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Zero-point Energy and the Casimir Effect

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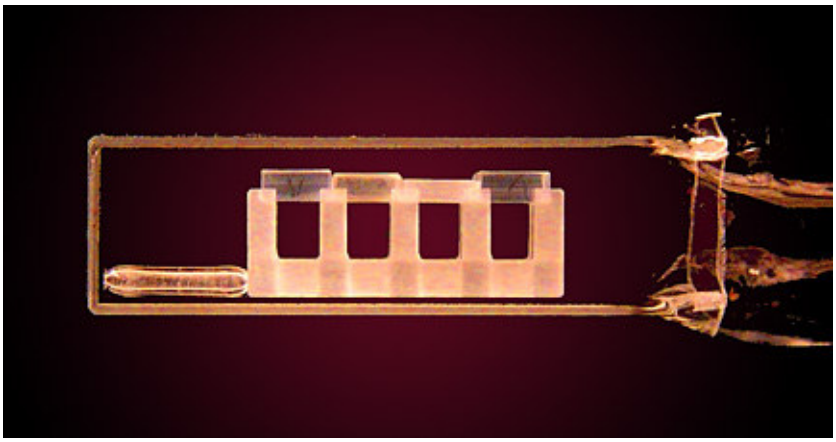

Abstract: I show that, given a quantized field, the zero-point energy cannot be at a point, cannot have anything to do with zero, and cannot sum to infinity in any finite space or time. Using my previous analysis of the calculus and the point, as well as the definition of quantum, I prove that renormalization is unnecessary, and I "normalize" an equation by much quicker and more logical means. This elegantly solves the mystery of the cosmological constant, among other things. Then I analyze the math of the Casimir Effect in detail, showing that Casimir's final equations can be improved upon simply by applying Newton's equation to the problem. In order to use Newton's equation on the metal plates of Casimir, I must do several simple transforms—each transform explained mechanically using my unified field. This shows unequivocally that the Casimir force is caused by *both* gravity and the foundational E/M field, falsifying the standard model analysis. It also provides a final equation that is vastly superior to Casimir in its ability to predict variation over all distances of separation and in its operational usefulness to experimenters.

According to the standard model, one of the biggest mysteries of physics concerns the infinite energy of space and the small finite energy implied by the cosmological constant. Using the math of both Einstein and QED, free space should have an infinite energy. Einstein and Stern showed in 1913 that the lowest energy of a mass-point should be expressed by the equation $E = h\nu/2$. If space is taken as a field of these mass-points (or oscillators), then a summation of free space—even a summation of any patch of space, no matter how small—must yield an infinite energy. But recent astronomical observations have put a limit on the cosmological constant of

$10^{-46}/km^2$.

This problem is very easy to solve, even without addressing the cosmological constant. I have shown in another paper that the cosmological constant, as applied to an expansion of space, is misapplied. In order to find a correct number for that constant, we should apply it to matter, not to space. But in this paper, that is of little concern. If we want to solve the major dilemma here, we only need to get rid of the infinity that comes out of the current analysis. The way that infinity is commonly dealt with is through the use of renormalization. But we don't need renormalization. No, we need to replace the abnormal analysis of the standard model with a normal analysis. Once we do that, we won't need to renormalize.

The standard model analysis is abnormal because it is illogical. According to this model, the energy of space is quantized. But if it is quantized, then it cannot be composed of "mass-points" or an infinite number of oscillators. A given area of space that is quantized MUST have a *finite* number of oscillators, by the definition of quantized. If a given area of space has an infinite number of oscillators or points, then each oscillator must have a size of zero. A size of zero is not a quantity. Space is either continuously inhabited and unquantized, and therefore potentially summing to infinity regarding number of points; or it is discontinuous and quantized, and therefore must sum to a finite number of oscillators.

This is why I said in other papers that my correction to Euclid and to the calculus solved the problem of renormalization. I showed that physical points cannot exist in mathematics. Only differentials exist in calculus and only differentials (lengths or intervals) exist in physics. Mass-points cannot exist by definition in any possible math or physics, and they certainly cannot exist in quantum math or physics. One would have thought this was doubly obvious, but it has not been obvious to the standard model in the 20^{th} or 21^{st} centuries. A quantum is an extension, and a point has no extension. A point is not a quantum. You cannot sum a finite number of quanta to infinity.

This is just to say that you either have mass-points or you have quanta. You cannot have both. But even if energy were not quantized, my analysis would still stand. Quantum mechanics was the doubling of my logic, but the logic existed even before QED or QM. The idea of the quantum forbids the mass-point or the physical point. But the point was forbidden from physical math (indeed all math) long before the idea of the quantum came to the fore. The point and instant never in history entered or exited any mathematical equation, and never shall, by definition. Math concerns numbers, and the only numbers that can apply to points or instants are ordinal numbers or the number zero. Using zero or ordinals in mathematical equations of any kind does not yield any usable information. Equations only "equate" when we use cardinal or counting numbers, and you cannot apply a counting number to a point or instant. This foundational fix makes all abnormal math normal again, and completely bypasses the need for renormalization. It does so even before we add to it the idea of the quantum.

What does all this mean for the idea of zero-point energy? Well, it means that the energy of space is not infinite, for a start. But it means much more than that. Einstein and QED have used a mechanically undefined field to calculate zero-point energy. Because there has been no mechanics, the door has been open to any explanation, and we have been inundated with abnormal explanations. Virtual particles, wormholes, infinite dimensions, Higgs bosons, space

pressure, and so on.

Since Einstein gave the energy of gravity to curvature, this zero-point energy had to be explained in other ways. You can have no curvature at a point. The only other field available was the E/M field, and that is the field that zero-point energy has been given to. According to the standard model, virtual particles mediate the E/M field at the most basic level, and it is the summation of that field that is now thought to go to infinity. Specifically, it is the so-called second quantization of the virtual photons that creates the forces at the zero-point. But according to my simple mechanics, the zero-point energy is not summable to infinity, nor is at a point, nor does it have anything to do with zero. Nor does it come out of the E/M field alone. No, it comes out of the *unified field*. Both gravity and E/M exist at all levels of size, and they combine at all levels to create all observed forces and energies.

I recently showed with simple math how the unified field works in a Cavendish device, and I will do the same here with a Casimir device. This will clarify the previous paragraph and show once again precisely how my unified field works. This will also serve to show how the zero-point field is created mechanically.

The Casimir Effect is an attractive force between metal plates that have been demagnetized and that have no electrical charge. No one before or after Casimir has thought that the effect had anything to do with gravity for two reasons. The first is the one I stated above: it was thought that gravity spent its force curving space. Since the standard model is postulating that zero-point energy causes the Casimir force, they think that there is no curvature at a point. The energy and force must then come from the E/M field somehow. The other is that everyone working at the top end of physics since 1948 (the year Casimir predicted the effect) has been in QED. They were therefore understandably keen to claim the effect for their own field. Casimir developed his equations from QED assumptions, and he did this before he ran the experiment. That is to say, he predicted the force and predicted that it arose out of quantization. Then he ran the experiment to prove it. He never considered the possibility that the force was gravitational, since his equations were not gravitational. And he never ruled out gravity based on any theoretical or mathematical analysis. His QED analysis gave him a number and he simply sought it in the experiment. When the experiment failed to produce the number he needed, he did not let this deter him, and no one since has let it deter them either. Wiki puts it this way:

One of the first experimental tests was conducted by Marcus Sparnaay at Philips in Eindhoven, in 1958, in a delicate and difficult experiment with parallel plates, obtaining results not in contradiction with the Casimir theory, but with large experimental errors.

That is a very strange way of stating it, to say the least. It is an odd scientific method to claim that large experimental errors do not contradict a theory. Say I invent a theory for measuring the life expectancy of domestic cats. Using this theory, I predict that cats should live to be 600 years old, on average. After taking a large sampling of dead cats, I find that the average age at death is 15. Rather than admit that I am a fool, I say that the results are not in contradiction to my theory, they simply betray a large experimental error.

As it turns out, my cat theory is better supported by the data than Casimir is supported by Sparnaay. I am only 97.3% wrong. Wiki doesn't tell us this, but Sparnaay had a margin of error

of 100%. This means that Sparnaay's experiment told us exactly as much about Casimir as it told us about shoe polish, and yet it is still mentioned and footnoted as confirmation in contemporary articles. According to the logic of Wiki, a 100% margin of error is not in contradiction to the theory, since it is possible that, beneath our error, the numbers match exactly. Who knows? But I think that to be fair, Wiki should have to call the experimental error something other than "large". How about "largest possible error"? You could even call a 100% error "infinite", since there is nothing greater.

We are told that in 2002 G. Bressi, G. Carugno, R. Onofrio, and G. Ruoso "confirmed" the Casimir effect using micro-resonators [PRL]. Unfortunately, they only "confirmed" to within 15%. That is not exactly impressive, considering the precision of modern instruments. Given a half-century of experiments and equation fudging, it is extraordinary that we are still at least 15% out from a real confirmation. It is even more extraordinary that these publications are taking a large miss as confirmation. In most cases, a 15% miss would cause a major re-assessment of theory. Here, it is taken as a strong confirmation. This experiment in 2002, like all other Casimir experiments, also had many other problems, the greatest of which is the inability to match or explain the variance of the force at varying distances. The equations cannot predict a number at any distance, large or small, and cannot predict the variation from one distance to another, and yet we are told all these experiments are confirmations. QED is supposed to be so successful and so exact in its ability to predict that there is nothing left to do. And yet one of the premier experimental proofs of QED, trotted out at all parties, can't get nearer than 15%, even with a half-century of renormalizing and other equation finessing. Amazing.

Also notice how the gravitational field is never once mentioned in any explanation of the Casimir Effect. We are never told why the force cannot be gravitational, although you would think that would be the first force to be checked. The Casimir Effect is an attraction, and so as the first preliminary step the physicists should have exhausted that possibility. In the first paragraph of any explanation of the history of the Casimir Effect, the reader should be told why the gravitational field was dismissed as a candidate. But this is not what we see. Neither Wikipedia nor any other contemporary gloss of the effect stoops to tell us why the gravitational field has been ignored so thoroughly.

The question is begged very transparently when the math is done. Casimir's own math ends in this equation

$$F/A = -\hbar c\pi^2 /240a^4$$

That tells us that force per unit area on the plate is inversely proportional to the distance of separation. An inverse distance law, in other words, just like gravity. And the negative sign tells us we have an attraction, again just like gravity. But we are to believe that no one ever noticed this, or asked if gravity might be involved here? Gravity is strong enough to move small lead balls and apples around in a modern Cavendish device, but it is ignored when we look at metal plates. Why?

The other thing that leaps out at an investigator is that the variable a is used here for the distance of separation. Why a? Since when has "a" been used for distance? We would expect either "d" or "s" or "r". We don't have a radius, but "r" is sometimes used for distance (especially

considering the fact that the latest Casimir experiments have not used flat plates, but instead have used plates that are "parts of spheres of very large radius"). We don't want to use "d" since Casimir's derivation is already using *d* for derivative. That we can accept. But in the Wikipedia derivation, "s" is used for "a complex number" in the renormalizing regulator. My question is, since when has "s" been used to stand for "a complex number"? That use is both odd and non-standard.

The reason for all this strange notation is this: if Casimir's last equation had been notated like this

$F/A = -\hbar c\pi^2 /240r^4$

or this

$F/A = -\hbar c\pi^2 /240d^4$

or this

$F/A = -\hbar c\pi^2 /240s^4$

some people might have noticed that looks like Newton's equation

$F = -GMm/r^2$

So they tell us we can't use "d" because it is standing for the derivative. We can't use "r" because it is not a radius (although "r" is not a radius in Newton's equation either). We can't use "s" because we are using it for "a complex number." So we have to use "a". And with "a", Casimir's equation is disguised just enough that no one looks at it and thinks "gravity."

The standard model (Wiki) tells us, "The presence of $\hbar$ shows that the Casimir force per unit area F/A is very small, and that furthermore, the force is inherently of quantum-mechanical origin." This is total misdirection. The presence of $\hbar$ tells us nothing of the sort. The reduced Planck constant $\hbar$ is present simply because Casimir has chosen to write the energy in terms of $\hbar$ and ω . We could do the same thing with Newton's equation. We let

$m = E/c^2$

and

$E = \hbar\omega /2$

So that

$m = \hbar\omega /2c^2$

and

$F = - Gmm/r^2$

$F = -G\hbar\omega /2r^2c^2$

If we notate the distance of separation as "a" instead of "r" we get

$F = -G\hbar\omega /2a^2c^2$

That is starting to look suspiciously like Casimir's last equation, and we haven't even begun all his fudgery with renormalizing, zeta regulating, the Riemann zeta function, summing, integrating, and then differentiating. All that is simply slippery math with a lot of manipulations that confuses anyone who looks at it and prevents them from asking the questions I am asking here.

Another reason 20th century physicists didn't want to fool with the gravitational field with Casimir is that Casimir's plates are not spheres. They are plates. It isn't immediately clear, without some work, how one would use Newton's equation on plates. Newton does not address flat objects in the *Principia*, and so no standard equation was sitting around waiting to be plugged into. But I will show below that it requires only a couple of simple transforms to apply Newton's equation to Casimir's plates. This makes it very odd that the standard model has preferred to use renormalized equations, in difficult and opaque deviations, in order to give the force to QED, rather than tweek Newton's equation in simple and transparent ways. Of course if they had done this latter, they could no longer use Casimir as a proof of quantization, wormholes, and so on.*

Even after a half-century of pushing and pulling, both with equations and with experiments, the standard model still cannot predict the outcome of a Casimir experiment. And they certainly cannot explain the mechanics of the experiment or the equations, as we have seen. Any time you start talking of "virtual particles" you have left mechanics far behind you. This is even more clear once we reach Wiki quotes like this one:

Exotic matter with negative energy density is required to stabilize a wormhole. Morris, Thorne and Yurtsever pointed out that the quantum mechanics of the Casimir effect can be used to produce a locally mass-negative region of space-time, and suggested that negative effect could be used to stabilize a wormhole to allow faster than light travel.

If the quantum mechanics of the Casimir effect can be used to allow people to say that, it can be used for anything, including hair regrowth, erectile disfunction, and canine shakra re-alignment.

But this is the state of the art in physics. You don't get mechanics; you get mystification and misdirection. If you want to know what causes the Casimir effect, you are sent to the zero-point energy page. If you want to know what causes the zero-point energy, you are sent to the canonical quantization page. If you study the quantization page, you find you must go to the pages on Hilbert spaces and Dirac brackets. If you go to those pages you are smothered with other terms and manipulations, but you never find any mechanics at the end of any of these rainbows. You find a lot of math, but never any physical field. All these fields and spaces and

brackets and matrices avoid any connection to reality or to a meaningful explanation. That is why Feynman finally had to tell the world to "shut up and calculate!" In this context it means, "Shut up and memorize the names and the terms and the manipulations. Study these pages and learn the vocabulary. Physics is not mechanics, it is vocabulary. The explanation you seek does not exist. The explanation that exists is what you see: a conglomeration of operators and eigenvalues and other fuzzy math that leads nowhere. This bog IS the explanation. If that bothers you, get out of physics!"

Well, it bothers me, and I ain't goin' nowhere. I am here to stay.

The Casimir effect is caused by the unified field, by both gravity and E/M. And since I have shown that Newton's equation is a compound equation that already includes both fields, we can apply Newton's equation directly to Casimir, without even un-unifying it or splitting the two fields. To solve, I will not convert my masses into energies, like I did above, to express the Casimir force as a function of $\hbar$. No, instead I will leave the masses in Newton's equation and see how little manipulation I can do to get a usable equation for this experiment. If the two metal plates were two equal spheres, we could calculate an attraction directly from Newton's equation.

$F = Gm^2/d^2$

Therefore, we must begin by defining the distance of separation as the distance from the center of each plate, not from face to face. We need to know a thickness of each plate. Say the thickness is W. If a is the separation, then distance from center to center will be W + a. We will keep d, as above, but define it as W + a.

$W + a = d$

Next, we will rewrite each mass as volume times density:

$F = G(VD)^2/d^2$

But that only works with spheres, so we have to transform the field from spherical to rectilinear. To do that, we subtly rewrite the equation once again.

$F = (GD^2/d^2)(V^2)$

Now, Newton's equation works because it gives us two correct field mechanisms. In the first part of this rewritten equation, we have the E/M field part of the unified field. The term GD^2/d^2 gives us the force of the bombarding field. D is the molecular or macro-density of the field and G transforms that density into a *B*-photon density.** The *B*-photons cause the actual force, by contact, so that is the mechanical density that we are seeking. The d^2 then just tells us how that field diminishes due to the spherical field. That d^2 comes right out of the surface area equation, as I have shown elsewhere. $SA = 4\pi r^2$, which means that a field expanding spherically, or traveling out from a source spherically must diminish as the inverse square of the radius.

The second term V^2 gives us the gravitational field strength, separated from the E/M field. I have shown that the solo gravity field, once split from the E/M field, must vary with radius and radius alone. Of course we can rewrite that volume as

$(4\pi r^3/3)^2$

And you can now see why I labelled the distance as d instead of r. We have both in these equations, so we have to keep them separate.

But Casimir's plates won't work either gravitationally or electromagnetically like Newton's spheres. Once we split the two fields, gravity is dependent only on radius, so you would think that the acceleration would be the same no matter the shape of the object. But to get the rectilinear equation to work using the spherical equation, we still need a transform. This is because Newton's equation works by multiplying one term by the other term, as above. This being so, we must make sure that each new term in the rectilinear compound equation works in tandem just like the old terms in the spherical equation.

Let us seek the force of a cube of the same radius as our sphere. We will begin by defining the radius of our first sphere. Let us look at a sphere in the exact middle of one of the plates. We will let the diameter of this sphere equal the width of the plate. This means the radius of this sphere is W/2. Now we turn that sphere into a cube of equal diameter. This central cube has the same width as the plate. The volume of this cube would be $(2r)^3$ or $8r^3$. But we need to transform $(8r^3)^2$ to $(4\pi r^3/3)^2$, in order to get the right number for Newton's spherical equation. You see, if we use this transform, we can then use the real mass of the plate in order to solve. Bear with me and you will see what I mean.

To get this transform we simply solve like this:

Let the transform be β

$\beta(8r^3)^2 = (4\pi r^3/3)^2$

$\beta = \pi^2/36$

We have completed the transform on the gravitational part of the equation. Now we proceed to the E/M term, GD^2/d^2. A spherical bombarding field will diminish with distance, but a rectilinear field will not. We would expect some diminishment of the field near the edges of the plates, as the field was lost into the free space surrounding the plates. But if the plates were very near, this loss could be minimized. We will calculate assuming that we have reached this limit, where the plates are so close that there is no loss of field strength, even near the edges. In this case the field strength would be GD^2. So to transform the rectilinear field to the spherical field, we must do as above.

Let the transform be ε.

$\varepsilon = 1/d^2$.

We have completed the E/M field transform. But we have another transform, necessitated by our mechanics. Newton's equation has always worked best between a large sphere and a small one, where the smaller sphere's mass and radius was mostly negligible. It turns out this is due to the fact that G transforms only the E/M field of the larger object, ignoring the field of the smaller object. When we have a meeting of fields of differing sizes, the larger field trumps the smaller one, and G only has to transform the major field. But with Casimir, we have two fields that are exactly the same size, one emitted by each plate. We therefore need to use G to transform *each* field, turning the molecular density of each object into the *B*-photon field emitted by each object. The density variable must be transformed for each field, not just one, so we require G^2 instead of G.

Now all we have to do is combine all our findings. Instead of writing Newton's equation as an attraction of two equal spheres,

$F = Gm^2/d^2$

we write it as an attraction of two equal cubes

$F = \varepsilon\beta\ G^2m^2/d^2$

$F = G^2\pi^2m^2/36d^4$

And this is easy to sum out into our plate, since we have already defined the size of our cube. The radius of our first sphere was half the width of each plate (so that we were measuring center to center, remember). So r = W/2. Obviously, this means our cube is W long on each side. If our plates are square, and the length of a plate is xW, then the total area of the plate is $(xW)^2$. Which makes our total force

$F = (xW)^2G^2\pi^2m^2/36d^4$

from above d = W + a, so

$F = (xW)^2G^2\pi^2m^2/36(W + a)^4$

But "m" here stands for the mass of the cube of side W, so if we want to express the F in terms of the mass of the whole plate, we need one more transform. We have x^2 cubes of mass m in each plate, so the total mass of each plate is mx^2. So we simply divide the equation by x^4 and let m equal the total mass of each plate.

$F = W^2G^2\pi^2m^2/36x^2(W + a)^4$

Since x = L/W,

$$\mathbf{F = W^4G^2\pi^2m^2/36L^2(W + a)^4}$$

It is scary how similar that looks to Casimir's fudged equation,

$$F/A = \hbar c\pi^2 /240a^4$$

If the plate is square, then $A = L^2$, so

$$F = \hbar c\pi^2 L^2/240a^4$$

Not only do we have a^4 in the denominator; we also have π^2 in the numerator. But notice that I did not have to renormalize. I didn't even have to integrate or differentiate. I didn't have to assume a zero-point field, a quantized field, or think about points or infinities.

Let's do one more calculation, to see how close my equation is to Casimir's. How does the value of $\hbar c$ compare to the value of G^2? Dirac's constant $\hbar$ is about 1×10^{-34}. The speed of light is 3×10^8. Together they are about 3×10^{-26}. G^2 is 4.4×10^{-21}. That makes Casimir's force 10^5 weaker than mine. However, he has L^2 in the numerator where I have it in the denominator. If we both solve for the entire plate, this adds a factor of approximately 10^4 to his equation. So we are within a factor of 10. He has 240 in the denominator, where I have 36, which gives him another 6.6, taking him up to about 66 times less than my equation. But then we have the mass and the width in my equation, which pushes us together once more. How close the equations are cannot be seen without plugging them directly into experiments, but it is already clear that my equation is certainly in the same ballpark as Casimir's, with much less work. If anyone ever stated or thought that the Casimir effect could not be predicted or approached with a variation of Newton's equation, I have proved them dead wrong.

My equation also has the very great benefit of coming with a clear and simple mechanics. I have not needed to hypothesize virtual particles, much less infinite or renormalized fields, spooky forces, wormholes, particle-antiparticle pairs, or areas of negative mass. I have not needed Hilbert spaces, Hamiltonians, Hermitian operators, Dirac brackets, eigenvalues, Feynman diagrams, Riemann zeta functions, or chiral bag models. The two fields that allowed me to generate transforms so quickly and easily are defined more fully in my other papers, but they are just the charge field and the solo gravity field. I have defined the charge field as real rather than virtual, and always repulsive. The solo gravity field is a function of radius and radius alone. The two together are in vector opposition. They are always present at every level of size. The gravity field is present at the quantum level and the charge field is present at the macro level. I have shown how they combine to create both macro-orbits and atomic orbits, with no forces of attraction at any level of size or in either field.

Finally, my equation will be much more useful to experimenters, since it includes the width of the plate. Casimir had never taken into account the width, but I have shown that it is a necessary part of the mechanics. Plates of differing widths will create different forces, and Casimir's equation has no way to account for this. I not only include the width in the equation, I show how the width creates the variation mechanically, by affecting the density of the emitted *B*-photon

field.

Some will be surprised to see my equation working like it does, despite containing gravity and being transformed from Newton's equation. What I mean is that some will find it odd that the force diminishes by an inverse quad law. To put it another way, shouldn't flat surfaces attract more than spherical ones, since there is more surface area in "field contact"? But here, at most distances, the attraction will be less for the plates than for equivalent spheres. Once again, this is explained quite simply by my compound field. As I showed during my derivation, the cube will be emitting more than the sphere, simply due to the surface area considerations. The sphere would have to be losing emission to surrounding space, even at very close distances, but the plates would not. Due to directional considerations alone, the plates lose much less emission to surrounding space, no matter the distance of separation. So if the cube is attracting (due to gravity and equal diameter) at the same rate as the sphere, but it is repulsing at a greater rate due to the shape of the emitted field, then it must be attracting less as a matter of the total or unified field.

Why then, you will ask, does it attract *more* at very close distances? Again it is quite simple. All you have to do is remember that gravity is an acceleration and E/M is not. In my unified field gravity is no longer a function of mass or density. It is a function of radius or size and nothing else. But it is still an acceleration, just as in Einstein's postulate of equivalence. But the E/M field was not an acceleration in the standard model and it is not an acceleration in my unified field. It is a repulsion caused by bombardment, but the bombarding photons are not accelerating. They are traveling c. Newton said you needed an acceleration to create a force, but you don't. If a car going a constant velocity hits you, it still creates a force. This is all that is happening with *B*-photon emission. The *B*-photons emitted by one plate are bombarding the molecules in the other plate, and this creates a force. Because one field is an acceleration and one is a velocity, they don't change at the same rate. When we move the plates closer, we are making both the distance and the time smaller, right? Well, as we do that, the acceleration of the gravity field begins to overwhelm the velocity of the E/M field. Over smaller intervals, an acceleration works more like a velocity. It has less time to vary, so its "average" strength or size over the interval increases. Think of it this way: the acceleration of gravity is constant, so it creates a constant force. Which means that this force will be the same over a large interval or a small. If we look at a tiny time interval, gravity must still create its force in that time. This must mean that, compared to a constant velocity, its strength must appear to increase. If you are comparing a force caused by a velocity and a force caused by an acceleration, as you diminish the time, the relative strength of the acceleration will increase. That is all that is happening with the Casimir Effect. It has nothing to do with Van der Waals, Relativity, quantization, or anything else.

You will say, if that is true, why doesn't gravity continue to increase compared to the E/M field all the way down to the quantum size? You will say, "According to your logic, gravity should utterly swamp E/M at the tiny time and distance separation of the proton and electron." Well, I have shown elsewhere that gravity is in fact about 10^{20} times larger than we had thought at the quantum level. It is a major player there; its effect has just been mislabeled up to this time. However, this is not the same as saying that gravity swamps the E/M field at the quantum level. It doesn't. Although it is 10^{20} times larger than we had thought, it is still the much weaker of the two fields at the quantum level.

But the basic reason that my comments don't apply at the quantum level is that the mechanics in a Casimir experiment and mechanics between a proton and electron are not equivalent. Although they are both caused by *B*-photon emission, the field between a proton and an electron is a field emitted mainly by the proton, at a density we must relate to the size of the proton and to its own gravity; the field between the plates is a summed E/M field, and its density is a density we must relate to the size of the plates. You can't think of the proton field as just a smaller version of the macro-field. Forces between quanta and forces between macro-objects cannot be compared directly: you cannot move from one analysis to the other, or one level of size to the other, without making some major mechanical adjustments. That was already known and I am not denying it. It answers this last question in a straightforward manner. Once we get so small that we go inside the macro-object, we have to re-establish our mechanics. Which is just to say that, once inside the plate, the plate is no longer an object. There is no such thing as the gravitational field of the plate inside the plate. It exists, yes, but there is no way to experience it or measure it. It is no longer potential data. There is only the gravitational field of each molecule or quantum.

The acceleration is no longer a summed acceleration, so any gravitational acceleration you look at inside the object can no longer be compared to the summed acceleration outside the object. They are linked, certainly, since the internal accelerations create the external or summed acceleration. But mathematically, you can't elide directly from one to the other. This is why you can't extrapolate my previous comments about acceleration and velocity down into the quantum level. In my previous comments, the time interval was getting very small compared to the size of the plates. But once we enter the quantum arena, that same tiny time interval is no longer tiny. Compared to the objects around it, that same time interval is now quite large. So you see there is no smooth transition from one level to the other.

*Just to be clear, I am not questioning quantization here; but Casimir is no proof of it.

**I have renamed the virtual or messenger photon as the *B*-photon, since it is neither virtual nor a messenger. It is real, mechanical, and works by bombardment.
