Gravity and Mach's Principle

Ernst Mach

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I don't normally have much use for Mach. I think this is the first time I have mentioned him in my papers. I have the same sort of natural aversion to him that Planck had, though my make-up is perhaps even more antithetical to his than Planck's was. Being an artist as well as a scientist, I can't abide Mach's disconnection to the visual. Whereas I had an innate understanding of perspective at age 3, Mach was still worried about walking into distant mountains when he was an adult. He had trouble reading drawings and even photographs, and I personally believe this disability colored his physics.

But I am not really interested in talking about the psychology of physics here. Nor do I think that it is necessary to defend the place of mechanics in physics. We have now seen the results of over a century of a physics unmoored from mechanics, and that evidence speaks for itself. The 20th century could be seen as an extended experiment into the feasibility of a lazy phenomenalism in physics, and the data is easy to read. The damage has been extensive and will take years to repair.

Mach's Principle, however, has always stuck in my mind as an interesting hypothesis. That "principle" is not really a principle, but it may be stated as the idea that each event in the universe is influenced or determined by the whole universe. In some theories, inertia is explained by Mach's Principle, in rather imprecise and sometimes wild ways. I have never seen a convincing mechanical explanation of it, however, so I have left it to others to discuss. My papers are about mechanics, and if I don't have at least the scent of a clear and concise explanation, I don't publish anything. I wait until I do. Now I do.

Newton defined inertia as the resistance to force, and tied it directly to mass. But as I have shown in other papers, this was more a naming than an explanation. Mass has inertia and inertia is caused by mass, so the physics is mostly circular. Newton never told us what mass is, either, which is why we are still inconvenienced by the illogic of the Higgs boson—which is supposed to give mass to mass. Newton called the cause of mass *ponderability*, but that is just another word for mass. Since inertia is a

resistance to a force, and force is caused by a motion (acceleration), it is not clear how mass can counteract motion. As a matter of logic, we would like to see motion counteract motion.
This is why I very early on tried to reduce mass, gravity, and inertia to a single motion. I made good progress on the problem in my first paper on the constant G, showing that all three could be explained by an outward acceleration of the shell of any quantum. This acceleration is the single cause of gravity, mass and inertia, greatly simplifying both the terminology and the math. However, this implied that all matter was expanding, which was never a very satisfying implication, even for me. I left it hanging for several years as a partial explanation, until earlier this year I found a way to explain the acceleration vector without expanding quanta. I explained it with circular motion instead.

To see how I explained it, we have to return to the historical explanations of gravity. Newton explained it as force at a distance. This was troublesome for three reasons, although only the first reason made the papers. One, there is no mechanism for *mediating* this force at a distance. If space is mostly empty, how is the force transmitted through the field? And even with a space full of particles of some sort, the force could only be repulsive. Real particles hitting one another can't cause attractions. Two, there is no mechanism for *the cause* of gravity. If matter attracts other matter, why does it do so? The force has no apparent cause. Where does it come from? Might there be a mechanical or kinematic explanation of it? Three, gravity as a constant force breaks the conservation of energy axiom. Since gravity is a force and a force implies energy either supplied or consumed, gravity implies a huge input of energy into the universe at every moment. In this way, the universe is not a closed system, with a constant level of energy, as we are taught. It is an open system, with energy coming in all the time from somewhere. From where?

Einstein tried to answer—or more precisely *hide*—these problems by giving us curvature. Problems two and three never made the papers, so they were already hidden, but curvature goes some way to hiding problem one. Einstein gave us a math that was already curved, so he didn't need a force to curve it. But of course someone should have asked him what was curving his math. It was still his central bodies doing it, so it was still a force. Einstein moved the force off the orbiting body and onto the field, but something still had to be curving that field. So problem one was poorly hidden, at best. Problems two and three weren't touched.

Claiming to follow Einstein, some later relativists proposed gravitons as a mediating field particle, to explain attraction. But there were also three problems with *that*. One, it didn't really follow Einstein, since Einstein explained gravity with curvature, not a field particle. Two, it didn't explain how a field particle could cause attraction. Particles colliding can only cause repulsion. Three, gravitons have never been found, despite huge amounts of time and money being spent on the search.

My reversal of the gravity vector, *a la* Einstein's equivalence principle, simplified both the math and the terminology of the field, since it automatically combined gravity, mass, and inertia, as well as returning us to a Euclidean field. It also solved problem one in a thorough and very satisfying manner. If gravity is a real acceleration, then it isn't a force, doesn't require a force field, and doesn't require a mediating particle. But my vector reversal only highlighted problems two and three, pulling them out of the shadows and putting a glaring spotlight on them.

So, we are left with an acceleration vector pointing out that we want to keep, but we don't want to assign it to real motion in the field, because we don't want expansion. Is that possible? Yes. To see how it is possible, we switch from gravity to circular motion. You will say that gravity and circular motion are linked—since the orbit is circular motion caused by gravity—but they are not *necessarily* linked. You can have circular motion without gravity. Think of the boy whirling a ball on a string, as we all remember from our physics textbooks in high school. You have a centripetal vector there, but it is not caused by gravity.

Well, in all circular motion you have an acceleration vector that you do not assign to expansion or contraction. The vector on the diagram points in, but that in no way implies that anything is shrinking. The boy is not shrinking, the ball is not shrinking, and the orbit is not shrinking. Why? Because the acceleration vector is resisted, and a balance is maintained. The acceleration vector exists, but no contraction is implied.

In the same way, it turns out that my acceleration vector on the surface of the shell of my quantum exists, but it does not imply expansion because it is resisted. This vector is the fundamental cause of the solo gravity field, but it is resisted by the charge field. Yes, my field is a dual field or a unified field, and it has two components at all levels. Even before I had shown how circular motion causes this gravity vector, I had already shown how it is balanced by the foundational E/M field or charge field. In the case of an orbiter, the central vector is countered by a repulsion between orbiter and central body. In other words, the Earth has a vector toward the Moon caused by this gravity vector pointing out; but the Moon and Earth are repulsing via the charge field; a tangential velocity also damps the effect of this vector, and balance is maintained.

You will say, "That may explain the balance of the orbit, but how does it explain the balance of the 'shell' of the Earth? The Earth still has a vector out at all points. What keeps it from expanding?" The same charge repulsion. The charge between Earth and Moon not only balances the distance between them, it also acts as charge pressure on the surface of each body, preventing expansion.

You will say, "That doesn't work, you fool! The charge from the Moon can't offset the gravity vector from the Earth. For one thing, you just said that part of that offsetting is done by the orbital motion of the Moon, so charge balances only a part of the gravity vector in the best case. Even worse is that the Moon, being so much smaller, can't be balancing its own shell in the same field that is balancing the Earth's shell. Aren't they both in the same field?"

Excellent points, but they have an answer. The problem does become more complex, but don't assume that these complexities mean I am wrong. They mean I have more to explain, but they do not mean I can't explain it. What you are saying is that all the bodies in the field have to balance their shells in the unified field, and that is true. Can it be done? Let's see. First let us address the Earth. You are correct that the Earth cannot balance its acceleration vector out with just the charge from the Moon. If it could, the Moon wouldn't need any orbital velocity. The Moon and Earth could just sit there in a unified field balance. And the Moon can't recycle that much charge anyway. The Moon by itself cannot balance the Earth in any way, as a matter of simple logic. Which means that the Earth must be balanced by other charge: charge from the Sun. Yes, the Earth is in (at least) two fields, and we already know that. It is part of two orbits: its own about the Sun, and the Moon about it.

So, if we are talking about balancing the acceleration vector as a matter of the *distance* between Earth and Moon, we balance the Earth's unified field against the Moon's, and include the tangential velocity of the Moon. But if we are talking about balancing the acceleration vector as a matter of the Earth's shell or size, we have to balance it against charge pressure from all the bodies around it. Adding to the complexity of the problem is the fact that I have shown that charge density from outer planets will increase as the charge moves toward the Sun. See my tilt papers and Bode's law paper. This means that we must include charge from all the outer planets when we are calculating this second balance. In other papers, I have shown that the charge from the Sun and inner planets is about $5.31 m/s^2$.** The charge from the Moon is 1.051/2 = .526m/s^2. And the charge from the outer planets is 5.32 x 23^2 x .0014 = 3.94m/s^2. That balances the vector of the Earth. That is why the Earth is where it is, in fact. It turns out, you see, that the ultimate position of objects is determined not only by their motion vectors in the field, but also by their gravitational acceleration vectors. All the vectors are linked.

To answer the second part of your question, we will look at the Moon in the same field. At first it would seem that the Moon cannot be balanced at the same distance as the Earth, but we have to remember that the Moon balances a different set of numbers. Yes, the initial numbers from the Sun and outer planets are the same, since the Moon is at the same distance from them as the Earth. So once again we get 5.31 + 3.94 = 9.25 for those influences. But the Moon is 3.67 times smaller than the Earth, so it will catch .2725 as much of the field as the Earth. That gives us 2.52. Then we add the influence from the Earth (.009545/2) x (50/1.67)=.143.* Which gives us 2.67, which is the *solo* gravity vector of the Moon that I calculated in an earlier paper (that number is determined by the size of the Moon alone, not by mass). We have balance on the surface of the shell.

You will say, "That explains everything except the gravity we actually feel, here on Earth. If the gravity vector out is balanced by charge pressure in, then the shell or surface of the Earth should be balanced. If it is balanced, there is no total vector out. So why do *we* feel a pull down?" Another very perceptive question, and one that seems difficult to answer at first. However, if we look more closely, we find an answer. The balance we have found above applies to the surface of the Earth. But bodies existing freely on the surface of the Earth are not part of the Earth. Being free and unconnected, they have to be studied as free bodies. In other words, we don't calculate forces on you as if you were a part of the surface of the Earth. You *aren't* part of the surface of the Earth, despite your position, so the forces on you must be calculated separately.

You will say, "Yes, that sounds good, but the bottom line is that the charge pressure—assuming it exists—on the top of my head has to be pretty much the same as the charge pressure that would have hit the Earth under me, so you can't create much of a difference here. You need to totally free up that acceleration vector, and there is no way I see you doing that." OK, keep your eyes open, because you are about to. The first thing you need to be reminded is that size matters in my new unified field. In other words, charge works differently at different scales. I have shown how that works in many papers. At the quantum level, the photon is a lot larger as a field particle, so the charge field increases its effects relative to gravity. The *B*-photon (charge photon) is about 10^{30} smaller than the Earth, but only 10^{10} smaller than the proton. The same thing applies here, since you are 10^7 smaller than the Earth. Your unified field is not the same as the Earth's unified field. We have to do our calculations at the level of our bodies. The above calculations were at a planetary level. Calculations on you are at the human level. The charge photon is 10^7 more powerful on you than on the Earth. This changes everything. The vectors you feel aren't the vectors the Earth feels.

We could calculate this in any number of ways, but I will choose the shortest, as usual. In my unified field, you can't just calculate generic forces at given positions in the field; you have to calculate those forces for given real bodies, and you have take into account the size of those bodies. We already saw this with my new Lagrange point math. So when we sum the forces on you, the sum we found above doesn't apply. Yes, you still feel the acceleration vector, because you are standing right on it, so to speak. Likewise for the charge of the Earth, which hits you directly on the bottom of your feet. Those two vectors still sum to 9.78, so you still feel that. But all the charge we summed from the outer planets and Sun and Moon doesn't apply to you like it does to the Earth as a whole, because those numbers were found considering charge as it affects planets, at that level of size. To say it another way, those numbers were found relative to the charge of the Earth, not relative to your charge. Those numbers are charge *sums*. And even then we had to correct them to account for the different size of Earth and Moon. If we correct them in the same way for the size of a person, they evaporate. Remember, I found (above) that the Moon only caught 1/3.67 the field as the Earth. Well, you will catch about 1/7,000,000 of that field, so it is negligible to our equations here. The Earth feels a balancing charge pressure; you don't.

“Hmm,” You will say. “Well, if you don't feel the charge pressure, wouldn't you just rise? Without the vector down, wouldn't you now have a vector up?” No. You are misreading the vectors. The vector up still belongs to the Earth, not to you. You are *feeling* a vector up, but that vector does not *belong* to you. What belongs to you is the *resistance* to that vector. The resistance to that vector feels to you like a pull down, which is why you feel gravity as a pull down.

“Wow,” you will say. “That *may* work, but I am still confused. You are saying that I feel a push up due to the vector or a pull down due to my reaction to it, but nothing is actually moving. The surface of the Earth is now in balance, since you got rid of real expansion, right? I follow your math and explanation, sort of, but I still don't understand how I can feel a push up from something that isn't moving up.”

Alright, fair enough. But remember that the old gravity had that problem as well. Do you understand how you can feel a pull from something that isn't sucking? No one has ever understood that, because it isn't mechanical. They just learn to accept it. However, with a bit more effort, I think you will come to understand how the unified field works. Keep reminding yourself that we have two fields working all the time, and that one field is doing the opposite of what the other one is, in most situations. In every old gravity field, we now have gravity plus charge. So when you start adding up influences on any body, you have at least twice as many to consider as you had before. You also have to learn to sum a lot of field differentials, since we have fields inside of fields. The Earth is inside the Sun's field, and you are inside the Earth's field, so we have a lot of stacked differentials, which are admittedly hard to keep track of. And since this is all vector math and diagramming—which no one has been good at for a long time—it makes it even harder. As we just saw, even once you have a vector, and you have it drawn in the right direction, if you don't apply it to the right object you are lost. *Does the vector belong to me or the Earth?* You have to be rigorous in your both your math and your assignments.

That said, maybe it will help to think of it this way: what causes the vector up to apply to you while it isn't applying to the Earth is that we always have to look at the sum of forces on the body in question. With my math and theory in the unified field, we can no longer just run the field equations for a position in space. That is what we used to do, you know (and still do, in the mainstream). Even with Einstein, we would run the field equations by inserting numbers that described a certain position in the field. Since your position is on the surface of the Earth, your field numbers would be the same as for a given position on the Earth. But in my field equations, it doesn't work that way. My equations are more specific than that. My equations show that different objects at the same position react in different ways. Yes, my equations would match Galileo's proof that all objects fall at the same rate in a vacuum, since the gravity vector remains the same for them all. I have not changed that. However, my equations would not match Galileo in all situations. I have already shown where my field equations diverge from Newton, and they would diverge from Galileo as well. They would diverge as a matter of charge. All objects are charge objects, even objects that have no E/M properties. Therefore, if Galileo could have dropped objects several orders of magnitude larger than one another, he would have found a small divergence. I repeat, this divergence would be caused by charge, not by gravity, so I am not overturning his laws, which were laws of gravity. I am just pointing out that his experiment was incomplete and inconclusive, regarding the unified field. He could hardly drop large asteroids from the top of the tower of Pisa.

Besides, the atmosphere here on Earth would skew any experiment, even one where we did drop objects greatly different in size. Air resistance would cause a much greater variation than charge, so the experiment would always remain inconclusive. To truly test the idea, we would have to drop objects many orders of magnitude different sizes from high above the Moon to the surface of the Moon, from a height large enough to cause a clear difference. In that case, my equations would be able to predict the variations due to charge. The current equations would not. The current equations would predict no variation. I would predict measurable variation, and the greater the size difference, the greater the variation.

So it is finally your size in the unified field that determines why you react differently to the field equations than the Earth does. It is your charge, both the amount of charge you are able to recycle given your size and the amount of charge that hits you per second. You are basically out of balance on the surface of the Earth, while the surface of the Earth is in balance. This gives *you* a total vector down, which is your weight.

"Well," you will say, "That is some tricky math, but it still doesn't make any sense. If it were true, then if we turned off charge, objects really *would* expand. That is a problem because it implies that celestial bodies can't ever be in transition. For instance, if the Earth ever left its balancing point here, it would immediately begin expanding (or contracting). Any wanderer would move through varying charge fields, and would contract or expand as it passed through them."

Yes. Are you *sure* that doesn't make sense? For one thing, according to my new unified field, the charge field is everywhere. It is heavier in solar systems and near stars, but it does not drop to zero anywhere. So you can't "turn it off." Are you quite sure comets are not denser when they pass near the Sun? Are you quite sure that hyperbolic comets do not expand when they leave the solar system? Are you quite sure that my theory contradicts any known data? Are you quite sure it does not explain data that has so far been mysterious? We will see.

For now I will leave that an open question and proceed to remind you of the cause of this gravity vector *out*. It is caused by the spin on the universe as a whole. If the universe as a whole is spinning, then everything in the universe will automatically be given vectors out, due to the rules of circular motion. If we can make the universe spin in 3D, then we can give bodies in the universe a 3D vector out. Of course this begs several questions, but I have already addressed them, and send you to that paper.

Supposing that my explanations hold, what does that mean for Mach's Principle? It means that the spin on the universe is the motion that connects all bodies in the universe. And this connection is made via gravity. Gravity is each body's response to that universal set of spins. Universal spin is the cause of the one vector out I have been discussing, and that one vector explains mass, gravity, and inertia. We have seen how it explains gravity, since it acts as the central vector. It is no longer pointed in, but it still explains the orbit and the apparent attraction, so it still stands for the old gravity. It also stands for ponderability, since it explains how bodies create internal pressure and maintain outer shells. And it stands for inertia, because it explains how bodies can resist a force or a motion with their own motion.

So we finally have a mechanical cause for how the "all" affects "the one." The all is the universe and the one is anything and everything in that universe. We are all linked by the spin of the universe. And, yes, inertia is explained by it. So the claim that Mach's Principle is connected to inertia turns out to be correct. The old explanations were squishy, but they were on the right track. However, there was never anything esoteric or mysterious about it. As with every other thing I have looked at, there has been a simple mechanical cause.

Ironically, this last sentence is anti-Machian. Mach didn't believe in causes and effects. He preferred a mysterious "interdependence." We certainly have an interdependence here, but we also have a cause and effect. The spin of the universe has caused this vector, and this vector has not caused the universe. Therefore we have a definite hierarchy and a definite direction of time. Yes, the universe is "dependent" on the things in it, in a sense, since it wouldn't be a universe if it were empty (we suppose). But that is missing the physical point. Speaking in terms of an interdependence is not false, but it is not physically useful, either. It deflates the question "why?" If you don't think that bodies and events are linked by definite chains of influence, then you don't seek to discover those influences. If you do, you do. So cause and effect is a quite useful idea in physics, and no real physicist would try to undermine it.† Undermining it, in the way of Hume and others, has always led to philosophical mush, while accepting it as a necessary postulate has led to more and more fruitful theories. Mach argued the opposite: he thought that the old ways of thinking were standing in the way of progress, and that we needed more freedom to theorize. Well, he was wrong. We threw out a lot of old rules in the 20th century, and their loss has caused physics to dissolve. We threw out a lot of old rules about art, and art has dissolved. We threw out a lot of old rules about society, and society has dissolved.

I am all for revolution when it is called for, and for questioning authority when it is called for. I am also in favor of recognizing the limits of science, since science *is* limited. But I do not think the "revolution" in science or art that we saw in the 20th century was called for. Some revolution may have been called for, but not that one. It was always sold as something it was not. It was never truly revolutionary, for the most part, it was only reactionary. It was a reaction to previous successes, and our inability to match them. It was a degraded novelty being sold as an advance.

It was felt by Mach and others that physics had hit a sort of wall at the end of the 19th century. Einstein was then interpreted to be the climbing of that wall, by a more free-associative thinking. And then quantum mechanics was interpreted to be the next great step of this revolutionary physics. But that has all turned out to be a misinterpretation. More than that, it has turned out to be a public relations fraud. Physics was in a minor rut at the end of the 19th century, but it traded that for a major rut by the 1920's, a rut most of physics is still deep in. Einstein was neither the solution nor the new rut. He has been oversold on both accounts. His theory was mainly true, so I don't blame him (much). It was the interpreters of his theory, and even more the particle physicists, that put us in this rut. The Copenhagen interpretation was the deepest cut of the rut, and the cart has been stuck in the road there ever since.

Although Bohr and Heisenberg were influenced by Mach (and of course Kierkegaard), I usually blame them rather than Mach. No one had to listen to Mach, and until the Copenhagen interpretation set his phenomenalism in stone, few physicists did. In the early years, Mach was more influential with Marxists than with top physicists. Mach was never authoritative, Bohr was. If you read the opinion of Einstein, Schrodinger, and Planck, you see that they felt much the same way. After being intrigued by Mach early on, Einstein soured on him. Once Einstein saw new physicists playing with his cosmological constant like it was an avant garde toy, he put all phenomenalism behind him once and for all.

*I divided the charge field by 2 in each case, because the bodies don't feel the charge being emitted away from them. With the Earth, I used the term 50/1.67 to represent the volume differential over the density differential. Due to size difference, the Moon receives 50 times more charge from the Earth than the Earth receives from the Moon. Due to density difference, the Moon feels 1.67 times less of that charge than the Earth would, over the same area. You will say, "Then why not use density and volume differentials from the Sun and planets on the Moon as well?" Because it isn't necessary to our solution. We are comparing *the same* external influences on the Earth and Moon, so we only have to calculate differences between Earth and Moon. We are calculating how the Earth and Moon are influencing eachother, but we aren't calculating how the Moon is influencing the Sun, for instance.

**This was found from the fourth root of $796 m/s^2$.

†Or as Lenin put it so well, "The philosophy of Mach, the scientist, is to science what the kiss of Judas is to Christ."