.

MacAndrew: Moreover, the annual CMB and quasar Doppler modulation (along with the annual Doppler modulation of all other extrasolar bodies) is synchronised in such a way that no matter how far away the bodies are and how long the light has been travelling, their annual Doppler shift modulation arrives at the Earth precisely in phase – all celestial bodies are blue shifted when, in the Earth-moving model, the Earth is moving towards them and red-shifted when it is moving away. If the universe moves round the earth annually with the sun, we would expect the phase of the Doppler shift modulation to be a function of the distance to each body and the time it has taken for the light from that body to reach us.

R. Sungenis: Says who? This is just another one of MacAndrew's *ipse dixit* assertions. Heliocentrists have claimed that since the Earth revolves around the sun at about 19 mps, this movement causes the Doppler shift of stars. As one author puts it,

“Classical physics, but not Special Relativity, predicts different Doppler shifts for the source moving versus the observer moving, allowing one to ‘determine’ whether the earth moves or a ‘fixed star’ moves....To conclude, Mach did not consider the difference between the Copernican and Ptolemaic/Brahean systems and the observations falsifying the latter.”⁵

The truth is, however, that the Neo-Tychonic geocentric system can easily explain Doppler shift. As we have noted previously, the Neo-Tychonic system has the star field rotating around the Earth on a 1 AU radial hub. As such, on one hemisphere of the star field the stars will be receding away from the Earth and on the opposite hemisphere the stars will be advancing toward the Earth. Those advancing toward the Earth will create a Doppler blue shift and those receding will create a Doppler red shift.

MacAndrew: But that's not what we see – they are all in phase and the phase depends only on the direction of the light's source. I will leave readers to decide whether it is tenable to believe that the source of the annual Doppler shift modulation is the motions of the stars, galaxies and other celestial phenomena, not moving together but all perfectly orchestrated backwards in time so that by the time the light reaches the Earth the modulation is exactly in phase and exactly reflects the Earth's orbital variations.

R. Sungenis: I'll leave it to the reader to reason that if the universe is moving the stars and the CMB at an equal speed in relation to the Earth, then we are not going to see any phase difference in the light that comes to us.

MacAndrew: Does the Earth rotate once a day or does the universe rotate around the Earth? Is the universe Machian? Is GR a Machian theory? Since the Earth is unquestionably rotating according to Newtonian and Special Relativity frameworks,

R. Sungenis: As we have seen, MacAndrew failed to show that Newtonian mechanics does not support geocentrism, which was due mainly to his misapplication of the center of mass for a rotating universe. Additionally, we have seen that it's specious to claim the “Earth is rotating according to Special Relativity,” since SRT was not invented after an attempt to measure a rotation of the Earth, but only after an attempt to measure the Earth's supposed revolution around

⁵ Herbert I. Hartman and Charles Nissim-Sabat, “On Mach's critique of Newton and Copernicus,” *American Journal of Physics* 71(11), November 2003, p. 1167.

the Sun. In fact, as we noted earlier, when an experiment was done in 1925 by Michelson to measure a rotation between the Earth and the universe (an experiment in which Michelson used the same kind of interferometer that he used in 1887 to measure if there was a revolution of the Earth around the Sun, but found no revolution), he found almost 100% of a rotation.

Did you catch that?

No results for a revolving Earth but about 100% results for a rotation between the Earth and the universe. That's bad news for heliocentrists like MacAndrew, for it confirms that the empirical evidence shows **there is no revolution, but there is a rotation**. But heliocentrists must have both a revolution and a rotation in order to explain the seasons and the day/night rhythm. They cannot have one without the other, but the empirical evidence only gives one, a rotation, based on the same exact principles of light interference in a highly sensitive interferometer. But geocentrism has no problem with this empirical evidence, since it says the Earth is not revolving around the Sun (thus null results for the 1887 experiment) but the universe is rotating around a fixed Earth (thus almost 100% result for the 1925 experiment). It fits like a glove, but it is a glove that MacAndrew refuses to wear.

So what did the brilliant Einstein do to fix this for heliocentrism? Well, he claimed that the reason the 1887 results were null for a revolving Earth was that the leading arm of Michelson's interferometer shrunk just enough to mask the movement of the Earth. Imagine that.

So when Michelson tested for rotation in 1925, what did Einstein do? Well, since the very aether that Einstein denied existed in the 1887 experiment showed up by almost 100% in the 1925 experiment, he obviously couldn't use Special Relativity to answer the 1925 experiment, since the 1887 experiment was based on the idea that there was no aether. So Einstein was forced to use General Relativity for the 1925 experiment, for at least GRT claimed there was at least some kind of aether in a 1920 paper by Einstein, which was five years prior to 1925.

But unfortunately for Einstein, the aether he allowed for GRT in 1920, was, according to his papers, "not ponderable," that is, we could not measure it. But that was precisely what Michelson did in his 1925 experiment – he measured a near 100% aether drift for a relative rotation between the Earth and the universe.

So, the result is that neither SRT nor GRT can explain the Michelson-Gale experiment of 1925; and, the attempt to use SRT to explain the 1887 Michelson-Morley experiment was thus undercut by the fact that Michelson found the very aether in 1925 that Einstein said didn't exist in the 1887 experiment (which he claimed, incidentally, in order to have the Earth revolve around the Sun).

In other words my dear public, you have been bamboozled by the highest lights of modern physics into believing that the Earth moves when in fact it doesn't move.

MacAndrew: geocentrists turn to General Relativity to save their case, so let's see how they fare:

As for Einstein's equations, which are merely a "relativistic" expansion of Newton's equations, they perfectly agree with the idea that the whole universe can revolve around a fixed Earth in the center.

General Relativity is far more than the "relativistic" expansion" (whatever that might mean) of Newton's equations. GR arises from a fundamentally different way of reasoning about the world. It is based on the realisation that acceleration is equivalent to gravitation and that physics should be identical in all co-ordinate systems. GR's postulates include the novel concept that mass and energy distorts space itself, so that space is not generally flat and there is no absolute universal reference frame, and that the motion of free falling bodies are geodesics (the equivalent of straight lines) in curved spacetime. Newtonian mechanics approximates to General Relativity under conditions of low gravity and low relative velocity (as it must do given the accuracy of Newtonian predictions in those conditions). GR makes novel predictions about the behaviour of the world that go beyond Newtonian predictions. These novel predictions have so far passed every experimental test, indicating that GR is a good description of reality.

R. Sungenis: Sorry, there isn't one test that GRT has passed. Oh yes, there are certain things that are propped up as "tests" that GRT has passed, but that is only after the resulting numbers are fudged to make it fit into GRT theory. I cover the history of these issues in *Galileo Was Wrong*. It's the same with SRT. It hasn't passed one test. But since it is the only theory that modern science possesses to explain the 1887 Michelson-Morley experiment, they will continue to use it so that they can convince people the Earth is moving when the empirical evidence shows it is not moving.

Case in point: Another experiment that Einstein avoided like the plague was the 1913 Sagnac experiment, which was the precursor and similar to the 1925 Michelson-Gale experiment. The importance of the Sagnac experiment would be proven many times in various applications, but none was as important as when the Global Positioning Satellites were put into orbit in the 1970s. In order to compensate for the fact that electromagnetic signals between GPS stations are slower when traveling west to east than east to west, the GPS satellites must be pre-programmed with the Sagnac correction in order to work properly. This is a fact that is generally hidden from the public. Instead of admitting that the GPS computers utilize the Sagnac effect, modern scientists claim that the GPS is proof of the theory of Special Relativity, which includes the constant speed

of light as its fundamental basis. In reality, the GPS shows that the speed of light is not constant, and is only made to *look* constant by applying the Sagnac correction.

MacAndrew: Sungenis introduces the concept of purely relative rotation.

In other words, Einstein's equations state that either the Earth can rotate in a non-rotating universe or the universe can rotate around a non-rotating Earth. The math AND the physics will allow such variation. The problem for General Relativity is that it can't tell us which one is correct.

It is not true that this equivalence is implicit in the Einstein field equations of GR; although we will see that it might be true in some of their solutions.

R. Sungenis: Here we go with the semantic games. But, of course, Einstein has been playing the "it is, but it isn't" game with our minds for a long time.

MacAndrew: However, this particular equivalence is implicit in Mach's Principle so let's explore this idea and its relationship to GR. A long standing question in physics is the origin of inertia, which was addressed by Newton in his famous rotating bucket thought experiment²². Newton thought that accelerations and rotations are relative to an absolute fixed space and that even in a universe devoid of all other matter we should be able to distinguish between rotation and non-rotation with respect to absolute space by the presence of rotational inertial forces – the Coriolis and centrifugal forces (which cause the water in the bucket to form a parabolic surface in the rotating case rather than a flat surface in the non-rotating case). On the other hand Mach speculated that the influence of the total mass-energy in the universe is what gives rise to inertia – the famous, rather superficial dictum that "mass there causes inertia here". This view is supported by the observation that accelerations and rotations are closely relative to the "distant fixed stars". According to such a view, and contrary to Newton's idea, in a universe devoid of all other matter except the bucket, one would not be able to distinguish between rotation and non-rotation – in fact the concept of rotation would not exist because inertia would not exist. I call this a speculation because Mach proposed no mechanism or physics that would explain how the influence of mass-energy in the universe as a whole would define the local compass of inertia and, of course, we cannot test his idea that inertia would disappear in an empty universe.

R. Sungenis: In other words, when MacAndrew says that "Mach proposed no mechanism" for why "mass there governs inertia here,"⁶ he is referring to the "action-at-a-distance" problem,

⁶ This phrase comes from Misner, Thorne and Wheeler's, *Gravitation*, 1973, pp. 543, 546-47, 549, which book is a treatise on how General Relativity works. See also Kip Thorne in a 2004 flash video speaking of Mach's Principle in relation to Gravity Probe-B and its detection of the dragging of space with respect to the Earth at http://einstein.stanford.edu/Media/Thorne-GPB_Significance-Flash.html

namely, how can gravity travel so far and so fast from the stars to the Earth? Since Einstein limited gravity's speed to c , then "action-at-a-distance" was a real problem for them. In geocentrism, we don't have this problem, since we hold that gravity travels virtually instantaneously, and we give the mechanism for this speed in *Galileo Was Wrong*.

MacAndrew: Furthermore "Mach's Principle" is a vague and ill-defined concept – indeed Bondi and Samuel list eleven different interpretations of what is meant by it²³.

R. Sungenis: This just shows how confused modern physics is. When it is convenient to bring out the anomalies of one theory in order to support his pet theory, MacAndrew doesn't hesitate. By the same token, there are many interpretations as to just what General Relativity is, and what red shift is, and what gravity itself is. For the record, there are at least eight interpretations as to what a "shrinkage" of length is in Special Relativity. (See *Galileo Was Wrong*).

MacAndrew: Within a Machian universe, a rotating Earth and a rotating universe are equivalent and to say one is true and the other false is meaningless. Einstein was influenced early on by Mach's ideas, and indeed it was Einstein who coined the term "Mach's Principle". When Einstein began to develop his theory of General Relativity, his ambition was to make it Machian. The neo-geocentrists are fond of a particular quotation of Einstein's which is relevant here, so let's look at this very quotation in context. This is Einstein talking about the programme that he successfully completed with his publication of the field equations of General Relativity in 1915²⁴:

"Can we formulate physical laws so that they are valid for all CS [coordinate systems], not only those moving uniformly, but also those moving quite arbitrarily, relative to each other? If this can be done, our troubles will be over. We shall then be able to apply the laws of nature to any CS. The struggle, so violent in the early days of science, between the views of Ptolemy and Copernicus would then be quite meaningless. Either CS could be used with equal justification. The two sentences, "the Sun is at rest and the Earth moves," or "the Sun moves and the Earth is at rest," would simply mean two different conventions concerning two different CS...Could we build a real relativistic physics valid in all CS; a physics in which there would be no place for absolute, but only for relative motion? This is indeed possible! . . . Our new idea is simple: to build a physics valid for all CS."²⁵ [Note my bolding]

So, after all that, did Einstein succeed in developing a physical theory that is truly Machian? Is General Relativity a Machian theory? Strange as it might seem, nearly 100 years after the publication of the General Relativity equations, these are not settled questions, and Einstein himself changed his mind about them throughout his life. I think most biographers agree that in the second half of his life he subscribed to the idea of some sort of absolute rather than purely

relative rotation²⁶. [FN: 26 See for example: Isaacson W, Einstein; His Life and Universe, p 319 et seq, ISBN 978-1-84739-054-7].

R. Sungenis: So MacAndrew admits that, even after 100 years of hammering away at the problem, the very physics upon which all of modern cosmology is based isn't even sure whether it is coming or going! Yet he asks us to put our trust in it as the answer to almost every physics issue we face. He glibly tells us that "Einstein himself changed his mind about them throughout his life" without understanding the gravity (pun unintended) of what he just admitted. That it doesn't bother him that Einstein went back and forth without any unequivocal resolution to one of the most fundamental issues in modern science (i.e., the origin and function of gravity and inertia) is rather amazing. How in the world, then, can MacAndrew be so self-assured against geocentrism, especially since it was the very system that at least one side of Einstein's mental machinations allowed with impunity?

MacAndrew: In any case, it is clear that General Relativity satisfies the equivalence of inertial and gravitational mass, and that within GR, local experiments (which are confined to the local frame and exclude those that look beyond it to the rest of the universe) cannot distinguish between inertial (i.e. non-accelerating) frames in a zero gravitational field and frames in free fall accelerating in a gravitational field. Similarly, local experiments cannot distinguish between rotation in flat spacetime (i.e. in the absence of a gravitational field) and non-rotation in the Coriolis metric which is like a gravitational field that causes Coriolis and centrifugal-like forces in a non-rotating frame. The form of the physics is the same in all co-ordinate systems, so does this mean that Mach was right about the origin of inertia; and if so is that concept built into GR? To answer this question, the first step is to ask whether solutions to the Einstein field equations can result in Coriolis and centrifugal-like forces in a non-rotating frame. They can. This was shown to be so by Hans Thirring, within two years of the publication of the field equations, in a paper in which he calculated the gravitational fields inside a massive rotating sphere and showed that Coriolis and centrifugal-like forces arise inside the sphere²⁷.

R. Sungenis: In case you were wondering, all that MacAndrew is saying above is supportive of the geocentric system. Because of GRT's covariance, MacAndrew is admitting he cannot disprove geocentrism.

MacAndrew: Subsequently Thirring and Josef Lense calculated the effect of this "frame-dragging" externally near to a massive rotating body and predicted that in the vicinity of a massive rotating body the compass of inertia would be dragged round relative to the distant stars²⁸. This prediction of GR has been confirmed experimentally by measuring the minute Lense-Thirring frame dragging near to the rotating Earth²⁹. This provides a plausible framework in which Mach's Principle can be satisfied because the Lense-Thirring effect, or more generally the GR effects of what is called gravitomagnetism, allow for centrifugal and Coriolis forces to

arise in a non-rotating frame if that frame is influenced by rotating mass-energy. (The term, gravitomagnetism, was chosen to emphasise the analogy with electromagnetism, because simplified forms of gravitomagnetism in General Relativity take the same mathematical form as magnetism does in the theory of electromagnetism.)

R. Sungenis: Once again, when MacAndrew says “allow for centrifugal and Coriolis forces to arise in a non-rotating frame if that frame is influenced by rotating mass-energy,” he is saying that GRT allows for the Earth to be a “non-rotating frame” that can experience inertial forces (i.e., centrifugal and Coriolis) created by a rotating universe (i.e., a “rotating mass-energy”).

MacAndrew: That’s all well and good, and it shows that the mass-energy in the universe can influence and potentially contribute to inertial effects, but it is insufficient for us to conclude that the rotation of the universe around a non-rotating object would create exactly the same forces as the rotation of the object at the same angular velocity in a non-rotating universe. This is because the magnitude of the gravitomagnetic force predicted by these solutions to the Einstein field equations depends on the masses and distances of the rotating masses and it is not immediately clear that the universe as a whole, if rotating, causes forces which are exactly equal to those experienced by a body rotating with the same angular velocity in a non-rotating universe.

R. Sungenis: “It is not immediately clear”?! In other words, GRT can’t answer the most fundamental question with which it is challenged, that is, whether its own covariance principle can be applied on large scales, yet this is the theory upon which all of modern physics is based, including how the Big Bang must operate. Earlier MacAndrew told us that “Einstein himself changed his mind about them throughout his life,” but we are going to witness MacAndrew trying to save Einstein from his own equivocation.

MacAndrew: Such a condition of exact equivalence is called “perfect dragging”. Is it met by our universe? The rotating spherical shell derivation of Thirring has been extended by Brill and Cohen³⁰ to show that under certain conditions a massive rotating sphere can cause perfect dragging; and by Cohen et al that a massive rotating cylinder can do so and also satisfy other requirements for the metric that the spherical shell does not.

R. Sungenis: Just for the record, all these references (e.g., Thirring, Lense, Brill and Cohen, and many more) are referenced in detail in *Galileo Was Wrong*, Chapter 9, but MacAndrew is apparently pretending that we are unaware of them and that he found these on his own. We are the ones who pointed out the frame dragging issue. In any case, MacAndrew admits that Brill and Cohen did, indeed, find perfect frame dragging, and thus there is no distinction that GRT can find between a rotating universe around a fixed Earth or a rotating Earth in a fixed universe. In other words, Brill and Cohen gave the green light to geocentrism.

Incidentally, from a General Relativity perspective, questions about perfect vs. imperfect frame-dragging have already been answered by Grøn & Eriksen (1989) and by Bondi (1994). The former make clear that for the Earth-Moon system, taken at rest, the rotation of the universe induces perfect frame-dragging and creates the forces to prevent the Moon and Earth from slamming into each other. This contradicts the critic who claims the Earth would fall into the Sun and that we have a two-body problem and nothing more. Perfect frame-dragging prevents that from happening.

MacAndrew: But the universe is neither a spherical shell nor a cylinder, so is there perfect dragging in our universe?

R. Sungenis: Another *ipse dixit* from MacAndrew. I suggest he talk with George Ellis, the premier Relativistic physicist in the world today, who said:

“I can construct [for] you a spherically symmetrical universe with Earth at its center, and you cannot disprove it based on observations. You can only exclude it on philosophical grounds. In my view there is absolutely nothing wrong in that. What I want to bring into the open is the fact that we are using philosophical criteria in choosing our models. A lot of cosmology tries to hide that.” (“Profile: George F. R. Ellis,” W. Wayt Gibbs, *Scientific American*, October 1995, Vol. 273, No. 4, p. 55).

MacAndrew: We can already see that a definite answer to this question requires a good knowledge of the details of the total distribution and flow of mass-energy in the entire universe over all of spacetime, which we don’t have.

R. Sungenis: If so, then it is obvious in the Newtonian system that MacAndrew can have no objection to the Earth being the center of mass for the universe.

MacAndrew: But what we can do is to turn the question around and indicate what conditions need to be satisfied in order to have a universe in which there is perfect dragging. In order to answer the question we need to avoid initial and boundary conditions which are simply not known. This can be done in the case of a compact spatially closed universe (such a universe is spatially finite and unbounded) such as a 3-sphere or a 3-torus. Schmid³¹ and Grøn³² show that perfect dragging can be present in a physical universe under the strict condition of a closed universe (amongst other conditions) as described above. So in a spatially closed universe, provided other conditions are met, perfect dragging can occur.

R. Sungenis: So, once again, MacAndrew admits the viability of geocentrism.

MacAndrew: Does this mean that the universe is Machian and that GR is a Machian theory? Well even if we can demonstrate perfect dragging of inertial frames there are good reasons to say that the universe is not Machian and that GR is not a Machian theory. One difference is that, in the Machian conjecture, the origin of inertia is necessarily determined by the entire mass-energy distribution of the universe – this is the substance of the conjecture. But it is not a necessary consequence of GR. As we have seen, solutions to the field equations do not generally give results in which inertial frame dragging is perfect, although they can do so. So GR is not Machian in the sense that perfect dragging should be implicitly built in to the theory and should necessarily follow in all physical solutions.

R. Sungenis: This must be painful for Alec. When he says equivocating things like,

“As we have seen, solutions to the field equations do not generally give results in which inertial frame dragging is perfect, although they can do so,”

he obviously doesn't know which way to turn. He thought this nut was going to be easy to crack when Keating or Palm asked him to silence Bob Sungenis with science arguments, but it is easy to see that Alec has been doing a song and dance for the last few pages that even I am embarrassed to see him go through. He simply doesn't want to become a geocentrist, so he is forced to try to think up ways in which he can avoid the perfect frame-dragging (read: “geocentrism”) in his own GRT theory.

MacAndrew: Second, the Machian compass of inertia is determined by the action at a distance of the entire mass-energy in the universe by some undetermined means, whereas GR is a local theory, in which the world lines of particles (I.e. how particles move freely through space and time) are determined by the local metric – these are profoundly different kinds of hypothesis.

R. Sungenis: Again, what MacAndrew is really saying is that Mach held that gravity can travel faster than the speed of light, but that Einstein limited the speed of gravity to the speed of light. Here's why Einstein did so. Let's go back to the 1887 Michelson-Morley experiment. In order to keep the Earth moving despite the empirical evidence that showed the Earth was fixed in space, Einstein was forced to say that the speed of light was constant. Light had to be constant in order for it to be the unchanging and fixed absolute that Einstein needed (as opposed to making a non-moving Earth the unchanging and fixed absolute). The terrestrially measured speed of light at that time was 186,000mps. So if light was made constant due to Einstein desire to keep the Earth moving, then light could never go faster than 186,000mps.

Unbeknownst to Einstein and his colleagues in 1905, the speed limit on light would subsequently hamper all of cosmology for the next 100 years, since about 20 years after 1905, cosmologists were finding all sorts of reasons why light speed should *not* be limited to 186,000mps. But if

they were to exceed c , then SRT would have to be abolished, and there would be no answer to the Michelson-Morley experiment, and thus the Earth would remain fixed in space.

So the Relativists built a Trojan horse and snuck an unlimited speed of light in the back door by using General Relativity, which then allowed Einstein to equivocate on whether he wanted his GRT to be Machian, but he never came to a firm conclusion (as MacAndrew admitted earlier).

In effect, when Einstein needed to make his analysis of the universe local, he made it local. When he wanted to make it non-local (i.e., Machian) he made it non-local. GRT became the wax nose that would allow anything they wanted, and it still is that way today, as confirmed by the testimony of Alec MacAndrew. That's why it's easy for me to use GRT to support geocentrism (to MacAndrew's chagrin) since it is so pliable.

MacAndrew: Third, Mach postulated that in an empty universe, there would be no inertia, and so accelerative, centrifugal and Coriolis forces would never arise. But in GR, the metric for an empty universe is Minkowski spacetime in which GR reduces to Special Relativity, in which there are universal inertial frames and in which rotation and non-rotation can be unambiguously discriminated. This contradicts Mach's Principle. For these and for other reasons the consensus is that GR is not actually a Machian theory³³.

R. Sungenis: Is all this dancing back and forth between theories confusing you? It's confusing because these men really don't really know what the blazes they are talking about. Postulating about "empty universes" and then drawing the conclusion from it that there is a "consensus that GR is not actually a Machian theory" is specious at best.

But while I'm here, allow me to take the mystery out of "Minkowski spacetime" and "GR reduces to Special Relativity." It goes back to the same issue we covered concerning the 1887 Michelson-Morley experiment. Since Einstein had to dilate time in addition to shortening the length of moving objects in order to make it appear as if the Earth was moving around the Sun, that meant that both time and space had to be quantized into a single equation, which Minkowski invented. But then MacAndrew says that GR reduces to SR, and in SR "there are universal inertial frames and in which rotation and non-rotation can be unambiguously discriminated." He just pulled a rabbit out of a hat. First of all, SR cannot distinguish between rotation and non-rotation since SR cannot deal with acceleration, which is what occurs in rotation. So if SR cannot measure a rotation, how is it going to distinguish it from a non-rotation?

MacAndrew: Although it is true that within GR, local experiments cannot distinguish between various manifestations of acceleration and gravity, it is wrong to say that one cannot make reasonable inferences based on non-local observations and on considerations rooted in causation (as we did for the annual Doppler shift modulation of the CMB and quasars above).

R. Sungenis: So now we are back to MacAndrew relying on “reasonable inferences” of things he cannot determine, such as whether we are moving toward them or they are moving toward us, due to the principle of relative motion.

MacAndrew: Is there any such evidence for the Earth’s daily rotation? Let’s look at Pioneer 10 and 11, two spacecraft that were launched in 1972 and 1973 respectively, to study the asteroid belt, Jupiter and Saturn. After completing their mission they continued on their trajectory out of the solar system at well above escape velocity. Pioneer 1034 remained in contact with earth stations until 2003 when it was some 12 billion kilometres away. You will remember that the Sun has by far the biggest gravitational field in the solar system and for that reason both Pioneers were slowed down by the Sun’s gravity as they flew away from the solar system. However measurements of the spacecraft position and speed indicated that both Pioneers were slowing down more than the models predicted and for several years this effect, known as the Pioneer anomaly, was a mystery. All we need to know about the anomaly is a) that it was tiny ($\sim 10^{-10}$ ms⁻² - a hundred billionth of the acceleration due to gravity at the Earth’s surface) and b) that it has been explained with perfectly conventional physics³⁵. What is relevant to us is the fact that the anomaly was so small and therefore, in order to measure it, physicists needed to know the position (range and direction) of the satellites with extreme precision. These measurements are made by Doppler measurements and timing of radio signals sent to the satellites and returned to Earth ground stations. There is a daily modulation of the Doppler signals caused by the fact that Earth’s rotation causes a daily change in the relative velocity between the spacecraft and the Earth which physicists must correct for. In fact this daily Doppler modulation is used to measure the direction of the spacecraft from the Earth (its amplitude gives declination and its phase gives right ascension).

But there’s more – because the Pioneer anomaly was so small, perturbations in the Earth’s daily rotation and in the velocity of the ground stations were significant and had to be taken into account. Corrections were made for³⁶: Earth’s precession, nutation, polar motion, tides, the Moon’s, Sun’s and planets’ gravitational torque, Earth’s mantle elasticity, Earth flattening, structure and properties of the core-mantle boundary, rheology of the core, underground water, oceanic variability, atmospheric variability, evolution of Earth’s shape, and the location of Earth’s centre of mass relative to the crust. Geocentrists would have us believe that the daily Doppler modulation was caused by variations in the velocity of the source (the spacecraft) and not by the Earth’s rotation which they claim does not exist. In that case, shouldn’t they explain why, according to them, the velocity of the Pioneer spacecraft, freely flying through space and several billion kilometres from Earth, cycled with a period of exactly one sidereal day? Can they explain why the details of the supposed Pioneer velocity cycle reflected all the subtle variations in the velocity of the ground station such as Earth’s precession, nutation, polar motion, and so

on? Can they give us one good reason to conclude that the daily Doppler modulation was caused by daily changes in the velocity of the spacecraft rather than by earth's rotation?

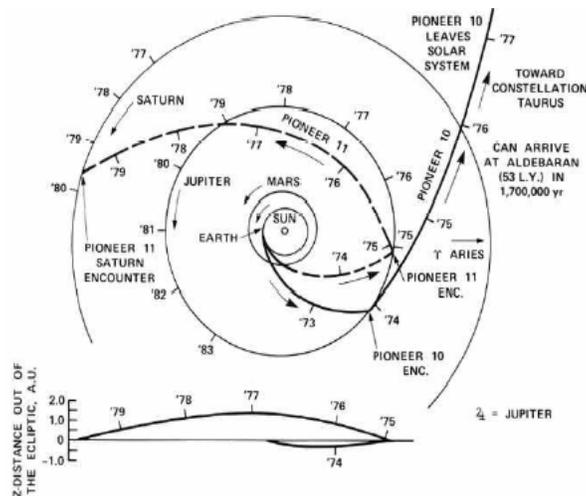
R. Sungenis: First, MacAndrew doesn't know the cause for the Pioneer anomalies. He can guess at them like everyone else does, but in the end, no one knows for sure. If MacAndrew had read our treatment of Pioneer in our book, *Galileo Was Wrong*, a lot of his challenges above would have been mitigated. Here is our present treatment:

Pioneer 10, 11 Anomalies, 1972 - 2004 update

Description:

The Pioneer anomaly/effect is the measured deviation from trajectory models of various unmanned spacecraft visiting the outer solar system, notably Pioneer 10 and 11. Doppler tracking data from the Pioneer 10/11 spacecraft from between 20-70 AU, yields an unambiguous and independently confirmed anomalous blueshift drift of $2.92 \pm 0.44 \times 10^{-18} \text{ s/s}^2$. It can be interpreted as being due to a constant acceleration of $a_p = (8.74 \pm 1.33) \times 10^{-8} \text{ cm/s}^2$ directed towards the sun. No systematic effect has been able to explain the anomaly as of 2005.

The Pioneer 10 data spans 11 years; Pioneer 11 spans 4 years. At 20 AU, the spacecraft was sufficiently far from the sun for the pressure of solar radiation to have dropped to a level where the 252 kilogram probe could no longer be accelerated by the pressure. A systematic error then became apparent, an unexplained acceleration directed towards the sun that has been present ever since in all four spacecraft – the two Pioneers, Galileo and Ulysses. Although the data from the Galileo and Ulysses spacecraft indicate a similar effect, their design, spin-stabilization and proximity to the sun do not favor easy detection. Should the anomaly not be a force but rather a cause that affects all frequency standards, accelerometers will be ineffective in discovering the nature of the observed anomaly. There are no current space missions that are expected to provide useful data.



Summary of the Pioneer orbits in the interior of the solar system.⁷

Details of the effect:

1. The Voyager data was too coarse for testing.
2. Large, bound astronomical bodies show no signs of the anomaly, although the acceleration is too large to have escaped detection in planetary orbits, particularly for Earth and Mars.
3. The fundamental problem is measured as a Doppler shift; the delta in acceleration is inferred by holding c constant.
4. The range of the anomaly is unknown; it is basically constant between 20 and 70 AU. (NB: an AU (Astronomical Unit) is the Earth-sun distance, about 92 million miles)
5. It was masked by the larger solar wind acceleration until reaching 20 AU.
6. The direction of the acceleration is assumed to be towards the sun, but the resolution does not permit this assertion. It is possible that the acceleration is: (a) toward the Earth; (b) along the direction of motion, or (c) along the spin axis.
7. The actual direction indicates a physical origin that could be: (a) new dynamical physics originating from the sun; (b) a time signal anomaly; (c) a drag or inertial effect; (d) a property of the ether flow in the outer solar system; (e) an on-board systematic defect.
8. When all systematic factors common to all four craft are taken into account, the anomaly still remains.
9. A Voyager-type space-craft is not appropriate; its frequent attitude-control maneuvers overwhelm any small external acceleration.
10. Ulysses data analysis discloses an unmodeled acceleration towards the Sun of $(12 \pm 3) \times 10^{-8} \text{ cm/s}^2$, about 50% higher than the Pioneer anomaly.
11. Viking ranging data accuracy limits any unmodeled radial acceleration acting on Earth and Mars to no more than $0.1 \times 10^{-8} \text{ cm/s}^2$.
12. Ranging data are independent of the Doppler shift; they are found from signal time delay calculations of the motion are made on the basis of the range time-delay and/or the Doppler shift in the signals.
13. Despite large solar radiation effects, the nominal value obtained for the Galileo spacecraft by measurement was $\sim 8 \times 10^{-8} \text{ cm/s}^2$, comparable to the Pioneer values.
14. The α_p stays approximately constant for a long period (Pioneer 10 is now past 70 AU).
15. The Pioneer anomalous acceleration contradicts the accurately known motion of the inner planets.

Suggestions/interpretations:

- A gravitational frequency shift of Pioneer signals proportional to distance and the density of the interplanetary dust cannot be responsible for the anomaly; known properties of the dust are not large enough to produce the observed acceleration.
- The effects of dark matter or modified gravity fail because observable effects that should be seen on the orbits and distances of the planets are not seen.
- Possible problems with atomic clocks have been eliminated as a cause.

⁷ http://arxiv.org/PS_cache/gr-qc/pdf/0507/0507052.pdf Fig. 1.

- The predominant opinion of a thrust from gas leakage does not explain why the leakage from four independent craft of three different designs has the same effect.
- Proposed missions to provide useful data include using two craft near Saturn at wide angles to pinpoint the effect direction by signal interferometry.
- internal systematic properties, undiscovered because of identical design.
- a viscous drag force proportional to the velocity of the Pioneers.
- Unknown mass distribution in the outer solar system.

The possibility of a new paradigm, or the reinstatement of an old one, may be in the offing.

C Anisotropy

The basic experimental observable is a Doppler frequency shift. If f_o refers to the observed frequency, f_m refers to the frequency predicted from theoretical models and f_r is the reference frequency, then:

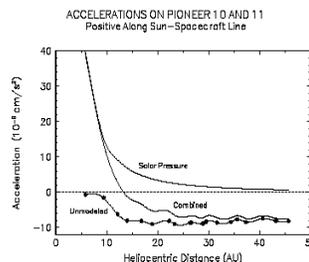
$$f_o - f_m = -f_r (2at/c) = -f_r (2v/c)$$

The frequency has been measured as decreasing at 6×10^{-9} hertz per second or 1.5 Hz over a period of 8 years. Since t and c are known, the non-Newtonian acceleration a has been the suspect. But the possibility of c changing with the ether density or flow has not been addressed. The behavior of the space probes provides dynamic information on the dependency of light speed on the ether of interplanetary space. The Pioneers are, in effect, mapping the solar system ether flow.

Measurements actually indicate that the observed Doppler frequency, f_o , is dropping with time. Let's solve for f_o from the above equation,

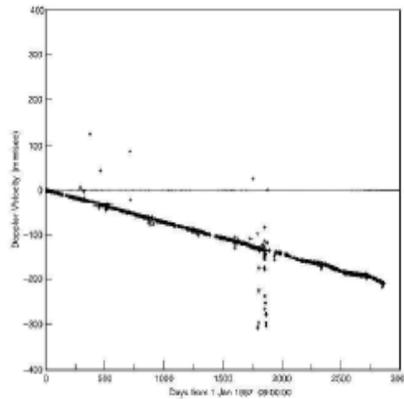
$$f_o = f_m - f_r (2at/c) = f_m - f_r (2v/c)$$

Since f_m remains unchanged, a decrease in observed frequency will occur with an increase in $f_r (2v/c)$ or a decrease in c . So a change in a or in c will cause the Pioneer effect.



Pioneer accelerations vs. distance from the sun.⁸ The accelerations are: a) the calculated solar radiation acceleration (top line), b) the unmodeled acceleration (bottom line), and c) the measured combined acceleration (middle line)

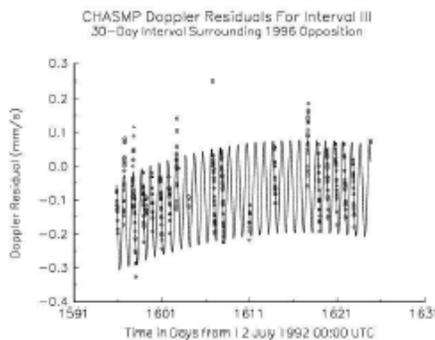
Subtraction of the measured acceleration from the solar wind/radiation pressure gives the unknown anomalous acceleration. The solar radiation pressure decreases as the inverse square, $1/r^2$.



Observed Doppler velocity minus model Doppler velocity for Pioneer 10 vs. time.⁹

The slope of the long term plot of velocity versus time above visually demonstrates that the acceleration is negative and constant. The drift is clear, definite, and cannot be removed without either adding acceleration, \mathbf{a}_p , or the inclusion of a frequency drift or clock acceleration, \mathbf{a}_t .

Periodic variations:



Periodic Doppler shifts over 30 day interval¹⁰

⁸ http://arxiv.org/PS_cache/gr-qc/pdf/0104/0104064.pdf Fig. 3.

⁹ http://arxiv.org/PS_cache/gr-qc/pdf/0104/0104064.pdf Fig. 6.

¹⁰ http://arxiv.org/PS_cache/gr-qc/pdf/0104/0104064.pdf Fig. 18.

A pattern now becoming familiar: a short-term diurnal sine wave within an oscillating long term envelope. The data lacks the details to separate out either diurnal (solar day) from sidereal day, or to determine the direction of the source. The odds are on the Virgo-Leo cluster for the sidereal direction and the ecliptic normal for the annual variation.

An anomalous oscillatory annual term, smaller in size than the anomalous acceleration a_p , has been found by using a 1-day average over all 11.5 years, yielding:

$$a_A = (7.77 \pm 0.16) \times 10^{-8} \text{ cm/s}^2$$

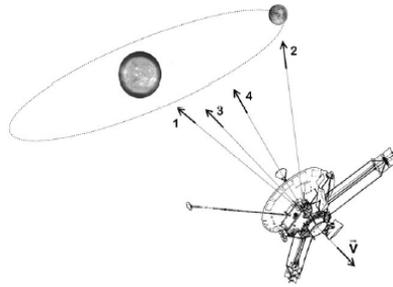
for the added annual oscillation. The presence of the small annual term on top of the complete solution is apparent in the graphic above. If approximated by a simple sine wave, the amplitude of the annual sinusoid is about $1.6 \times 10^{-8} \text{ cm/s}^2$. Two different programs were independently able to produce similar post-fit residuals, giving confidence in the solutions.

A least-squares fit to an annual sine wave produced:

Amplitude v	$0.1053 \pm 0.0107 \text{ mm/s}$
Phase	5.3 ± 7.2
Angular velocity ω	0.0177 ± 0.0001 rad/day
Bias/offset	$0.0720 \pm 0.0082 \text{ mm/s}$

The amplitude v and angular velocity ω of the annual term results in a small acceleration amplitude of $a = v\omega = (0.215 \pm 0.022) \times 10^{-8} \text{ cm/s}^2$. As seen above, there is a significant diurnal term in the Doppler residuals, with period approximately equal to the Earth's sidereal rotation period. The diurnal amplitude is comparable to that in the annual oscillation, but the angular velocity is 366 times larger. So the magnitude of the apparent angular acceleration, $(100.1 \pm 7.9) \times 10^{-8} \text{ cm/s}^2$, is large compared to a_p . The best estimate of the amplitude of the Pioneer 10 sine wave is $(0.525 \pm 0.155) \times 10^{-8} \text{ cm/s}^2$ and that of the Pioneer 11 wave is $(0.498 \pm 0.176) \times 10^{-8} \text{ cm/s}^2$. The difference in phase between the Pioneer 10 and Pioneer 11 waves is 173.2, similar to the angular separation of the two spacecraft in ecliptic longitude. The amplitudes are in the same proportion as the cosines of the ecliptic latitudes for the two spacecraft. Are the annual and diurnal terms caused by a misalignment of the Pioneer orbits on the ecliptic?

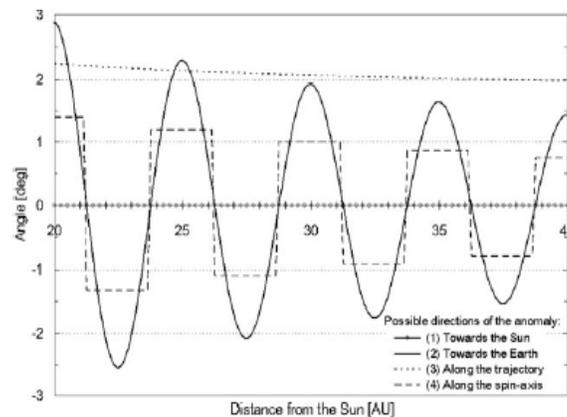
Still, the characteristic signature of a_p is a linear drift in the Doppler frequency, not the annual/diurnal features.



Direction of average acceleration¹¹

Four possible directions for the Pioneer anomaly:

- (1) towards the Sun,
- (2) towards the Earth,
- (3) along the direction of motion,
- (4) along the spin axis.



Characteristics of four possible directions of the anomalous acceleration.

The signatures are distinctively different.¹²

At 20 AU, the angle between sun and Earth is only three degrees, which is the maximum angle subtended by the sun and the Earth. The average angle is < one degree. With the radiation pattern of the Pioneer antenna and the lack of precise 3D navigation, the determination of the exact direction of the anomaly is difficult. Without an improved antennae and navigation the following directions are indistinguishable:

- (1) towards the sun

¹¹ http://xxx.lanl.gov/PS_cache/gr-qc/pdf/0308/0308017.pdf Fig 3.

¹² http://xxx.lanl.gov/PS_cache/gr-qc/pdf/0308/0308017.pdf Fig. 4.

- (2) towards the Earth
- (3) along the direction of motion of the craft
- (4) along the spin axis

This suggests, for each respective direction, the corresponding inference:

- (1) new dynamical physics originating from Sun
- (2) a time signal anomaly
- (3) a drag or inertial effect, or
- (4) an on-board systematic

- The angle from the sun (1) to the trajectory line is fixed.
- The angle towards the Earth (2) is a cosine curve formed by its orbit that is modified by a $1/r$ envelope as the craft moves further out. If the anomaly is directed towards the Earth (2), the current accuracy of the Earth's ephemeris and a sinusoid signal will be essential to determine this.
- An almost-linear angular change approaching the direction of the Sun would indicate a path-related source for the anomaly (3)
- The direction along the spin axis (4) is a series of decreasing step functions, created by the orientation maneuvers.

These four possible anomaly directions all have different characteristics. A future space mission dedicated to resolving the direction of the anomaly should be able to resolve the direction uncertainty.

Claims and Responses

Claim #1: The angle towards the Earth is a cosine curve formed by its orbit. If this cosine variation is observed, the conclusion is that the anomaly is pointed at the Earth, not the sun.

Response: No. There is a metaphysical assumption here that the Earth moves around the Sun. The reality is that the Earth is fixed, so no variation in direction should be seen. It is the sun that should display a sinusoid curve, in its motion around the Earth. This is a good example of how false cosmic premises compound conceptual errors. The erroneous interpretation of the results will be taken as more proof of a fixed sun and an Earth in orbit around it.

Claim #2: The Pioneer mystery was attributed to a possible “anomalous” acceleration (new physics!), directed toward the sun for both spacecraft.

Response: But if the Pioneer signal travels faster in the ether of space, due to either a change in its density or speed, the frequency shift/acceleration would be a consequence of the change in c .

Claim #3: The position of a spacecraft is found by examining the diurnal variation imparted to the Doppler shift by the Earth's rotation.

Response: Or the effect of the ether rotational flow on the spacecraft!

Claim #4: As the ground station rotates underneath a spacecraft, the Doppler shift is modulated by a sinusoid.

Response: Or the ether rotates between the two!

Claim #5: If the Pioneers are simulating the rotating Earth as in Foucault's experiment, a coordinate transformation to the Cosmic Microwave Background rest frame would entirely remove the Pioneer effect.

Response: No. The effect is absolute, due to the ether, and would be seen in any frame.

Claim #6: The annual and diurnal terms are likely different manifestations of the same modeling problem whose sources are both Earth-related.

Response: The terms are manifestations of an ether that flows through space. The Earth is related to these terms via the ether.

MacAndrew: What does all this mean for the question posed at the beginning of this section? Does the Earth rotate once per day or does the universe rotate around the Earth once per day? If we follow the view of many physicists, which is that GR is not a Machian theory and that, in GR, rotation retains absolute characteristics³⁷, then we can say that the Earth rotates for the same reasons that we can say so within a classical or Special Relativity framework, viz. we measure the effects of centrifugal and Coriolis forces on the Earth's surface caused by its rotation. We can also infer the earth's rotation from considering causation and non-local observations as we did above with the Pioneer measurements.

However, if we insist that in the universe the mass-energy is distributed and the universe topology is such that perfect dragging occurs, so that it fully determines the compass of inertia at all points, and therefore that one important aspect of Mach's Principle is satisfied, then we would really be unable to distinguish empirically between Earth-rotating and universe-rotating models.

All that we could then say is that the compass of inertia is aligned to the distribution and flow of mass-energy in the universe and that there is relative rotation between the Earth and the universe.

R. Sungenis: So, bottom line, MacAndrew is admitting that General Relativity has no way to disprove geocentrism, and, in fact, supports it to a very high degree that is only limited by the unresolved matter concerning whether perfect-frame dragging is a reality. This means that modern physics has no right to discount geocentrism as a perfectly viable and satisfying cosmological system. As I said before, the discussion should be over at this point, but apparently MacAndrew wants to see what he can salvage out of this intractable dilemma.

MacAndrew: But what would it then mean to make an absolute claim, like geocentrists do, that the Earth is absolutely not rotating and the universe is rotating around it? In the Machian scenario, the compass of inertia is aligned with the universe, so what would the universe be rotating relative to? It can't be rotating relative to itself. We should ask the geocentrists to define precisely what they mean by rotation and particularly by non-rotation, but my operational definition, and that of almost all physicists, is that dynamical rotation is determined relative to the local compass of inertia, which, in the case of perfect dragging, is relative to the average distribution of mass-energy. In this case, the claim that the universe rotates while the Earth does not rotate violates normal scientific and lay usage of the term "rotate". Of course, this definition of rotation is conventional, which is why it is so important for the geocentrists to define what they mean by the terms. This might be semantics, but in science the precise definition of the meaning of words is important.

R. Sungenis: Well, this is why the Steady State infinite universe of Hoyle and Bondi was very tempting for modern science, since once you postulate a Big Bang, then you must answer the question of how a universe can rest in the "nothingness" that is outside of the bounds of that universe. Big Bangers have the same problem when they say "space expands." Expands into what? Nothingness? Nothing doesn't exist, so how could space expand into it?

At this point in physics we enter into the realm of metaphysics. The old question of "why is there something rather than nothing?" can only be answered by the presupposition that God exists and has always existed. Therefore, He is the final reference point when physics begins to spill over into metaphysics. In that light, as regards what we see, the universe rotates with respect to a fixed Earth. As regards to what we don't see and what we know from revelation, the universe rotates with respect to God.

MacAndrew: But let's side-step the conventional usage of terms, and consider the consequences if the dynamic Earth- and universe-rotating scenarios are totally indistinguishable. Then saying that one or other is "correct" is meaningless. It's not that we are powerless to determine which one is correct, which implies that one is correct and the other is not; it's that they are equivalent by definition and therefore neither one is "correct" or "incorrect". We can take any frame as being non-rotating that we choose and the choice is entirely arbitrary. Since, according to this view, there is no absolute rotation, then there is no absolute non-rotation; and therefore the claim that the Earth (or any object) is absolutely not rotating is inconsistent with the premise. It is an unfalsifiable unscientific claim.

R. Sungenis: At this point is when we go to the empirical evidence and relook at it without the presupposition of the Copernican Principle forcing us into a particular model. This is why we consistently bring up the 1887 Michelson-Morley, the 1913 Sagnac and the 1925 Michelson-Gale experiments. They all support geocentrism, *prima facie*. The only way Michelson-Morley

can be forced into a heliocentric system is by creating all kinds of weird fudge factors, like length contraction and time dilation. Sagnac is likewise muddled by GRT being forced to create “infinite frames” to have even a possible answer to it. Michelson-Gale, as noted earlier, brought back the very aether that Einstein eliminated when he invented Special Relativity, and even though General Relativity’s aether was “non-ponderable,” it was forced to answer Michelson-Gale’s ponderable aether, since Special Relativity was totally contradicted by Michelson-Gale. The anomalies and contradictions in Einstein’s theories are just dripping from the data, but MacAndrew simply refuses to acknowledge them, and that is because, whether he admits it or not, he begins his analysis of the data from the presupposition of the Copernican Principle. So, he will go on creating fudge factors to answer the empirical data until one day he realizes he is on the wrong track.

MacAndrew: So the geocentric claim that the Earth is not rotating is either meaningless or plain wrong depending on whether your interpretation of General Relativity is more or less Machian.

R. Sungenis: Do you see what MacAndrew is doing? His favorite theory, General Relativity, has shown him that he cannot disprove geocentrism, but he wants to frame this fact into something less than a fact, namely, “the geocentric claim that the Earth is not rotating is either meaningless or plain wrong.” Instead of being absolutely astounded that the best modern physics analysis available to him opens up the possibility that the Earth could be fixed in the center of the universe (just like the ancient cosmologies and the Catholic Church said it was), apparently this doesn’t even faze him.

This shows you how much MacAndrew’s atheism and his devotion to the Copernican Principle guides his thinking. He knows that if he were to give any credence at all to the fact that the Earth is fixed in the center of the universe, he would need to revamp his whole understanding of life. That simply can’t happen for a modern devotee like Alec MacAndrew. He is reluctant to go back and reanalyze the Michelson-Morley, Sagnac and Michelson-Gale experiments with an open mind. He is likewise reluctant to admit the contradictions in Einstein’s theories. He will likewise never see the Axis of Evil as a clear sign of the Earth’s special position, but merely as an “anomaly,” as the ESA recently did. So he will continue to downplay the evidence and say that it is either “meaningless or plain wrong,” and grin with self-satisfaction that he has dealt with the problem. He hasn’t. He’s only compounded the problem, because now he has given clear evidence that the problem is within Alec MacAndrew and not in the cosmos.

MacAndrew: (For the sake of completeness, we should note that there is an exact solution to the Einstein field equations in which the universe does rotate. This solution was found by Kurt Gödel³⁸. In a Gödel universe, the entire mass-energy does not rotate around a fixed axis as a rigid body as it does in the geocentric model. Instead, observers at rest with respect to the mass-energy in the universe find that they still experience rotational inertial forces such as Coriolis and

centrifugal forces with respect to a preferred plane. If observers orient themselves so they feel no rotational inertial forces they will observe themselves and other inertial observers rotating with respect to the cosmic matter. The solution is profoundly un-Machian, demonstrating that GR is not an inherently Machian theory. It is also unphysical in that it has closed time-like curves, i.e. it allows time travel. Universe rotation of this kind has been ruled out by observation to very stringent limits – to less than 10^{-9} rads per year³⁹ so it is not a good description of our universe.)

R. Sungenis: This brings up another important point, which is that the so-called “Einstein field equations” can be interpreted and applied in many different ways. We point out seven of them, including Gödel’s, in our book, *Galileo Was Wrong*. This tells us the same thing I tried to point out to MacAndrew earlier – that modern physics is mainly a process of manipulating the mathematics. As J. J. Thompson once said:

“We have Einstein’s space, de Sitter’s space, expanding universes, contracting universes, vibrating universes, mysterious universes. In fact the pure mathematician may create universes just by writing down an equation, and indeed if he is an individualist he can have a universe of his own.”¹³

It also tells us that all of modern cosmology is ruled by Einstein. No one is allowed to drift to the left or the right of Einstein. If you do, your career will be in dire jeopardy. That is a fact. But as we have seen, Einstein’s two theories contradict one another and contradict the findings of quantum mechanics. Einstein’s two theories were created for the precise reason of trying to keep the Earth moving when the empirical evidence showed it was standing still in space. In other words, all of modern cosmology is built on the resolve to avoid a geocentric universe, and Einstein is their supreme leader.

Fortunately for us, in looking very closely at what he actually said, we have been able to show that the very attempt by Einstein to eliminate a geocentric universe in one theory was turned upside down by his subsequent theory. Only time will tell whether the MacAndrew’s of the world will cease calling it “meaningless or wrong” when, in fact, it is probably the most astounding fact of nature that mankind has ever had the privilege to know.

MacAndrew: According to GR, can the Universe have a centre?

R. Sungenis: At this point I have to wonder how many more times MacAndrew is going to ask this same question (and come up with a different response each time).

¹³ *Einstein: Life and Times*, p. 301. Misner, Thorne and Wheeler list seven distinct universes that can come from changing the mathematical variables of General Relativity (*Gravitation*, p. 747), let alone the numerous variations of other models, e.g., Steady State and Plasma universes.

MacAndrew: In GR the concept of a centre to the universe is as meaningless as the centre of the surface of a sphere – such an idea carries no meaning.

R. Sungenis: That is a plain lie. The surface of a sphere has no center, whether it's in GR, Machian or Newtonian physics, so it's facile to compare the surface of a sphere with a center to the universe.

Let's be honest, MacAndrew. We found out from Hubble that the real reason modern cosmology wanted to make the universe like the surface of a balloon was precisely because Hubble and his colleagues found it "intolerable" to have a center to the universe (which "center" the redshift was showing them). The only one who is becoming "meaningless" here is Alec MacAndrew, since it appears he will go to absurd lengths to deny geocentrism a place at the science table. As for GR, Einstein never said a center was "meaningless." He said in his 1938 quote that the Sun goes around the Earth or the Earth goes around the Sun both have "equal justification." Which one of these was correct he had no way to determine from GR.

MacAndrew: In General Relativity, the concept of the flat Euclidean space of classical physics is replaced with the pseudo-Riemannian manifold of 3+1 dimensions which can be distorted by the distribution and flow of cosmic matter. In GR, our familiar three-dimensional space is embedded in four dimensions (just as a two-dimensional sphere is embedded in three dimensions). According to GR, the topology of the universe as a whole is either compact (i.e. finite, like the surface of a sphere in one higher dimension but without a spatial boundary - this is the solution favoured by Einstein); flat and infinite and so extending indefinitely without boundary; or open with negative curvature and infinite, again without boundary. So in all of these cases, physical solutions to the field equations which approximate our local universe describe a universe with no spatial boundary. The concept of a centre is meaningless in all of these cases.

R. Sungenis: MacAndrew just defeated his own argument. In revealing that there are at least three very different solutions to Einstein's field equations, he not only shows us that the same equation can give three different answers, but he also leaves open the possibility that Einstein's equations could also provide a flat and bounded universe. All one needs to do to get to that type of universe is tweak a number or two in the equation. If you don't believe me, then perhaps you will believe George Ellis, the premier physicist in the world today who abides by Einstein's field equations:

"I can construct [for] you a spherically symmetrical universe with Earth at its center, and you cannot disprove it based on observations. You can only exclude it on philosophical grounds. In my view there is absolutely nothing wrong in that. What I want to bring into the open is the fact that we are using philosophical criteria in

choosing our models. A lot of cosmology tries to hide that.” (“Profile: George F. R. Ellis,” W. Wayt Gibbs, *Scientific American*, October 1995, Vol. 273, No. 4, p. 55).

It doesn't sound like Ellis believes a center to the universe is a “meaningless” proposition. He knows it is full of meaning, which is probably the reason he doesn't prefer it. It is for “philosophical reasons” that he doesn't like a geocentric universe, which is the same reason MacAndrew doesn't like geocentrism, but isn't as willing to admit it as much as Ellis is.

MacAndrew: Because the Earth is unambiguously rotating in Newtonian mechanics and Special Relativity,

R. Sungenis: Here is more of MacAndrew's chest-beating but there is no substance to it. As we have seen, MacAndrew totally distorted the issue of the center of mass in Newtonian mechanics. Additionally, he has failed to deal with the Michelson-Morley, Sagnac and Michelson-Gale experiments, and instead hopes to win the day by relying on the fudge factors latent within Special Relativity (e.g., the reason Michelson saw the Earth wasn't moving was because the arm of his interferometer shrunk just enough to hide the Earth's movement!). People like MacAndrew will never admit the truth, at least as long as we allow them to fill physics with fudge factors to support their atheistic agenda.

MacAndrew: the new geocentrists have been forced to invoke General Relativity, which, unfortunately for them, fundamentally undermines the very concepts of “static” and “centre” which they are trying to demonstrate.

R. Sungenis: No, the only thing that was undermined is MacAndrew's credibility in knowing how to deal with these issues. George Ellis has stated that a universe with a center can, indeed, be constructed from modern physics, contrary to MacAndrew. MacAndrew himself admitted that a Machian GR supports geocentrism, but then tries to tell us that some Relativists argue that GR is not Machian just so that he can have room to escape the implications of an already equivocal theory.

MacAndrew: This is what I mean by the Great Inconsistency – they are forced to invoke a physical model which renders their claim meaningless, or admit that their claim is wrong. Moreover, Sungenis and many other geocentrists violently reject both Special and General Relativity⁴⁰. Surely it is deeply inconsistent and illogical to invoke physics in support of their claims that they think is wrong-headed, atheistically motivated, a product of the author's moral degeneracy and medical ailments, and amounting to no more than science fiction⁴¹ – to do so smacks of desperation.

R. Sungenis: True to form, MacAndrew totally ignores the fact that geocentrists aren't forced to General Relativity. Let me say it again for the umpteenth time to MacAndrew: we don't believe in General Relativity. We appeal to it only because YOU believe it is the correct way to view the universe. Hence, when General Relativity supports geocentrism (contrary to your present attempt to downplay that support), then it serves us well to point out that YOUR OWN science can't refute what we are saying. The only one who is "desperate" here is Alec MacAndrew, since he is beside himself with frustration that he can't get Einstein to deny geocentrism.

MacAndrew: So since the very propositions they are trying to prove are meaningless in GR, let us ask the geocentrists to define precisely just what they do mean by a body being unmoving, not rotating, or being at the centre, in a way that is physically falsifiable. They are making these physical claims about the universe, so they should be able to define what they mean. If they cannot provide an unambiguous definition of these terms, then the claims are not physical but theological or metaphysical. And, if so, we can dispense with all the pages of tedious geocentric argument and mathematics. It is ludicrous to argue for the truth of physical claims about concepts that are physically meaningless.

R. Sungenis: A clear case of the pot calling the kettle black. MacAndrew lives in a world in which everything is moving and there is no fixed point. Literally speaking, the MacAndrews of the world don't know whether they are coming or going. They don't know left from right or up from down. I would conclude that people who live in glass houses shouldn't throw stones.

As for "physically falsifiable," we've plainly stated (and MacAndrew has consistently ignored) that our claims to a non-moving Earth are verified by all the empirical evidence, from Arago, to Airy, to Michelson-Morley, to Sagnac, to Michelson-Gale. Scientifically speaking, geocentrism stands or falls on these experiments. We have shown that Einstein's attempted answer to these experiments (Special and General Relativity) don't provide cogent answers, are full of contradictions, and are mathematically manipulated to give the illusion of appearing true. I will publically debate Mr. MacAndrew on these issues anytime he wishes to.

MacAndrew: Sungenis cuts and pastes. At this point in his paper, Sungenis does a strange thing. He copies four more or less complete works mostly written by other people which appear, at first sight, to be serious mathematical treatments of orbital dynamics which apparently support the neo-geocentric system in the framework of Newtonian mechanics (they are all Newtonian because they contain no mathematical reference to the Einstein field equations or their solutions).

R. Sungenis: What MacAndrew leaves out, of course, is that the solutions are a combination of Newtonian and Machian physics, but since MacAndrew has already admitted that a Machian physics supports geocentrism, then it is best for him to ignore that dimension of the argument.

MacAndrew: He fails to acknowledge the author of the first two at all,

R. Sungenis: So here MacAndrew makes an insinuation that I plagiarized these papers and deliberately did not give credit to the author. Huum, is that why in footnote #6 I specifically mention the author? Check this out: ⁶ Luka Popov, “Newtonian–Machian analysis of the neo-Tychonian model of planetary motions,” *European Journal of Physics*, 34, 383-391 (2013). Also available at arXiv:1301.6045 [physics.class-ph]. Dr. Popov is employed by the Dept. of Physics, University of Zagreb, Bujenička cesta 32, Zagreb, Croatia.

MacAndrew: although he acknowledges the “help” of the authors of the latter two.

R. Sungenis: That’s because it was a collaborative effort.

MacAndrew: It’s a strange thing to do because normally one would not copy others’ work wholesale like this, but would refer the reader to the source. I can only assume that he hopes that the very length and apparent complexity of the maths will lend an air of respectability to his article; that people will think, “Look at all that complex maths that goes straight over my head. These people must know what they are talking about”.

R. Sungenis: So now we know how MacAndrew thinks about the reasons one would display math equations – to look impressive. Since MacAndrew doesn’t know what my motives are, what he did is called “projection” in psychology, and MacAndrew just fell into it. On the other hand, when we don’t fill out explanations with math equations, MacAndrew complains that we either don’t know the math or that our explanations are inadequate because they don’t contain math. We are damned if we do, and damned if we don’t.

And just for the record, Dr. Popov is a personal friend of mine, and he gave me permission to reprint the whole article, both in the Keating rebuttal and in *Galileo Was Wrong*.

MacAndrew: They don’t, as we shall see. All of these papers are either erroneous or contain nothing more than co-ordinate transformations – i.e. kinematic transformations rather than dynamic equivalences. There is nothing new in them and they do not advance the geocentric case. Here we go:

Paper 1: Popov, Luka. "Newtonian–Machian analysis of the neo-Tychonian model of planetary motions." *European Journal of Physics* 34, no. 2 (2013): 383.

Of the four papers, this is the only one which has been published in a peer-reviewed journal. It is also available⁴² on the arXiv pre-print server. It is copied wholesale into Sungenis’s article, minus its Introduction, starting at Section 2. Note that the *European Journal of Physics* is a journal which accepts papers relevant to the teaching of physics, but does not publish original

research⁴³. It has a very low impact factor⁴⁴ and this paper has been cited only by its own author in further unpublished papers⁴⁵. The paper purports to show, using an approach to calculating orbits called the Lagrangian method which relies on the invariance of the sum of kinetic and potential energy in a system, and by invoking Mach's Principle which we have discussed above, that the Sun orbiting the Earth can be shown to be equivalent to the Earth orbiting the Sun. The paper proposes that the centrifugal "pseudo-force" as 41 Dr Robert Bennett, PhD in physics and Sungenis's scientific consultant and co-author writes: "Relativity, quantum mechanics, Big Bang cosmology...all science fiction." "...but the Einstein universe includes inconsistent/illogical premises; Newton's doesn't" [Bennett's ellipses]. observed from the frame of the orbiting Earth is an actual force resulting from the actual acceleration of the universe which gives rise to an actual universal potential as observed from the static Earth. There is no support for this proposal in Newtonian mechanics. The paper begins with and depends fundamentally on an elementary text book derivation of orbital mechanics using the Lagrangian. Unlike Sungenis, the author is not opposed to considering the two-body problem as a valid approximation for the Sun-Earth situation, and so the paper sets out a derivation of solutions to the well-known Kepler problem (solving the equations of motion in the central potential of a two body system where the force between the bodies varies as the inverse square of the distance). Early in the paper, Popov reduces the analysis to a one-body problem⁴⁶ based on the reduced mass of the system ($m_1 m_2 / m_1 + m_2$) again - he is quite happy at this point to dispense with everything other than the Sun and Earth ("it's easy to notice that the dominant contribution in these sums comes from the Sun", he writes) and so makes the problem once more a two-body problem, and from there reduces it to a one-body problem as before. But we already know that the one-body analysis using the properly calculated reduced mass will yield an orbit for the Sun in the rest frame of the Earth that looks identical to the Earth's orbit in the rest frame of the Sun - the one body reduction yields relative orbits referred to the other body. So, the entire paper is trivial and does nothing more than derive the orbit of the Sun (and Mars) in the rest frame of the Earth - a pure kinematic co-ordinate transformation.⁴⁷ where the subscript SE denotes Sun to Earth motions and distances. You will note that the kinetic term in this Lagrangian has the solar mass, and the potential term has the square of the solar mass. In other words, this Lagrangian represents the orbit of the Sun around another body of the same mass as itself at a distance of Earth to Sun. The author goes on to set the reduced mass equal to the mass of the Sun; this substitution is incorrect for the Earth-Sun interaction. The correct reduced mass is approximately equal to the Earth's mass. In any case, all of this is pointless, as the original one-body solution arrived at in the paper gives the relative orbits for the Earth in Sun's rest frame and vice versa.) to derive the relative orbits of the two bodies - i.e. the orbit of any one of the two, referred to the rest frame of the other, rather than to their centre of mass. In other words the reduced-mass one-body solution gives the motion of each body in the non-inertial rest frame of the other. For a system where one body is much more massive than the other (such as the Sun and Earth) this provides a good approximation to the motion of the less massive body (the Earth) in an inertial frame. But it does not give a good approximation for the motion of the more massive body (the

Sun) in an inertial frame. It is peculiar that in a paper which attempts to show the dynamic equivalence of the Earth orbiting the Sun, and the Sun orbiting the Earth, the author reduces the problem to a form that is capable of calculating only relative orbits from the outset. After several pages of elementary textbook derivations, we eventually arrive at the orbits of Earth and of Mars in the Sun's rest frame, and of Mars in the Earth's rest frame. None of this work rises above undergraduate physics. Having demonstrated in the rest frame of the Sun that this procedure yields the expected orbits, Popov calls on Mach's Principle, claiming that we must consider the Lagrangian of all the bodies in the universe. Clearly Popov and Sungenis don't communicate, because unlike Sungenis, Popov, having spirited up all the other bodies in the universe like genies, commands them all to disappear

Paper 2: Popov, Luka. "The dynamical description of the geocentric Universe." arXiv preprint arXiv:1304.7290 (2013). This copied paper starts on page 12 of Sungenis's article and is also not acknowledged. The paper has not been published. It purports to demonstrate the equivalence of geocentric and heliocentric dynamic analyses including the rotation of the Earth on its axis. To do so, Popov calls on the paper we looked at above and invokes the Machian influence of the rest of the universe to create a term called a vector potential in the Lagrangian which, when solved, yields Coriolis and centrifugal-like forces in the rest frame of the Earth. However, the vector potential is just invented out of thin air and is given the appropriate value to get the right result. Although Popov uses the term, gravitomagnetics, which implies the use of General Relativity concepts, there is no attempt to explain the physics which gives rise to this potential in terms of solutions to the Einstein field equations. And indeed, Popov is on a hiding to nothing, because precisely this result has been derived more rigorously by starting with the Einstein field equations and then deriving the magnitude of the gravitomagnetic frame dragging, first of all inside a massive rotating hollow shell⁴⁸ and then more recently, to show perfect dragging under rotation of the universe^{49 50}, as we have seen above. These results show, far more rigorously than Popov does, that under certain conditions, local inertial frames are dragged to be aligned with the mean star field (or average matter-energy distribution in the universe), subject to perturbations caused by local masses, whether we take that star field to be in a rotating or non-rotating frame.

R. Sungenis: Dr. Popov's response to MacAndrew is as follows:

First of all, I don't even intend to argue that my calculation and formulae does not contain any mathematical nor physical error. This paper has been peer-reviewed by four peers (two working for *American Journal of Physics*, two from *European Journal of Physics*) and neither of them reported any error. The only reason why the paper was rejected by the *American Journal of Physics* is because one of the peers didn't find it very interesting. Subjective, not objective reason. The same goes for my next two works

on geocentrism which are never published not because they contain error, but because the community doesn't find them interesting or important. De degustibus...

Anyway, if my math is wrong, how come it resulted with Sun's and Mars' trajectories which perfectly coincide with the observed data? Just think about this for a moment.

The next complaint states that *European Journal of Physics* does not publish original research. That is true, but that is exactly the point! One doesn't have to invent anything new, plain old Newtonian mechanics combined with some imaginative application gives you geocentric system with equally good predictive power and equally simple as the heliocentric system. I didn't invent any new theory, I've just applied the existing well-tried theories to construct the geocentric system. It was therefore natural choice to publish it in the *European Journal of Physics*. Speaking about impact factor, EJP has the highest impact factor among journals of this type. One does not compare apples and pears. Besides, EJP is listed in the Current Contents database which lists only most prestigious scientific journals.

It was also mentioned several times that math I used does not rise above undergraduate physics. Again, exactly the point! One doesn't need to be new Einstein to see that geocentrism is at least equally good as heliocentrism. Any second-year undergraduate physics student can figure this out.

As a conclusion, I would like to stress that my papers show that geocentric model is (a) equally valid and (b) equally simple model of planetary motion as heliocentric model. And you don't have to be genius with PhD in physics to figure this out.

MacAndrew: Paper 3: “Additional Kinematical/Vector Analysis of a Rotating Universe”

This paper seems to be written by Gerardus Bouw or by Sungenis in collaboration with him, and is not published. Remarkably, it takes four pages of extremely tedious and elementary derivation to get to the trivial and wrong conclusion that in a geocentric universe the total force required to accelerate a star at distance R from the polar axis, declination δ , revolving once per day around the Earth's polar axis is:

$$F = -m\omega^2(\mathbf{R} - D\hat{\omega} \sin(\delta)) \text{ (Bouw's or Sungenis's equation (12) which is wrong)}$$

The reason this is wrong is the inclusion of the term $\omega^2(\mathbf{R} - D\hat{\omega} \sin(\delta))$ which has the form of a Coriolis acceleration acting on the star in the direction of the polar axis; the term should not be there. Bouw or Sungenis, or whoever derived this, has confused the velocity of the revolving star

in the Earth frame, $v = \omega \times \mathbf{R}$ with the velocity used to calculate the Coriolis acceleration, which is also commonly designated as v (let us call it v') and which is referenced to the rotating frame:

$$\alpha_{\text{coriolis}} = -2\omega \times v'$$

In this paper, the universe is assumed to be rotating with constant angular velocity around the Earth's polar axis. The velocity of the star with respect to that rotating universe (the rotating frame) is zero. In fact, Sungenis and Bouw say exactly this, "...we will use a single star since its co-ordinates are fixed in the sphere of the universe which carries the star." Therefore, and so the second term above reduces to zero. The correct expression for the force required to accelerate the revolving star in its orbit is very simple:

$$F = -m\omega^2\mathbf{R}$$

and the acceleration is

$$\alpha = -\omega^2\mathbf{R}$$

These are simply the centripetal force and acceleration required to keep the star revolving once a day about the Earth's polar axis. It is remarkable that someone who claims to have a "scientific background" as Sungenis does can endorse such an elementary mistake.

And now that we've corrected the new geocentrists' maths, we still need to ask how this helps them make their case? In short, it doesn't.

Let's calculate what that force and acceleration might be for a solar mass star located at, say, redshift $z=0.1$ away from the Earth's polar axis and revolving around it. The co-moving distance of the star from the polar axis is 1.3×10^9 light years, which is 1.23×10^{25} metres. The angular velocity is 2π radians per day or 7.3×10^{-5} radians per second. The centripetal acceleration required is then $6.6 \times 10^{16} \text{ ms}^{-2}$ or 6.7 thousand trillion times the acceleration due to gravity at the Earth's surface. The centripetal force required to accelerate a solar mass star of $1.98 \times 10^{30} \text{ kg}$ thus would be 1.3×10^{47} Newtons which is a truly stupendous force.

Bouw (or Sungenis) claims that "every celestial object is held in place by this equation" (actually the incorrect one above; but in any case it doesn't matter.) The statement is quite nonsensical. What he or they would have calculated if they hadn't got the rather simple maths wrong, is the enormous centripetal acceleration and hence the vast centripetal force that would be required to maintain a celestial object in a circular diurnal orbit. The equation shows what would be required but, needless to say, does not propose a source for these enormous forces. The paper is riddled with error, is utterly trivial, and fails completely to achieve its aims.

R. Sungenis: Contrary to MacAndrew's critique, there is nothing wrong with equation (12). MacAndrew simply misunderstands it. Our model is portraying vector summation. Its effect is to keep the star at its proper latitude so it will not "fall" to earth's equatorial plane. Secondly, the Coriolis force is included in equations (3) through (7) where it is best expressed as:

$$2\omega \times dR/dt.$$

Moreover, the universe, which we understand as the Firmament composed of an all-pervasive Planck medium, is the absolute inertial field, and it is anchored to the center of the earth.

This means that the star in the illustration is not "revolving" around the axis of rotation. The universe itself is rotating. In fact, the rotation of the universe (vacuum space) with respect to the Firmament amounts to roughly one rotation per 20 billion years. Thus all of MacAndrew's force and acceleration analysis of a solar mass star at $z=0.1$ is meaningless since our inertial field is "omnipresent" in the Firmament. A more detailed derivation of these matters can be extracted from: <http://www.spiritus-temporis.com/coriolis-effect/applied-to-earth.html>

MacAndrew: Paper 4: M. Bernadic? "The Geocentric Lagrange Points" This unpublished paper seemingly written by Milenko Bernadic, attempts to calculate the five Sun-Earth Lagrange points⁵¹ [FN: 51 The Lagrange points of a two-body system are points in space where the gravitational potential is such that the force due to gravity provides the centripetal force which is required for a third less massive body located at those points to remain and to orbit with the same period as the other two] from a geocentric perspective. The paper appears to be missing some material in the middle, and so is incoherent. The author also accepts that the Sun-Earth system can be represented as a two-body system, contrary to Sungenis's erroneous claims above. But in any case it does not seem to contain anything more radical than a kinematic transformation of the conventional derivation of the two-body Lagrange points to Earth-centred Earth-static coordinates.

R. Sungenis: Dr. Milenko responded to MacAndrew's critique as follows:

I've seen the comments of Dr. Alec MacAndrew on the work of Robert Sungenis. In particular, I will refer briefly to Lagrange points and the two-body problem, as to the approach in general. You can see, for example, in the Popov's article, he stated: "note that it is not a central potential," *i.e.*, we start from the fact that the universe rotates, and in that case the forces from the rotation of the entire mass of the universe are capable of keeping the Sun in its orbit; it doesn't need a central potential.

From where is the necessary force for such rotation preceeding? From the initial conditions of our system. Is it reasonable to assume such rotation? Yes, because among

other things the experiments of Michelson, Morley, Gale, etc., can confirm that assumption perfectly. (Note especially the work of the physicist Héctor Múnera that questions the Michelson Morley experiment supposedly null data.) Geometrically, the two systems are also equivalent, but physically the heliocentric model has difficulties not recognized previously, and are very serious.

A theory is developed from the set of axioms that you previously establish. The theory must not contradict any established axiom, and if so, then it is consistent. In our case, geocentrism wouldn't be true if we arrived at results that contradicted the established axioms. In fact, the axioms must be consistent with the observation, geometric and physical.

On the other hand, it is interesting to observe that in the orbits of electrons in the atoms we find Lagrange points, as described in this paper:

<http://physics.aps.org/articles/v2/19>

(Viewpoint: An astronomical solution to an old quantum problem)

The electrons do not have a force of attraction negligible with respect to the atomic nucleus, as it would be the case of the Earth with respect to the gravity of the Sun's gravity. Whereupon, the Lagrange points (atomic orbit) can be caused by the necessary forces that maintain a body in its orbit.

End