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ANALYSIS of the DYNAMICAL CASIMIR EFFECT

including a look at the Sokolov-Ternov Effect

by Miles Mathis

My readers have begun to swamp me with links to new mainstream articles and with requests for new papers from me responding to these articles. Sometimes this is a test to see if I can answer these articles; sometimes it is a push to force me to apply my theories to current problems. Either way, I see it as a good sign. The upswing in emails is a sign of the huge increase in website hits I have gotten over the past year. And the requests give me new tests of my theories. I am told they also help readers see how the theories hold up in real action. Few people exist in the rarefied atmosphere I do, and they would rather watch me go head to head with *Scientific American* or some Nobellist than watch me pull apart dusty 300-year-old equations. I confirm that the latter action remains more important, but if the former acts as successful PR, I can stop to do a bit of it now and then.

Here I will look at the recent report from *Nature*, claiming proof of vacuum energy. This could also be called proof of the Dirac field or the Higgs field. I will also comment on the PDF posted at ArXiv.

The report at *Nature* starts off in a very curious manner. The reporter, Geoff Brumfiel, admits that the paper in question has not been peer-reviewed or verified in any manner whatsoever, and that the announcement at ArXiv is just a sort of pre-publication, but that does not keep him from selling it as the next big thing. He even says,

High-profile journals, including *Nature*, discourage researchers from talking to the press until their findings are ready for publication.

Wait, isn't Brumfiel part of the press? Is *Nature* still a magazine, and therefore part of the press, or is it

now part of peer-review? Have peer-review and cheerleading been merged?

Brumfiel continues:

Nevertheless, scientists not directly connected with the group say that the result is impressive. "It is a major development," says Federico Capasso, an experimental physicist at Harvard University in Cambridge, Massachusetts, who has worked on similar quantum effects.

How does Capasso know it is a major development? Has he considered any alternate explanations of the experiment? Of course not. Although he is "not directly connected with the group," he is working "on similar quantum effects." Which means he is also seeking experiments that will "prove" his own viewpoint, while ignoring all other possible explanations of data. So of course he is going to embrace all this as soon as it hits the freesheets.

But again, all this is curioser and curioser. People like me are accused of sabotaging or skirting the peer-review process (although all we are doing is critiquing it), but this report at *Nature* makes a mockery of peer review. It is a hamhanded attempt to influence the jury and the judges before they have even had an opportunity to review the paper.

If researchers are discouraged from talking to the press in such cases, it must be to prevent articles like this one at *Nature* from being published and to prevent reviewers from being improperly influenced. But Brumfiel drives right around this. No, he doesn't even do that. He doesn't so much misdirect the reader as hypnotize him. He uses the modern psychological ploy—that works almost every time, I don't know how—of lying right to the reader's face. Most readers are so shocked by this ploy that their judgment simply shuts down. They think, "A science writer couldn't be so bold and unscientific as to tell me A while showing me B, so I will simply look away." To avoid the further shock of further bald lies, the reader refuses to look closely at the rest of the article as well, and decides the easiest thing to do is catalog the main contention of the article as true.

Brumfiel has not tried to hide the fact that all this is grossly improper. He (all but) tells you in the second paragraph that it is grossly improper for articles like this to be written, and then he writes it. The hypnosis lies in the fact that he does not state it in those terms. He does not say, "This is grossly improper!" He just reminds you that "researchers are discouraged." It requires you yourself to make the next step: to let the domino fall between "researchers are discouraged" and "because it is grossly improper". Apparently most readers don't want to let that domino fall, because they feel guilty judging Brumfiel this early in the article. And if Brumfiel can keep that domino from falling, he can keep all the other dominoes from falling later. The bigger the lie early on, the bigger the benefit of the doubt the liar receives.

You will say, "Wait, the researchers haven't actually talked to reporters, so nothing untoward occurred here." But that is splitting hairs. That is to pretend that writing is not speech, is not a form of communication. If the reporter reads the paper that the researchers have written, then the researchers have talked to the reporter. If the reporter then writes a glowing review, the proper channels have been bypassed. Peer reviewers are going to have a more difficult time tearing up a paper that has already been made famous in the press, aren't they? Hiding behind technicalities doesn't change that.

It is not researchers talking to reporters that is the problem. The problem is the publishing of articles like this in the press, before the paper has even been presented. Researchers talking to reporters can only lead up to the foul. But the actual foul is the publication of the article in the press. That is where

the damage is done. If the researchers talk to the reporter, and no article is published, no harm is done. But if the researchers do not talk to the reporter, and the article is published anyway, the harm is still done. *Logic.*

The next thing Brumfiel does is misdirect the reader into the Casimir effect. As usual, the fact that the Casimir effect is an attraction is glossed over quickly. Brumfiel doesn't even bother to use the word "attraction," telling us only that virtual photons push the plates together.

If two mirrors are placed extremely close together, the kinds of virtual light particles, or photons, that can exist between them can be limited. The limit means that more virtual photons exist outside the mirrors than between them, creating a force that pushes the plates together.

The problem there is that that is also true if the mirrors are not "extremely close together." Mirrors that are one inch apart or three inches apart also "limit" the number of virtual photons between them, do they not? In that case, there must also be more photons outside the mirrors than inside, right?

At this point, mainstream physicists will say, "No, in larger areas like that, the number of virtual photons goes to infinity. Einstein and Stern showed in 1913 that the lowest energy of a mass-point should be expressed by the equation $E = h\nu/2$, and so every point in the vacuum has an infinite potential energy. That is what zero-point energy is, my friend!" But this answer only takes us into another mathematical mess. It does not answer the question at hand. The question begged here is, *At what point does the virtual field go from being infinite to being finite?* If, as Brumfiel says, there are "more" virtual photons outside the mirrors, then he must be counting photons. If there are more outside, there must be fewer inside. The photons inside cannot be "fewer" in number and also be infinite. But if virtual photons have no rest mass and no radius, you should be able to fit an infinite number anywhere you like, even in the tiniest crack between plates. Why should there be fewer photons in a 10nm gap than in a 10cm gap? Doesn't infinity equal infinity?

Some readers will say, "Aren't you undercutting yourself here? Even though you make your photons real and give them size and mass, don't you use basically the same mechanism to account for this apparent attraction?" No, I don't. As you can see by reading my paper on the Casimir effect, I don't use photon pressure to solve this problem. There I apply my unified field equations to the problem, showing that it is gravity at the quantum level that solves this one. Specifically, I show that the current Casimir equation is just a variant of Newton's gravitational equation. I show you how to go from one to the other, in about five lines of math. Since Newton's equation was always a unified field equation, we can use it on quantum problems as well as macro problems. We just have to understand what it actually contains in the way of fields.

But back to this "proof" of vacuum energy. Using a SQUID (superconducting quantum interference device) and a reversing magnetic field, the researchers caused the SQUID to wiggle very fast, at about .05c. A shower of microwave photons was produced.

The group's analysis shows that the frequency of the photons was roughly half the frequency at which they wiggled the mirror — as was predicted by quantum theory.

That is where you should let out a gigantic guffaw. Just think about the math for half a moment, and I bet you can predict the frequency to be half, too, without knowing a jot of quantum theory. If you graduated from sixth grade and can do fractions, you can predict the fraction ½. If you can't do it, I will help you. The mirror has a frequency of 1 per second, say. What does that mean? It means that

some point on the mirror hits the same spot every second. One full wiggle is one full "wavelength," and there is one of those every second. But remember our mirror has two sides. If we propose that the wiggle is causing the mirror to throw off photons by some mechanism (it doesn't matter what mechanism), it can be throwing them off to one side or the other. Energy is being released both left and right, as it were. Half the energy of the wiggle will go left and half will go right. Problem solved.

You don't need quantum theory to solve, you just need to know the definition of frequency and of "wiggle." The magnetic field is reversing, so it is going in two directions only. One frequency divided by two directions equals a halved frequency of emission.

Carpasso calls the experiment "very clever." Yes, top physicists not knowing how to do fractions is very clever. But maybe he means it takes someone very clever to sell this slop to the public.

Here is the final paragraph:

Pendry says that the result, if it stands up, is bound to generate excitement. "Work in this area stirs considerable passion in the breasts of physicists."

Pendry was also not involved in the experiment, but that doesn't prevent him from having his breasts considerably stirred. Yes, I suppose it must generate a lot of excitement in those who can't do math or physics, to realize that neither one is required anymore. All you need is a friend in the press.

If you haven't had enough fun yet, we can look at the comments section. A Dr. Shoaib complains that this interpretation nullifies the conservation laws, and he is answered:

This IS an experimental confirmation. However, your statement about nullifying the conservation laws is quite on-target. The mirror transfers some of its own energy to the virtual photons to make them real. —*Edward Schaefer*

Oh really? And by what possible physical mechanism does a motion create "reality"? Schaefer appears to be saying that motion or kinetic energy can make a particle real. Maybe this is what happened to the Velveteen Rabbit? Perhaps if we shake our plush toys at a fraction of the speed of light, they will become real? If only Pygmalion had known, he could have passed Galatea through this reversing magnetic field.

Not satisfied with the depth of the hole he now sits in, Schaefer continues to dig:

So what we have so far is **temporary** conservation of energy violations. However, the photons produced by this experiment are real: They are not about to pop back into nothingness. So the question is this: Can a virtual particle become real? The answer is yes, but to do so *it must take real energy and other conserved values from something real*.

In the case of this experiment, the something is the mirror. The SQUID mirror is being driven by an oscillating magnetic field. Without that oscillating field, the mirror's vibrations would quickly damp down, due in part of the energy it is losing as it transfers energy to formerly virtual microwave photons in its vicinity.

So the photons may come "from nothing", but their energy does not.

Schaefer doesn't appear to recognize that this contradicts one of the claims of Brumfiel in the article, one that I already quoted above: "The limit means that more virtual photons exist outside the mirrors than

between them, creating a force that pushes the plates together." We see that virtual photons can create a force, according to this warped logic. How can virtual photons create a real force? What real thing are the virtual photons in the Casimir experiment getting their conserved values from? No doubt Schaefer will again say the mirrors or plates. But that means that the plates are causing forces upon themselves. He has gone circular.

Schaefer is also confirming another commenter, without intending to. Matthew Britton asks,

Is it possible that the mirror might have just begun shaking apart? Was the mirror the same mass after the experiment as it was before?

I can almost hear Schaefer sniffing at such a suggestion, but if virtual photons are getting their energy and reality from the mirror, as he claims, then the mirror must be losing energy. The mirror cannot give energy to virtual photons and also keep it, can it? If the mirror is losing energy, then it is also losing mass. And if that is so, then the virtual photons become superfluous. They become an unnecessary middle step. Why should the mirror give energy to the virtual photons, which then give it to the real photons? Why not just have the mirror emit the real photons?

Any real physicist would make that assumption first, not the virtual assumption. If we see a wiggling thing, and photons seeming to come from it, why not assume the photons are coming from it? Why insert this middle step and say that the photons are coming from the virtual field? It is absurd from the first word.

The reason current physicists are making this absurd assumption is that they need some way to prove the existence of the Higgs field. They haven't been able to find the Higgs boson with their multi-billion dollar new toys, so they need to at least convince gullible readers that the field exists. If not the boson, then the field. But, as you see, this experiment is proof of nothing in that regard. The entire virtual argument is only proof that pettifogging still exists. Physics has devolved into unskilled sophistry.

We see this again by going to the PDF at Arxiv. This is how the abstract starts:

One of the most surprising predictions of modern quantum theory is that the vacuum of space is not empty. In fact, quantum theory predicts that it teems with virtual particles flitting in and out of existence. While initially a curiosity, it was quickly realized that these vacuum fluctuations had measurable consequences, for instance producing the Lamb shift of atomic spectra and modifying the magnetic moment for the electron. This type of renormalization due to vacuum fluctuations is now central to our understanding of nature.

Actually, quantum theory *doesn't* "predict" virtual particles. Certain quantum physicists like Dirac *postulated* the existence of virtual particles, to help fudge their equations, but there was never any prediction involved. A prediction is based in theory and ends in data, but virtual particles come from need, not theory. And they cannot possibly end in data, since no data can prove or disprove virtual particles. Since they exist when you want them to and disappear when you need them to, they are beyond any physical proof. You might as well seek proof of a wish.

Quantum theory can exist with or without virtual particles. Virtual particles are not a necessary outcome of quantum math. Quantum math simply has some holes that some physicists have chosen to fill with virtual particles, but that is not a prediction. So this first sentence of the abstract is already a misleading and false statement. It should concern you, the reader, that these seven authors should choose to begin their paper with a false statement.

The third sentence is also false. The vacuum fluctuations have not been proved to cause either the Lamb shift or the electron's magnetic moment gap. In my paper on the Bohr magneton, I have shown the real cause of the magnetic moment gap. It is basic mistakes in the math, not any input from the vacuum, that cause it; and this applies to the Lamb shift also. But even without the corrections I have shown, it should have been known that vacuum fluctuations don't "produce" these phenomena. For something to physically "produce" a shift, a physicist has to show a mechanism for that shift. Vacuum fluctuations are not mechanisms, and they are not physical. They are just mathematical hole fillers. That is to say, the theory of vacuum fluctuations has zero physical content. To use their own epithet, the theory is metaphysics, or worse than metaphysics. It is magic. The authors as much as admit that when they call vacuum fluctuations a "type of renormalization." Renormalization is math. Renormalization is pushing equations, as even Feynman admitted. This would make vacuum fluctuations neither mechanics nor theory, neither a prediction nor a postulate. They are a mathematical fudge, or, as Feynman put it, "hocus-pocus."

Nor can you come to an "understanding of nature" via such hocus-pocus. An understanding of anything is not achieved by filling holes in any way you choose. But these authors are correct when they state that this sort of fudging is central to the new physics. All of contemporary physics is corrupted by this failure to maintain rigor and logic and consistency. All the new physics papers begin and end with these sloppy sentences, where the seven authors cannot make any sense between them.

As further proof of this, we continue to study the abstract:

From early on, it was discussed if it might instead be possible to more directly observe the virtual particles that compose the quantum vacuum. 40 years ago, Moore suggested that a mirror undergoing relativistic motion could convert virtual photons into directly observable real photons.

More sophistry. If you are converting virtual photons into real photons, and observing the real photons, you still aren't observing virtual particles. This isn't observing virtual photons "more directly," or even more indirectly. It isn't observing them at all. The virtual photon is no more or less a wish after the experiment than it was before. What evidence or data do we have that virtual photons are converting anything here? None. The data and evidence will always be the real photons, by definition, and virtual photons will and must remain nothing but a poor inference.

The last sentence of the abstract is this:

In addition to observing the creation of real photons, we observe two-mode squeezing of the emitted radiation, which is a signature of the quantum character of the generation process.

The "two-mode squeezing" is just our half frequency again. I have shown that this is not "a signature of the quantum character of the generation process", much less of the virtual field. It is just a reminder of the definition of "wiggle." A wiggle is a two-mode motion.

Now we get to the body of the paper, such as it is. The first couple of pages are just preparatory bombast, and we learn nothing new. On page 3, we find this:

If the boundary is driven sinusoidally at an angular frequency $\omega_d = 2\pi f_d$, then it is predicted that photons will be produced in pairs such that their frequencies, ω_1 and ω_2, sum to the drive frequency, i.e., we expect $\omega_d = \omega_1 + \omega_2$. This pairwise production implies that the EM field at these frequencies, symmetric around $\omega_d/2$, should be

correlated. In detail, we can predict that the field should exhibit what is known as two-mode squeezing[19]. These correlations are a signature of the two-photon nature of the photon generation process.

That's pretty amazing to see, since it confirms my analysis above. I had expected a whole lot of difficult math to hide this fudge, but the authors don't even bother. They do basically the same math I did, only diverting you by telling you it is an outcome of pair production. It isn't, since we have no evidence of pair production. It is simply an outcome of the fact that the device has two sides. It *is* funny that the authors think it is necessary to dress this up with a footnote. Since the math is not opaque enough on its own, they at least use an opaque new term, "two-mode squeezing", and flower it with a footnote. Like a banker or politician dressing for dinner, new physicists know that when you have no content, it is best to wear as many expensive flourishes as you can. The politician will always have an expensive suit and a $3000 watch and a $200 haircut. In the same way, the new physicist will always be sure to use the tools at his disposal: lingo, footnotes, quotes, name-dropping, opaque math, multiple authors, computer models, and fancy color diagrams.

We see this proved again in the next paragraph, where the authors decide, somewhat late, to include the opaque math. It is late because they just showed us the simplified version. If the simplified version is false, the full version is bound to be false as well. Someone needs to tell them that it isn't done this way. It is always a mistake to include the simple version, and especially to lead with it. You are hiding behind the full version, so it is counterproductive to include a simplification, or to explain your math.

The rest of the paper is a diversion into this opaque math, which I will not analyze here. I will comment on only a couple of things that jump out of the math. One, the authors tells us,

In order to generate DCE radiation, ℓ_e must change with a nonuniform acceleration.

But, as one of the commenters mentioned at *Nature*, it doesn't require non-uniform acceleration to generate radiation. Any acceleration will do. Quantum theory predicts this in several ways, including so-called Unruh effects, and Sokolov-Ternov effects, and the latter are said to be confirmed. This is a problem here because it complicates the pseudo-mechanics and the math. Specifically, without a variable acceleration, the math in this paper falls apart. That is what the authors mean by the word "must" in the quote above. The math shows vacuum coupling and energy production *only if* you have non-uniform acceleration. But since we know we have energy production without non-uniform acceleration, this math must fall. Since this math is fudge from top to bottom, it won't be hard to add another layer of chocolate frosting, by getting rid of the "non-uniform" part of the math. All the authors have to do is a subtle hip-check to the existing math, and I predict this is what they *will* do.

We can peg a further wedge into the quantum field theory by pursuing the Sokolov-Ternov effect, which is slightly more transparent than this DCE effect. At Wikipedia, we find this:

An electron in a magnetic field can have its spin oriented in the same ("spin up") or in the opposite ("spin down") direction with respect to the direction of the magnetic field (which is assumed to be oriented "up"). The "spin down" state has a lower energy than "spin up" state. The polarization arises due to the fact that the rate of transition through emission of synchrotron radiation to the "spin down" state is slightly greater than the probability of transition to the "spin up" state.

That is the lead-in to the Sokolov-Ternov math, but I have already shown that is false. In a series of papers on beta decay and related problems, I have shown that spin-down is greater than spin-up not due

to probabilities, but due to the fact that the local charge field on the Earth is not symmetrical. In other words, we have more photons spinning down than up, and this energy transfers to electrons. All the current parity problems are solved in this way. Notice, for a start, that the explanation above leaves you dangling. WHY is the probability for one greater? The mainstream answer is that the unequal probabilities are created out of the vacuum, via a lot of fudged symmetry breaking math. Since I have now provided a mechanical answer using real photons with real spin, we don't need a virtual answer. This ties into the DCE effect because it is answered by my mechanics in the same way. This vibrating SQUID is not interacting with the vacuum field, it is interacting with the charge field. It is not interacting with virtual photons, it is interacting with real photons. Quantum physicists have misunderstood the field content of their own equations. Because they have insisted on using a gauge math that requires a field "boson" with no mass and no radius, they have been required to steal energy out of the void in order to maintain the consistency of their gauges. But as soon as you give the boson or photon mass and radius, the problem evaporates. You no longer have to fudge the equations or borrow from the vacuum. These new physicists will tell you that quantum theory requires that the photon be massless, but that is false. It is not quantum theory that requires this, it is the gauge math that requires it. But quantum theory does not require gauge math.

In fact, quantum theory requires a photon with mass. Why? Not only due to logic, but due to the fact that quantum theory was built on E/M theory, and E/M theory requires a photon with mass. Why? Because the equations that still underlie current E/M theory contain this requirement of mass. The way that the Coulomb is defined, as well as the way that *e* is defined, require that charge has mass, as I have shown. Once again:

$e = 1.602 \times 10^{-19}$ C
$1C = 2 \times 10^{-7}$ kg/s
$e = 3.204 \times 10^{-26}$ kg/s

Those first two equations are bedrock. I did not make them up. They have not been overthrown by QED. Combining them gives us the third equation, which tells us that the electron is emitting 35,000 times its own mass as charge every second. That is where the energy in this SQUID experiment is coming from, not from the vacuum.
