Mechanical Thrust from the EM Quantum Vacuum

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According to Quantum Electrodynamics, QED, a hidden source of great momentum and energy, called the EM Quantum Vacuum, fills the Universe. A Quantum Thruster will use refraction to alter the radiation pressure of the Quantum Vacuum so that it will push harder on one side of a mirror than on its opposite side. This is a new class of macroscopic prime-movers, a kind of massless propulsion, a new environmental-energy conversion device. Even though the individual forces are small, many Quantum Thrusters might be stacked to achieve arbitrarily large forces. Such compound Quantum Thrusters may someday replace car motors, jet engines, rockets and electrical- generator engines.

1. Introduction: A new prime-mover

According to Quantum Electrodynamics, QED, the EM Quantum Vacuum fills the Universe. If it could be seen, it would look like the tiny flashes of static-snow that are seen on televisions in-between channels. It is believed to consist of photons that momentarily manifest then promptly disappear. This is called Zero-Point Energy because this is the energy that would fill space, even at Absolute Zero degrees, after all heat and matter has been removed. This EM field is far more energetic than any amount of known heat energy.

One author of NASA's Breakthrough Physics Propulsion Program report, Marc Millis, says that it might be possible to induce powerful propulsive forces by developing new means of causing the EM radiation pressure of the Quantum Flux to push harder on one side of a vehicle than on its opposite side.[1] A practical approach to accomplishing that is explored in this paper. Another author of this report, Jordan Maclay, disputes this. The proposed experiment may resolve this issue.

2. The Defining Problem

This paper proposes a realistic, simple solution to a profoundly difficult problem: The EM Quantum Flux Radiation-Pressure is equally energetic in every direction. Put another way, this radiation-pressure normally pushes equally hard on opposite sides of most objects. All of these forces would normally be totally used-up, just counteracting each-other. Since these forces are normally equal and opposite among themselves, a single, isolated two-sided mirror floating in Space would normally remain stationary..

In Fig. 1 the two yellow rays represent the light of the EM Quantum-Vacuum. In particular, they represent the fact that its light particles strike any given point on the mirror mostly at non-perpendicular angles. They also represent the fact that, usually, the light the EM Quantum- rays of Vacuum would strike a two sided mirror equally on each side. Therefore, this floating, two-sided mirror would not be pushed in either direction by the radiation pressure of the EM Quantum-Vacuum.

Fig. 1

3. A Simple Solution

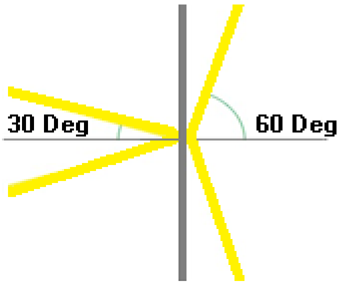

Fig. 2

The problem in Fig. 1 is not merely that the rays of light are equally-intense. Rather, the difficulty lies in the fact that they are equally-intense *and* opposite.

Fig. 2 illustrates one way to obtain a net force from two beams that are equally-intense. Two equally intense beams of light are striking a two-sided mirror that is floating freely in Space.

Consequently, the plate will be pushed to the right, even though the beams are equally-intense. This could be done with two equally-intense lasers.

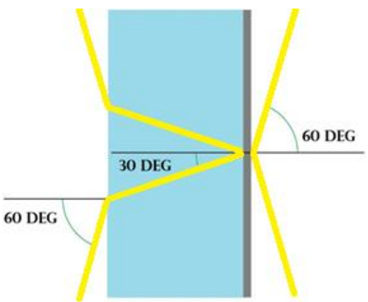

Fig. 3

In Fig. 3, two equal and opposite beams of light remain equally-intense but *become* non-opposite. One light-beam approaches the blue refractive-medium at a sixty-degree angle that is equal and opposite to the light-beam that is approaching the bare side of the mirror on the right, at sixty degrees; but then the beam on the left is refracted. The light on the left strikes the mirror at a thirty degree angle which is steeper than the light that strikes the right side of the mirror. Therefore, a net force to the right acts on the two-sided mirror, as in Fig. 2.

One might fallaciously analyze this as one entire system. One would errantly start by writing an equation that presumes that the forces that act on the two sides are equal and opposite. This is fallacious because that is what we are trying to prove or disprove. Since this is a two-sided mirror, it is important to analyze this as two independent systems with two separate mirrors. First, the forces are calculated separately for each mirror. Then, the forces that are acting on the bare mirror are subtracted from the forces that are acting on the mirror that is covered with the refractive material.

F is the force of a ray of light striking a mirror at a zero-degree angle, (perpendicular to the surface.) The net force is equal to the difference of the momentum of the light rays that are shown in Fig. 3. The forces of the rays acting on the mirror are: F cos 30 degrees = 0.8660 F and F cos 60 degrees = 0.5000 F

This leaves a net force of: F cos 30 degrees - F cos 60 degrees = 0.3660 F.

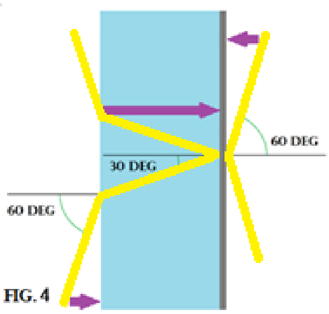

FIG. 4

Fig. 4 illustrates what happens to a typical pair of equal and opposite light beams. Again, both beams approach the system at 60 degree angles; this is shown by the equal and opposite small purple arrows. However, the ray on the left is refracted so that it strikes its side of the double mirror at a more-normal 30 degree angle. The refracted ray strikes its side of the mirror harder than the ray that strikes the bare side of the mirror; this is because its normal momentum component, shown by the longer purple arrow, is longer than the momentum component of the non-refracted ray, which is shown by the shorter, left-pointing purple arrow.

Obviously, the mirror in these arrangements will experience a net force; however, now one must ask if the forces that act on the refractive material counteract the net force that acts on the mirror.

4. There Are No Refractive Counter-Forces

As light enters the more-refractive material, it slows down. It is as though it is exerting deceleration reaction forces on the refractive medium. These forces are analogous to a car that imparts a forward-directed force to the roadway as it decelerates upon entering a school zone. This forward-directed force is directed *into* the slow-speed zone.

Surprisingly, it turns out that a force also acts back toward the refractive medium as the light exits the refractive medium. This exit force has been experimentally demonstrated. A laser was shined through a glass fiber and a recoil force was noted; it bent the fiber as the light exited out the end of the fiber.[2] Loudon and Baxter also claimed this result in their paper on Poynting.[3]

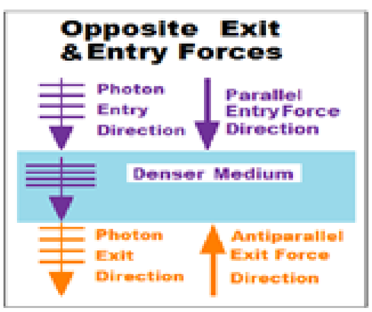

Fig. 8

The car in this case is exerting backwards-directed forces on the roadway, as it pushes against the road to accelerate while leaving the school-zone. In other words, the refraction forces that act on the refractive material, are always pointing into the refractive material, both when the light is entering the refractive-material and when it is exiting the refractive-material.

In Fig. 8, both when the light enters and when it leaves the refractive material, it exerts a force that is directed toward the refractive material. These entry and exit forces are equal and opposite-to each-other; however, they are equal and opposite only because, in this particular instance, the light enters into one side of the more refractive material and exits from the opposite side of the more refractive medium; but this is not always the case.

In Fig. 9, the refraction forces are shown with the green arrows. Both refractive forces are still directed toward the refractive medium; but in this case, "exerting a force toward the refractive-material" means the entry-forces and exit-forces are both exerted in the same direction since the light both enters and exits from the same side of the refractive material.

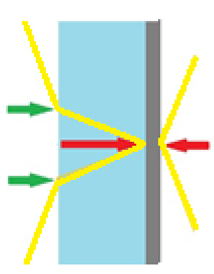

Fig. 9

This time, the refraction forces do not counteract each-other. Neither do they counteract the net reflection force that is acting on the mirror that is implied by the longer red arrow. All three forces are directed toward the back of the mirror. Therefore, a net-force will act on the entire thruster system, including the refractive medium. For this to not be true, the light would have to pull on the refractive material, not only when it left the refractive medium, but also when it was entering the refractive medium.

5. Energy is Conserved

Extra energy is positively-not appearing inside of the refractive material, not temporarily, not at all. The same amount of total-energy and momentum-amplitude are present on the bare side of the double-mirror as on its refractive side, inside the refractive-material; but that energy is reorganized by the refractive-forces that the light and the refractive material exert on one another.

The EM energy will be represented by three component vectors **i**, **j** and **k**. One component vector, **k**, is the vector component of all energy insofar as it is directed perpendicular to the surface. The other two vectors represent the energy vector components that are directed parallel to the surface. Normally, one third of the energy is directed normal to a surface; since the other two thirds of the energy are flowing in the other two parallel vector directions. However, when the light refracts, all of a sudden, more than one third of the energy is perpendicular to the surface. Since energy must be conserved, less energy is now flowing in the other two directions.

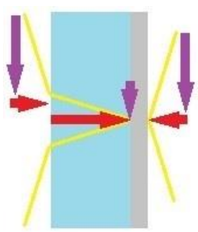
Fig. 10

In Fig. 10, as the light enters the refractive medium, the short red perpendicular energy vector, outside of the refractive medium, becomes longer as it enters the refractive medium; but the parallel energy vector (purple) is longer outside of the refractive medium; but it is shorter inside the refractive medium.

Clearly, this analysis holds true with rays of ordinary light. It remains to be seen if the EM Quantum Flux can be refracted in the same manner. The point of this paper is not to prove that this idea must work; rather, the point is to stimulate discussion and action on the proposal and to justify performing the proposed experiments. This paper is also intended to persuade qualified persons with access to the necessary equipment to perform these experiments.

References

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