

# Suggested Theoretical Explanation for the Operation of the EM Drive

(C) Declan Traill 8/5/2015

[declan@netspace.net.au](mailto:declan@netspace.net.au)

## Abstract

The EM Drive is a propulsionless drive thruster that could be used in spacecraft. It uses microwave energy to generate thrust without the need for a propellant. Mainstream Physics is reluctant to recognise it as valid as it appears to break the law of conservation of momentum in its supposed operation, as it generates thrust without expelling a propellant during its operation. This paper suggests a possible theoretical explanation for its operation (using conventional Physics) whilst retaining conservation of momentum.

## Explanation

In reference to the confirmed testing of the EM Drive (Ref [1]):

After reading the theoretical paper (Ref [2]) explaining the supposed operation of the EM Drive I am left pondering the exact mechanism for its operation.

I would like to offer a possible mechanism for its operation that gives a clearer idea of what might be going on to produce the drive's thrust:

Essentially I think the microwave cavity is operating as a MASER (a microwave version of a LASER). The injected microwave energy is bouncing back a forth between the ends of the resonant metal cavity. The microwave energy energises the Quantum vacuum (if of sufficient intensity) such that virtual particles in this

vacuum are boosted to become more energetic, though not sufficiently to become permanent 'real' particles. I refer to these particles as quasi-real virtual particles.

The energy density of the microwaves is higher at the narrow end of the cavity and less at the wider end due to concentration based on the geometry. This causes a gradient in the excitation of the quasi-real virtual particles – thus there is effectively a higher pressure amongst the quasi-real virtual particles at the narrow end of the cavity. This causes the quasi-real virtual particle gas to expand and flow towards the wider end.

Then, as they move from the higher pressure region to the lower pressure region, they undergo a transformation: they undergo Stimulated Emission Of Radiation in their direction of motion. The emission is triggered by the stimulation provided by the microwave energy in the cavity (much like a MASER) and due to their direction of motion, the emitted radiation is directed towards the wider end of the cavity.

Therefore there is an increase in the amplitude of the microwave radiation directed towards the metal plate at the wider end of the cavity, and thus a greater transfer of momentum to that plate (compared to the plate at the narrow end). In the process, the quasi-real virtual particles lose energy and recoil in the opposite direction and fade back into the Quantum vacuum once more – thus they do not interact with the metal plate at the narrow end of the cavity.

In this way the EM Drive can generate thrust in one direction, and due to the interaction with the Quantum vacuum there is no actual breaking of the conservation of momentum.

## References

[1] **Daily Mail** *Nasa's 'impossible' fuel-free thrusters DO work: German scientists confirm viability of super-fast space travel that could slash a journey to the moon down to 4 HOURS* **29 July 2015**

<http://www.dailymail.co.uk/sciencetech/article-3177449/Nasa-s-impossible-fuel-free-thrusters-work-German-scientists-confirm-viability-super-fast-space-travel-slash-journey-moon-4-HOURS.html>

[2] Sawyer. R. *A Theory of Microwave Propulsion for Spacecraft* **2006**

<http://www.emdrive.com/theorypaper9-4.pdf>