

A Casimir Energy Device ???

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Ilya Prigogine received the 1977 Nobel Prize in Chemistry for establishing that random energetic, non-linear systems can self-organize under some circumstances. I propose that the asymmetric Casimir Effect is an example of such a non-linear, self-organizing Vacuum Phenomenon. Furthermore, the Quantum Flux can be interpreted as a continual flow of electromagnetic radiation *into, through and out of* our Space-time: Anytime there is a **flow** of energy, we should at least **consider** the *possibility* of harvesting that energy.

This paper proposes *exactly how this might be done!* Naturally, I intend to perform a proof-of concept experiment **before** soliciting money to do serious development! I am asking people to pass this paper around until it finds its way to the diverse experts who can each play some part in the initial proof-of-concept experiment, perhaps just a brief comment or maybe they know someone who *might* help !!!

At first glance, it really *does* seem impossible to extract useful energy from this particular kind of electromagnetic "flow" since, **like** air pressure, the Quantum Flux pushes equally in all directions; to all appearances, these forces would seem to always *counteract* each other; however, the Photons of the Quantum Flux are different from air pressure in a number of important ways. For example, they obey all the usual laws of electromagnetic radiation; yet in contrast to *ordinary* photons, *these* photons are so *short-lived*, it is possible to partially suppress their radiation-pressure in a cavity. If the Radiation-Pressure Interpretation of the Casimir Phenomenon is really true, then common, every-day objects are **constantly** being kicked back and forth very minute amounts, *one Quantum-Flux photon-collision at a time!*

The Casimir Effect can be *incredibly* powerful. To date, most experiments have been conducted at scales of hundreds of nanometers where the forces are still very modest; however, as we consider Quantum Flux electromagnetic radiation wavelengths that are less than 35 nm, the forces become large. Under 15 nm they can be many tens of thousands of Pascal. Macroscopic Arrays with nanoscopic features might *potentially* experience **very** large *total* forces!

Casimir originally proposed placing two metal plates very close to each other.



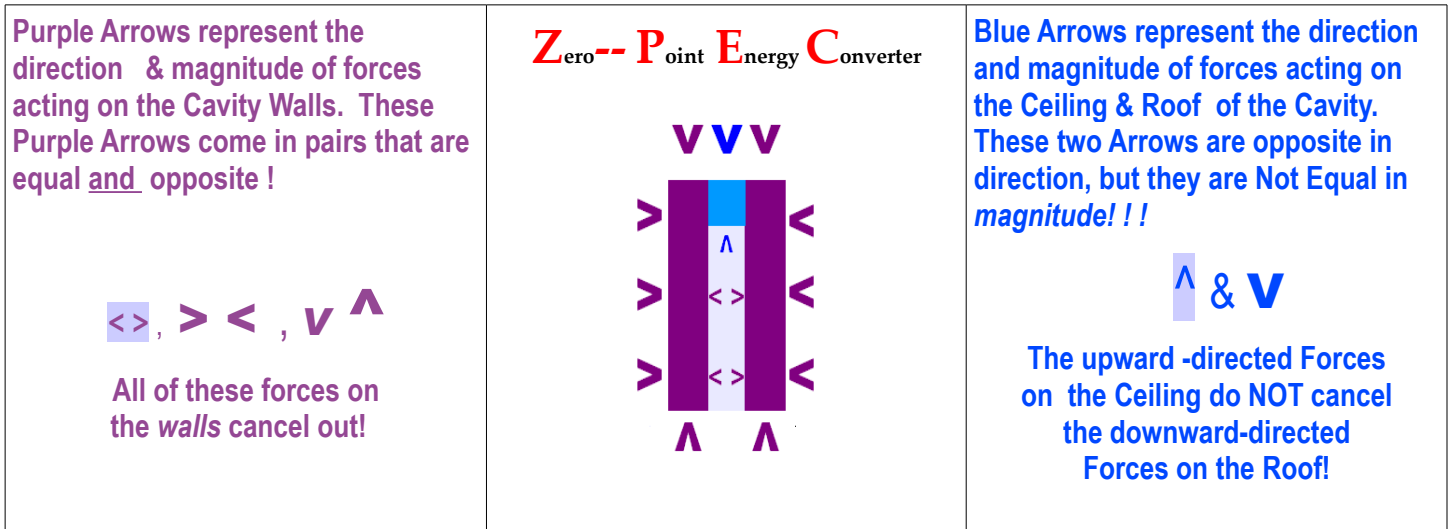
Casimir reasoned that the two plates do not alter the Quantum Flux outside the cavity, but they do alter the Flux in the cavity between them. In the Classical Experiment, the plates are uncharged, grounded (electrically connected and neutral) conductors. Under these conditions, they suppress the formation of wavelengths that are larger than the distance between the plates; therefore, there is a Flux Depletion Zone between these two plates while at the same time, the ambient flux outside the cavity is still as strong as ever. Therefore, the stronger, unaltered ambient flux pushes the plates together, more strongly than the *remaining* depleted-pressure that is between the plates that *weakly* pushes the plates apart. Therefore the plates are moved together by the stronger external unaltered ambient Flux.

The possibility of extracting useful energy from the Quantum Flux seems to hinge on whether the Radiation-Pressure Interpretation of the Casimir Phenomenon is physically correct! I will present a detailed argument for this assertion near the end of this paper; but for now, I will discuss **why** this *truly matters!* The very worst artifact of supposing that the Casimir Effect consists of two objects exerting forces on one-another is this: We are making the implicit false-presumption that there *has* to be a *second* object for the *first* object to be attracted *to* or repelled *from!!!* We have thereby ruled out any possibility of a material object being entirely moved by the momentum of its very real collisions with the very-real photons of the Zero-Point Energy Field. As was already mentioned, this is *probably already* happening all around us, **everywhere, all of the time, anyway!**

If we **insist** on viewing the plates as "attracting" each other we will start wrongly **assuming** that some of the **limitations** that govern what can and cannot be done with magnets also applies to the plates. For example, even if we can gain energy when two magnets come together, we must then apply at least as much energy to separate them again! So, **with magnets**, there is no energy gain. With **magnets**, there is no way around this dilemma since it is the magnets *themselves* that are the *source* of the force since they really *do* indeed *attract* one-another; therefore, objects *such as magnets* must *always* be **forced** back to their initial positions to complete some sort of cycle; therefore, there is **truly no** possibility of extracting net energy from two magnets!!!

However, if the plates are **not** actually attracting or repelling each-other, **different rules apply!!!**---We do **not** have to let them come together *at all*, **neither** must we *separate* them!!! The fact that the Flux cannot **continuously** move the two plates in the original Casimir Experimental Design is an incidental artifact of that particular Two-Object Geometry; it has nothing whatsoever to do with any supposed-violation of energy-conservation, were it not so! Again, common isolated, singular objects are probably, *continually* being kicked around by the photons of the Quantum Flux: Why not Casimir's Plates?

As illustrated below, the two cavity walls, which are purple, correspond to the Two Casimir Plates. By adding a third "Plate" we are adding a side (blue) that forms the ceiling of the inside space of the cavity and also forms the roof that is on the outside of that cavity.



The third side accomplishes a number of important things.

First, the photons outside the cavity consist of the *unaltered*, full spectrum of the Ambient Quantum Flux; they push harder than the Depleted Flux of Photons inside the cavity. On the one hand, all external forces that are acting on the walls counteract each other, as do all *internal* forces that act on the walls! In contrast, the outside surface of the third side--the roof of the cavity experiences the stronger Quantum Flux Radiation Pressure of the entire spectrum of the Ambient Flux outside the cavity, yet the other side---the Ceiling of the Cavity is exposed to the much-weaker Radiation-Pressure of the Flux-Depletion Zone; therefore, the stronger, full-spectrum, downward-directed ambient Quantum-Flux Radiation-Pressure pushes harder on the **Roof** of the Cavity than the depleted Quantum-Flux Radiation Pressure that is pushing upward on the Cavity **Ceiling**. In other words, there is a **net** downward-directed force acting on the Roof!

Second, the third side prevents the first two plates from moving together so we don't have to separate them again!

Third, we now have a permanent Flux-Depletion Zone in the cavity between all three sides of the Three-Plates. This is not like producing an air-vacuum between two plates and waiting for the air to rush back in!!! The two sides *continuously* suppress the formation of the larger-wavelength photons of the Quantum Flux. We do not have to supply the energy to maintain this Flux-Depletion Zone! We already know that the structure of the cavity and the Casimir Effect will do this for us!


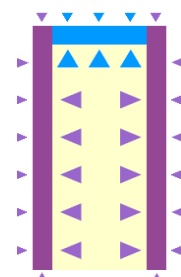

Fourth, the two *sides* of the cavity suppress the formation of all photons whose wavelength is greater than the distance between the plates---regardless of what direction they would be traveling had they been allowed to pop into existence! Why? Because the *wave-length* characteristic can just as aptly be called *wave-width*, as evidenced by diffraction gratings; therefore, the distance between the two sides still limits the size of the photons that can strike the ceiling of the cavity.

Fifth, the more numerous photons of the ambient Quantum Flux that exist outside the cavity are not going to rush in and strike the Ceiling because photons don't behave like gases; for the most part, they do not affect each other at all! Quantum-Flux photons that form outside the cavity don't *exist* long enough to travel the length of the cavity and impact the ceiling!!!

At first glance, it **appears** that we have a cavity that is experiencing a net-force, one that is driven only by the Radiation Pressure of the Quantum Flux; however, there is one more problem that must be solved: Consider the larger, excluded wavelengths that cannot enter the cavity or form there; these larger wavelengths probably bridge across the cavity openings and apply a force that is equal and opposite to the same larger-wavelengths that are acting on the roof at the opposite end of the cavity. Therefore, all forces that are acting on **this** cavity are equal, opposite and **useless!!!**

Fortunately, all is not lost!!! There is a considerable peer-reviewed literature that proposes that, under some conditions, the Quantum Flux can resonate inside of small cavities, much like the "Roar of the Sea" inside the cavities of some sea shells (which in reality is the sound of countless air molecules colliding and producing an audible, **amplified**, multifrequency standing-wave!) Also, cavity materials might be developed that are able to engage in optical pumping until they maintain some yet-higher equilibrium point! A recent Patent issued to Fabrizio Pinto for a pair of reciprocating plates where one plate will be a conductor and the second plate will be a semiconductor that can be switched between a conducting state that causes the Quantum Flux to push the two plates together, and a non-conducting state that causes the Quantum Flux to push the plates apart.--Of course, it may very well take more energy to switch the semiconductor than can be obtained from the system; nonetheless, it supports the point that some cavity designs will enhance their internal radiation-pressure.

Below, is a *Cavity* where the radiation-pressure is *enhanced!* inside the cavity. With this *flux-enhancement* cavity, any photons bridging across the opening actually contribute to the net force!

<p>Purple Arrows represent the forces that are acting on the Cavity Walls. These Purple Arrows come in pairs that are equal in magnitude <u>and</u> opposite in direction!</p>  <p>All of these <i>pairs</i> of forces that act on the Walls cancel !!!</p>	<p style="text-align: center;">Z_{ero} -- P_{oint} E_{nergy} C_{onverter}</p> 	<p>Blue Arrows represent the forces that are acting on the Ceiling and Roof of the Cavity. These two Arrows are opposite in direction, but they are Not Equal in <i>magnitude</i> !!!</p>  <p>This pair of Forces that act on the Ceiling and Roof do NOT cancel !</p>
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How You Can Help Make it Happen!

Naturally, we are not going to laboriously assemble mega-quadrillions of individual nanoscopic plates; instead, we are going to make a macroscopic array of nano-size holes, trenches or pores in one side of a plate! This can no doubt be done in many ways. **Everyone** can help by simply sharing these materials with everyone they can think of that *might* be interested. If enough people do this then these documents will find their way into the hands of willing people who have the necessary wisdom, knowledge, skills, equipment and facilities. I need some preliminary expert-comments to nail down some specific approaches and to make a preliminary budget!

I need to consult, at least briefly, with experts in many diverse fields such as, Cavity-QED and other fields of Quantum-Optics, Semiconductor Engineers and Technicians, Nanotechnologists and Material Science Experts. After a short period of cross-disciplinary discussion it will be possible to identify the optimum approach and to write a budget so a modest amount of money can be raised for a proof-of-concept experiment. **Right now, I mainly need people to offer comments or to help resolve some of the following questions or approaches!** I need preliminary answers such as:

- The skin-penetration depth of different combinations of materials and wavelengths.
- The optical-pumping characteristics of various materials.
- A clearer general understanding of any other factors in generating positive radiation pressure inside of cavities.
- Recommendations of which approach is most likely to give early definitive results.
- Recommendations of which approaches are the best prospects for commercial development.
- Estimate of the comparative costs and anticipated effectiveness of the different possible approaches.
- Does anyone have any ideas that I have not listed, below?

I am tentatively considering the following approaches :

Tailor-made materials can be laid down on a silicon chip. Then holes or trenches can be precisely photo-engraved using the exact procedures that have been developed for the latest 34 nm semiconductor technology. This is, much simpler than a microprocessor so we can probably make holes or trenches that are perhaps half that size. Due to the lack of complexity, it should cost a great deal less. Even though we would be using the same equipment, it would require *much less* process-time than the simplest microchip! I need a semiconductor engineer to prepare a professional bid request that semiconductor labs and foundries will actually respond to or an interested party that has access to a company or university semiconductor lab!

Perhaps we will want to make a plate of the desired materials and bombard it with high energy particles electrons, neutrons, protons, or atomic nuclei. Such a General Bombardment would be very simple but would create irregularly spaced holes. Much progress has been made in growing a variety of nanoscopic structures, perhaps we can find an expert who knows how to grow a large array of nanocavities! We might be able to make effective cavities by mimicking the process used to make Raney Nickel. Nickel and Aluminum are alloyed together, then the Aluminum is selectively leached out of the material leaving a Spongy Surface composed mainly of Nickel. We would want to treat one side of a *solid* plate of the alloy; whereas usually, it would be ground to a fine powder then leached!

Deriving Casimir's Radiation-Pressure Interpretation !

Everything so-far stated is premised on the *Electromagnetic Radiation-Pressure Interpretation of the Casimir Phenomenon*. By considering the origins of the Zero-Point Energy Concept we find compelling justification for this *supposedly* controversial interpretation.

The electromagnetic radiation of the Quantum Flux was first detected in the equations of Quantum Dynamics. An energy field term emerged from the calculations because it was necessary to model a field for particles to exchange energy with. Furthermore, it was found to be impossible for the energy level of empty Space to be truly zero due to the Uncertainty Principle. Oddly, they started talking about “Virtual” Photons as though they were some sort of mathematical fiction—that *somehow* influenced *real materials!!!*

Then by invoking Relativity, the density of any frequency of the Quantum Flux can be calculated by applying Lorentz-Invariance to the Quantum Flux Distribution—in other words by assuming that observers in all inertial frames will see the same Quantum Flux frequency-distribution. This yields the following equation; it calculates the density D of any particular frequency f:

$$D(f) = k \cdot f^3$$

We can take *that* equation, convert it from terms of frequency to terms of wavelengths and energy. At this point we can calculate the Energy Density of any single wavelength of electromagnetic radiation in the Quantum Flux. Finally, we can integrate *this* energy equation which is for a **single** wavelength in order to sum together all the energies of **all** the wavelengths that are greater than or equal to any specified wavelength d. This becomes Casimir’s equation for the Pressure P of the Quantum Flux acting on two conducting metal plates. The letter d is for the distance between the two plates and $K = 1.30 \times 10^{-27}$

$$P = K / d^4$$

The accuracy of this equation has been **experimentally** verified *many times!*

Casimir reasoned that the two plates do not alter the Quantum Flux outside the cavity but they *do* alter the Flux in the cavity *between* them. In the Classical Experiment, the plates are uncharged, grounded (electrically connected and neutral) conductors. Under these conditions, they suppress the formation of wavelengths that are larger than the distance between the plates; therefore, there is a Flux Depletion Zone between these two plates while at the same time, the ambient flux outside the cavity is still as strong as ever. Therefore, the stronger, unaltered ambient flux pushes the plates together, more strongly than the depleted- pressure pushes the plates apart. Therefore the plates are moved together by the stronger *radiation-pressure of the external unaltered ambient Quantum Flux.*



Furthermore, the Quantum Flux may be the Rosetta Stone that ties Quantum Mechanics, Relativity and the rest of Physics together. Problematically, k / d^4 extrapolates to infinite pressure as the distance d goes to zero. Wheeler, (Geometrodynamics, 1962) extrapolated the energy-density down to a point where *Relativity* required the mass-energy density to cause Space to fold in upon itself, forming a series of Black-Holes (and, according to Einstein himself *White-Holes!!!*) Fascinatingly, these White & Black Holes turned out to be about the size of a Planck Length—an *amazingly* non-arbitrary result!!!

Casimir’s equation accurately predicts the sum of the Radiation Pressures of all wavelengths that are excluded from the cavity! Numerous versions of Casimir’s experiment have been performed and the experimental results have matched the theoretical prediction of the k / d^4 equation very closely. Therefore, since the Casimir Phenomenon can be predicted based on finding a Lorentz-Invariant Distribution of the frequencies of the electromagnetic radiation of the Quantum Flux, it is inseparably rooted in the notion of the physical reality of the Radiation-Pressure of the electromagnetic radiation of the Quantum Flux; Nonetheless, this clear connection has been obfuscated in the most remarkable fashion!

Casimir originally pointed to Van der Waals forces as an example of the Casimir Quantum Flux Radiation-Pressure Phenomenon in action. But many people soon became uncomfortable with the notion of “empty” Space or mere “Virtual” Photons exerting an actual physical force on “real” matter—even though the concept was originally invented to facilitate a model of what was really happening to “real” matter! therefore, in order to deny the reality of the radiation pressure of the electromagnetic radiation of the Quantum Flux, many started saying the opposite—that the Casimir Phenomenon was nothing more than Van der Waals Forces! This is the tail wagging the dog! It is every bit as absurd as saying that the path of the Earth around the Sun causes gravity and inertia when the *reverse* is true!!!

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