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A RECALCULATION OF THE ROCHE LIMIT

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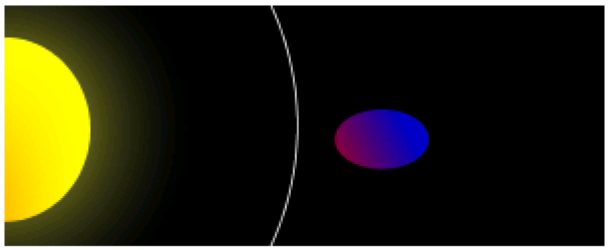

Abstract: I will show that the current Roche limit is a myth. It is achieved by faulty postulates as well as faulty math. I will then calculate a new Roche limit, defined as that distance at which the charge field balances the gravity field. This will give us a useful equation to explain how bodies avoid collision. I will apply it to the great inequality between Jupiter and Saturn, showing how they create the resonance and showing the distance at which they passed millions of years ago.

In my first paper on tides "http://milesmathis.com/tide.html, I showed that current and historical tidal math is wrong from top to bottom. It relies on a differential field that doesn't exist. It fudges solar and lunar equations to match data. And it predicts a barycenter that *cannot* exist. If the barycenter existed, the tide from orbiting the barycenter would swamp all other known effects, dooming the current math.

In subsequent tidal papers http://milesmathis.com/tide2.html, I showed that tides must be caused by the unified field, not the gravity field. And, although the unified field includes the gravity field, it is the E/M part of the unified field that actually causes tides. That is, gravity has absolutely nothing to do with either tides or the Roche limit. The only reason that tides have been given to gravity is that the unified field has been represented by Newton's gravity equation up to now. Because Newton's equation defined orbits and perturbations, it was also thought to define tides. I have shown that Newton's equation *does* define tides, but only because it has always included the E/M field. http://milesmathis.com/g.html

I have not just offered this as a bald theory, I have provided the foundational math for it. I have pulled apart Newton's equation, showing precisely how it contains both fields and how to segregate them mathematically. I have shown what G is, as a scaling constant. Furthermore, I have already used my new equations to calculate the foundational E/M fields or charge fields of the Earth and Moon http://milesmathis.com/moon.html. Beyond that, I have *confirmed* those new numbers in other papers, tying those new fields to other theory and math. To be specific, I have shown that the .1% error between the Bohr magneton http://milesmathis.com/magneton.html and the magnetic moment of the electron is caused by the charge field of the Earth. I have also shown that the atmosphere expresses http://milesmathis.com/atmo.html about .1% of its weight, due to a simple semi-confinement equation in the curved field, offsetting the charge field. In other words, I have confirmed my numbers in separate problems, with independent math.

It is clear that my correction to tidal math must doom the current math for the Roche limit. Since tides aren't caused by gravity, all the historical math must be false. However, using the unified field that has always been contained in Newton's equations, we may easily find a new Roche limit. Yes, there is a unified field analogue to the Roche limit. It is the limit where the charge field repulsion of the two bodies matches the gravitational pseudo-attraction, keeping the orbiting body from a closer approach.

In my recent paper on Laplace http://milesmathis.com/laplace.html, I showed that this new Roche limit must play a part in the resonance between Jupiter and Saturn. Although Laplace's equations are nearly correct as a heuristic model, they contain no mechanics. In other words, Laplace never told us *why* the two planets began moving apart in the first place. Using gravity alone, any approach would be fatal. Gravity increases with decreasing distance, so gravity cannot explain a resonance. Gravity would guarantee a collision. The mechanical reason that Jupiter and Saturn began drifting apart in the distant past was due to this Roche approach of the two planets. A near approach caused a sharp increase in the E/M part of the unified field, bouncing the planets apart. I will do the math below.

In my "two-mile problem" in my paper on Newton's equation http://milesmathis.com/weight.html, I fine-tuned Newtonian mechanics to allow us to solve problems like this. Although Newton's equation is correct as a first approximation, it often doesn't allow us to solve real-world problems. The Roche limit problem is just one of many such problems.

Since the Roche limit problem was thought to be concerned with tides, and since gravity is not a pulling force, gravity has nothing to do with a Roche limit. Gravity is a real acceleration, and causes no forces or perturbations. It creates motions only. These motions can give the appearance of forces, but they cannot create tides or Roche limits.

A second Roche limit might also be calculated. That limit would be the distance at which the charge field of the primary would be great enough to begin to break up the satellite, based simply on a rate of bombardment. But of course that Roche limit would depend not only upon the charge field of the primary: it would also depend on the cohesion of the satellite. This is where the standard model begins to talk of tensile strength. We will study this more closely as we go.

Before I begin to calculate either of these new Roche limits, I would like to look at the current math. I will first show that the current math would fail in any possible scenario. The current equation is found by setting the gravitational equation equal to the tidal equation, as in

$$Gmu/r^2 = 2GMur/d^3$$

The problem there is that there is no representation of the velocity of the orbiting satellite. You can see the full math at Wikipedia,[1] where they admit that the tidal equation is just an expression of the difference between "the primary's gravitational pull on the center of the satellite and on the edge of the satellite closest to the primary." That would give a resultant tidal force only on a satellite in freefall toward the primary. In other words, it gives us the force on u toward the primary, *if there is* *no tangential velocity*. We have found a resultant centripetal acceleration, due to the differential field, and that will give us an "instantaneous velocity" toward the primary. But if the satellite is moving in orbit, then during that same "instant" or dt, it will also be moving at a right angle to the centripetal force. The final force will be determined by *both* motions.

This means that even if we apply currently accepted theory and math, the Roche limit doesn't include the tide caused by the centrifugal force. On the tidal pages, current theory uses both mechanisms to calculate tides. On the Roche limit page, current theory uses only the centripetal mechanism. If you go to my first paper on tides, you will see that I copied the full math from the mainstream pages on the internet. Their tidal equations include the orbital speed of the satellite, ω. Both the centripetal effect and the centrifugal effect are included, with the centrifugal effect being half the centripetal. Much math is done to prove that the tidal effect caused by circular motion is half the tidal effect caused by the static gravitational field, and that the two must be added. But when it comes to the Roche limit, the circular motion is ignored. Why? We must assume it is because the tidal theory is used to explain tides on the Earth, and historical theory couldn't get the number high enough without including both effects. But with the Roche limit, observed data can be better explained without the effect from circular motion. If we use the full tidal math, with both effects, the Roche limit is taken higher. This is a major problem, because then even more of the moons of Jupiter and Saturn fall inside the limit, and are thereby counter-examples to the math.

But the primary problem here in the beginning is that they forgot to match the two maths to one another. The math on tidal pages doesn't match the math on Roche limit pages. The Roche limit math is applied to bodies in orbit, but the Roche limit math doesn't include the tide caused by orbiting.

This is another example of how gloriously negligent modern physics and math really is. They post this math assuming no one will study the equations. And they post it and teach it, despite the fact that we must assume they know it is full of gigantic holes like this. How dishonest do you have to be to teach these equations and defend them? And how brazen do you have to be, when any fool can see that they don't match? In answer to my first paper, Wiki just deleted all its math. We may assume they will also delete the math on the current Roche page.

Edouard Roche created this equation 150 years ago, in 1848, and no one has seen the hole in it in all that time? Impossible. It must be that they haven't corrected it because they haven't wanted to correct it. Correcting it would have made it weaker, not stronger, so they have preferred to keep it in its weakest form and hide all the holes with a load of *ad hoc* verbalizing.

The current math is known to fail, and this admitted by the mainstream. It is admitted at Wiki, where Jupiter's moon Metis and Saturn's moon Pan are admitted to be beneath the Roche limit. It is also admitted that Saturn's E-ring and Phoebe ring are outside the Roche limit, when they should be inside it. *Ad hoc* theories are pasted over the current equations, to explain these anomalies, but they are unconfirmed and logically unconfirmable. For instance, we are told that the tensile strengths of Pan and Metis keep them from breaking up, but we don't know the tensile strength of Pan or Metis. If planets and moons are created by gravitational forces, then they shouldn't have tensile strengths beyond those created by gravity. If gravity compressed them, it should be able to uncompress them. Only great heating or pressure, beyond that created by gravity on a small body, could cause an increase in tensile strength, and we have been shown no mechanism for that, especially in the cold reaches of outer space (Pan is said to be around 78K). Even if some mechanism could be shown, the gain in tensile strength would be expected to be at or near the core of the moon, not at the surface. This means that Metis and Pan should be obliterated down to the core. Perhaps they are, but then the core would be expected to be spherical. If its tensile strength was created by extra heat in some non-gravitational process, then we would not expect an out-of-round core. And yet Metis and Pan are both very irregular, Metis being almond shaped and Pan being walnut shaped.

Also against the "high tensile strength" theory is the fact that ring moons are postulated to be gas-condensed:

These orbits are consistent with an origin scenario in which the moonlets condensed from a disk of gas and dust surrounding proto-Jupiter.[2]

This important paper is linked from Wiki, and is one of the main sources for the Jupiter moon pages, but its theories are ignored or contradicted. Moonlets condensed from gas and dust can hardly have a high tensile strength.

This same paper tells us that the innermost moonlets of Jupiter are heavily cratered, having craters "whose diameters approach the satellite's mean radius." So even with huge impacts on the remaining surface, these moonlets have not disintegrated. We find these low-density moonlets inside the Roche limit being hit by huge hammers and still not breaking up. What do we require to dislodge this theory and math?

Wiki contradicts itself again regarding Metis:

The bulk composition and mass of Metis are not known, but assuming that its mean density is like that of Amalthea (~0.86 g/cm^3), its mass can be estimated as ~3.6×10^{16} kg. Amalthea's density implies that that moon is composed of water ice with a porosity of 10–15%.

We are told that Metis is probably composed of ice, with a low density and (relatively) high porosity. The tensile strength of ice is very low, being between 2-4MPa. So Metis' existence below the Roche limit cannot be explained by tensile strength. The standard model wants it both ways. It want to explain Metis' existence by tensile strength, but then wants to explain the rings as dust blown off from Metis (see just below).

And the pages at Wiki contradict themselves again. The Roche limit page tells us that Metis exists below the limit because of its high tensile strength, but on the Metis page,[3] we are told this:

Metis supplies a significant part of the main ring's dust. This material appears to consist primarily of material that is ejected from the surfaces of Jupiter's four small inner satellites by meteorite impacts. It is easy for the impact ejecta to be lost from the satellites into space because the satellites' surfaces lie fairly close to the edge of their Roche spheres due to their low density.

So Metis has both a low density on its surface and a high tensile strength? Next we will be told it is both red and green, in honor of Santa Claus, who lives there.

Pan theory is also contradictory. At a paper linked from Wiki, we find this:

The innermost ring-region satellites have likely grown to the maximum sizes possible by accreting material around a dense core about one-third to one-half the present size of the moon.[4]

Pan's walnut shape and equatorial ridge are said to be caused by this accretion. I hope you already see the multiple problems there. It contradicts what we have been told of Metis, since Metis is sluffing off and Pan is accreting. Why would Pan act so differently from Metis, in a similar situation? Perhaps even more to the point, how can a moonlet below the Roche limit accrete? It should be disintegrating, but instead it is accreting? Come on, make sense!

Pan also has a low density, being about .41g/cm^3, according to Wiki.[5] That is less than twice the density of cork. This conflicts once again with the high tensile strength assertion.

Finally, Pan must be accreting in the plane of the rings, but if it is, it is acting anti-gravitationally once more. The tidal forces should be stretching Pan radially, toward Saturn. Metis is aligned radially in this way, we are told (although I could find no data confirmation of it). With a density of cork, Pan should be a long string pointing right at Saturn. But we see nothing like that in the photos.

Look at the illustration under the title here. That is posted all over the internet as a sample of tidal forces breaking up a body near the Roche limit. If tides are breaking up the body, it should break up radially. But neither Metis nor Pan nor any other bodies near or inside the Roche limit look like that or are breaking up in that way. Pan is actually accreting radially, which must doom the entire theory and all the math. Like the barycenter problem, this data should doom the current gravity model from top to bottom. Why hasn't it?

Now let us calculate the first new Roche limit, where the E/M field balances the gravity field. Using the equations from my UFT paper http://milesmathis.com/uft.html, we just set the two fields to equal one another:

$m(A + a) = [GMm/R^2] – [m(A + a)]$
$2(A + a) = GM/R^2$
$R = \sqrt{\{GM/[2A + 2a]\}}$

For the Earth and Moon, that distance would be about 4,006 km. To find that number, I used my new accelerations for Earth and Moon. In those equations, the accelerations are for the solo gravity field, not the unified field, so standard-model numbers are not what we want. Current numbers are calculated from Newton's unified field equation, and are field differentials. In other words, I used the number 2.67 for the Moon, not 1.62.

What I just found is a Roche limit assuming the Moon has no tangential velocity. If the Moon had neither a tangential velocity, nor an approach or impact velocity, the Earth would be able to hold it at a distance of 4,000 km, like a magnet. That is well inside the atmosphere, almost on the surface. Of course, we would never see a situation like that, since the Moon will never be *placed* at a distance of 4,000 km, with no velocity.

So let us calculate a new Roche limit assuming the Moon keeps its current orbital velocity. We will assume, like Newton, that the Moon has an "innate" tangential velocity, uncaused by the field itself. I have shown that this is not the case, but we can choose any velocity we like to develop an equation, and the current one is as good as any.

$[m(A + a)] – mv^2/2R = [GMm/R^2] – [m(A + a)]$
$4R^2(A + a) – v^2R – 2GM = 0$
$$R = \frac{v^2 + \sqrt{[v^4 + 32GM(A + a)]}}{8(A + a)}$$
For the Moon, that would be
R = 4,023km

In my math, the orbital velocity doesn't make much difference. You will say, "Well, that is why it doesn't make any difference to the current Roche limit!" But, again, that is false, since the current Roche limit is dependent on tidal effects. The tidal effect of circular motion is always half the tidal effect of straight-line gravity, and therefore cannot be excised from the equations. This is according to the current rules of tidal math.

You will say that my Roche limit is very small, but it isn't much smaller than the current Roche limit. The current Roche limit for the Moon is

$d = r(2M/m)^{1/3}$
d = 9,488km

In either case, the Moon would have to be very near the Earth, as you see.

Now you will say, "I thought your orbit was already a balancing of the two fields. Shouldn't you have found the current orbital distance of the Moon, instead of 4,000km?" No, that is a big oversimplification. Yes, I have said that orbits are a balancing of both fields, but the Moon's orbital distance is caused by both Earth and Sun. We therefore have to balance six fields, not four. In my paper on Mercury http://milesmathis.com/orbit.html, you may have seen me balance only four fields, but that is because Mercury is a simpler case than the Moon.

Besides, you can see in these equations that even at the current distance of the Moon, the two fields are very near balance. We find a precise balance at around 4,000 km, but at 384,400 km, the balance is only slightly off. Just insert that last number into the first equations, with no orbital velocity. You will find that the unified field (represented by Newton's equation) is 4,580 times smaller than the solo gravity field (represented by [m(A + a)]). This means that only about 1/4,580 of the field is out of balance at that distance. The orbital velocity makes up a small part of that difference, and the Sun makes up the rest.

In fact, the new Roche limit for the Moon I just calculated is still an oversimplification, for the same reason. If the Moon were bumped into a vastly lower orbit by some phenomenon, it would matter whether the Moon neared the Earth on the day side or the night side. All the fields present would have to be monitored mathematically, and I have left the Sun out of it.

You see, the Sun tends to increase orbits of satellites, and it does this more on satellites that are near to it. In other words, if the Sun weren't present, the Moon would orbit nearer the Earth. This is one of the reasons why the moons of Mars are much nearer to it, with Phobos orbiting at only 9,000 km. If it weren't for the Sun, Phobos would be even closer, but the Sun doesn't effect Phobos as much as our Moon, both because Phobos is smaller and because it is farther away.

The simple reason for this is that the Sun "pulls" our Moon more when the Moon is nearer the Sun, than when the Moon is farther away. If we divide the Moon's orbit into a near half and a far half (near being near the Sun), then the Sun tends to increase the orbit in the near half and decrease the orbit in the far half. But it must increase it more than it decreases it, because it is closer in the near half than in the far half. The E/M fields adjust for this effect if it gets out of hand, but within certain margins the Moon is free to "float", and it does so by increasing its orbit to suit the Sun.

But let us move on to look at the second sort of Roche limit, the one that mirrors more closely the current one. We want to find a distance at which the E/M field would break up an orbiter. As should already be clear from our analysis of Pan above, this limit is a phantom. If Pan is still experiencing accretion when it is so near the surface of a huge planet, then we may assume that the tidal Roche limit is a complete myth. The E/M Roche limit would also be a myth, in that case, because we can see from Pan that neither field is strong enough to disintegrate a moonlet, even when it is low density and hammered by collisions.

The E/M field would tend to bounce a large body out of a low orbit, because a level of balance would be impossible to find in a natural way. Large bodies simply don't settle into low orbits with little or no impact trajectory. If they have high incoming velocities, the primary bounces them away with a quick increase in the E/M field. If they have low velocities, the E/M field keeps them at a greater orbital distance.

This is why only very small bodies are found in low orbits. They encounter a small section of the charge field, feel a much smaller repulsion, and settle into orbit much more slowly. This is also why they can exist in these low orbits: using their own charge fields, they funnel the primary's charge field around them, encountering a smaller effect. Larger bodies can't do this nearly as efficiently.

For example, our Moon is so large it cannot dodge the Earth's charge field efficiently, even at such a great distance. This is why the near side crust is nearly obliterated. The current gravitational model cannot explain why the Moon's near side crust is obliterated, but the unified field explains it immediately. It is a direct outcome of charge field bombardment. The charge field and the ions it carries blast the Moon daily for millions or billions of years. Easy to explain with E/M, impossible to explain with gravity, which should create permanent tides on both the near and far sides of a synchronous Moon.

This becomes even easier to explain if we add it to the previous finding. The Sun is increasing the orbit of the Moon, which means the Moon used to be closer to the Earth. When the Moon was closer, it felt more bombardment from the Earth's charge field. We may assume that much of the near side crust loss happened in the past, when the Moon was nearer.

But let us return to Pan and Metis for a moment. Their smallness is to their benefit for another reason, one specific to the problem. They are found among rings. Inner rings block a large part of

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