

# Found material creates a unidirectional force due to vacuum fluctuations.

***Differential sail* is theoretically discovered. "The paradox of occurrence of unidirectional Casimir force in some designs in the modern interpretation of QED"**

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We propose an experiment, the results of which can solve important questions: Do vacuum fluctuations<sup>1.1, 1.2, 1.3</sup> (zero-point energy<sup>1.4, 1.5</sup>) exist or is it just a mathematical abstraction? Can they be used anyhow? If they exist, their energy and momentum can be used by *Differential sail*. If they do not exist, it solves the problem of the cosmological constant (discrepancy of the observed energy of vacuum fluctuations with the theory<sup>1.7</sup>).

## **The issue of the Casimir Force**

The Casimir force (effect) is attraction of conductive plates at distances less than 1 $\mu$ m.

There are 2 versions accounting for the Casimir effect<sup>1.8, 1.9</sup>.

A The Casimir effect is a consequence of vacuum fluctuations resonance and reduction of the energy density between the plates. The plates are attracted to the space between them under pressure of virtual photons.

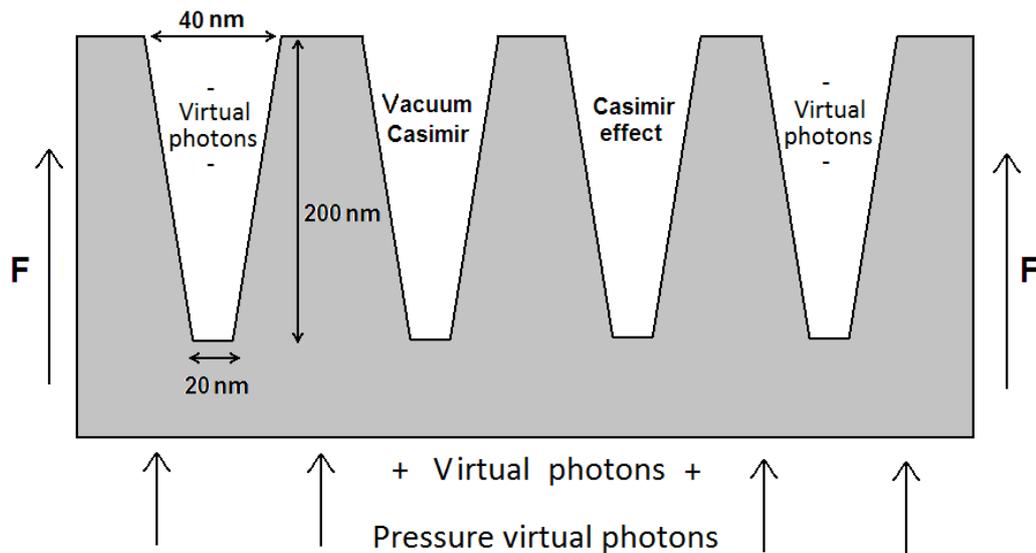
B Casimir effect is a kind of Van der Waals forces. The plates are attracted to each other.

The question of Casimir force is part of the more general question of existence of zero-point energy and interpretations of QED phenomena. In physics, the question of existence of zero-point energy is not yet resolved; many people think it is not real, but only a mathematical abstraction. This is an important issue in physics.

## ***Differential sail* theory**

If we assume that the Casimir force is the pressure of virtual photons, then there is a "paradox of occurrence of unidirectional Casimir force in the horseshoe-shaped configurations of reflecting plates." 16 years ago in the debate on the future of space flight, called Breakthrough Propulsion Physics Program<sup>1.10</sup> an idea was proposed that a force can be generated as a result of vacuum fluctuations pressure affecting the plate. This phenomenon was called *Differential sail*<sup>1.8</sup>. Now, theoretically, we have such an opportunity. Imagine a plate with deep trapezoidal grooves. The width of the groove is less than 50 nm; the depth is about 500 nm. In these grooves, because of vacuum fluctuations, the resonance density of virtual photons and zero-point energy is lower than outside. The grooves create a Casimir vacuum<sup>1.11, 1.12</sup>. There appears a force pushing the plate in the direction with grooves as attraction takes place (according to QED) not between atoms and molecules but to the region of space around them under pressure of virtual photons. Scientific texts can say this: Creating pressure gradient vacuum fluctuations by changing the boundary conditions on one of the surfaces.

## The emergence of uncompensated Casimir force.



### Implementation of conservation laws

Implementation of the law of conservation of energy. A. Under a similar process the missing energy is obtained by changing the cosmological constant, the so-called dark energy. B. By the disappearance of a small volume of space and the associated zero-point energy. In this case, the most correct way is to describe a similar process as follows: the withdrawal of minimum energy of a quantum mechanical system leads to its disappearance. In this case, the minimum energy is the energy of vacuum fluctuations. The quantum mechanical system is the volume of space. A classical analogous process is absorption of a photon.

Implementation of the law of conservation of momentum. The momentum of the body with such a drive is taken from the local momentum of virtual photons, and the local momentum of the virtual particle is part of the momentum of the universe. A classical analogous process is the comb's movement at a shallow uniform agitation.

### Conclusions, experiment and consequences

Conclusions: There is no theoretical solution of this issue. Conservation laws are fulfilled in both QED interpretations with the presence of zero-point energy, and without it. Both QED interpretations are not internally inconsistent. Similar powers can be found in at least three scientific articles<sup>2.1.1, 2.1.2, 2.1.3</sup>. In addition, a variant of this paradox is proved mathematically by an average level scientist<sup>2.1.3</sup> and NASA has recorded the draft of an EmDrive<sup>2.1.4</sup>.

That is why it makes sense to carry out a critical experiment that will determine the true QED.

Experiment: Make a plate, better of copper. Take a unit of single- or multi-electron-beam lithography. The force should be measured on the torsion balance. The experiment cost is \$5,000-50,000. A direct analogous process in classical physics is the comb's movement at a shallow uniform agitation. This experiment gives a positive result.

Consequences: The experiment is important because its outcome affects the interpretation of QED and development of mankind. In one case, we can use ZPE; in the other case ZPE does not exist. In the case where the Casimir force ZPE is created, we can use the energy and momentum of the ZPE. In the case where the Casimir force is created by the Van der Waals forces, the absence of ZPE will be proved and the problem of the cosmological constant will be solved.

## Related phenomena and scientific works

1. Physical phenomena and theories.
  - 1.1. Wikipedia [QED vacuum](#)
  - 1.2. Wikipedia [Quantum fluctuation](#)
  - 1.3. Wikipedia [Virtual particle](#)
  - 1.4. Wikipedia [Zero-point energy](#)
  - 1.5. Wikipedia [Vacuum energy](#)
  - 1.6. Wikipedia [Cosmological constant](#)
  - 1.7. Wikipedia [Vacuum catastrophe](#)
  - 1.8. Wikipedia [Casimir effect](#)
  - 1.9. R. L. Jaffe [The Casimir Effect and the Quantum Vacuum](#) (2005).
  - 1.10. Wikipedia [Breakthrough Propulsion Physics Project](#) (1996-2004).
  - 1.11. Wikipedia [Scharnhorst effect](#)
  - 1.12. Marcus Chown [Can photons travel `faster than light'?](#) (1990).
2. Mentions of uncompensated force in a some designs.

Note: The force's names are different. The schemes in which it occurs are different.  
Pseudoscientists discarded.

- 2.1. Antipin Alexandr Veniaminovich, [USING THE CASIMIR FORCE FOR THE CONTROLLED MOTION OF MACROBODIES](#) (2014).
- 2.2. I. G. Pirozhenko (Russian), [Casimir effect: from quantum field theory to the micro \(nano\) mechanical machines](#) Mention on page 12. (2009).
- 2.3. Alexander Feigel, [A magneto-electric quantum wheel](#) (2009).
- 2.4. Wikipedia [Quantum vacuum thruster](#)
- 2.5. Internet forum [Vacuum generator](#) (Russian). Mention on page 5. (2011).
- 2.6. Internet forum [Casimir Effect Engine](#) (Russian). Mention on page 1 (2014).

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