EmDrive and momentum conservation

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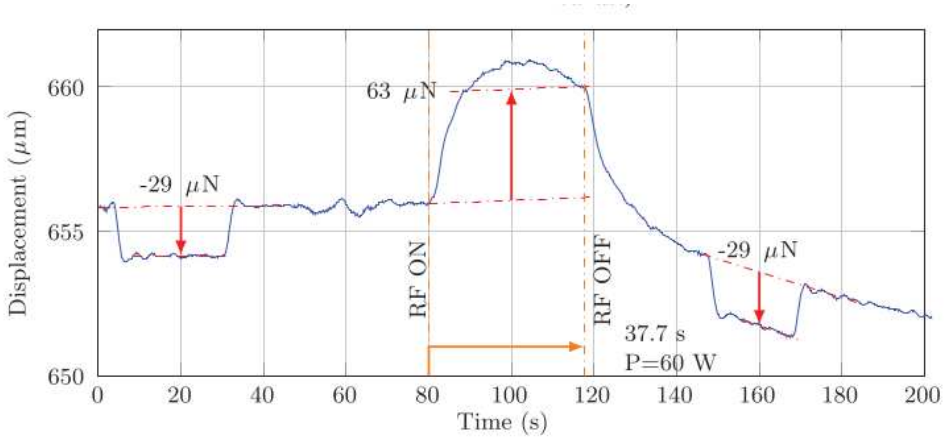
Abstract

In this short article we use the notoriety of the EmDrive to get more attention to the important theoretical paper [1] "Momentum conservation in electromagnetic systems" (removed by the moderators of arxiv).
More precisely, here we illustrate the meaning of the final comment:
"It might even be that the small results described in [2] have to be associated with the *impulsive internal forces* (we expect to observe) generated when turning on and off the EM-drive."

EmDrive: the impossible engine

The experimental results described in article [2] published on Journal of Propulsion and Power have caused a lot of clamour on the media. The observed effects, though being very small, seem to violate the fundamental principle of momentum conservation. Therefore they have been skeptically judged by the majority of physicists and mostly attributed to experimental errors.
In his article [3] G.Bettini understands that these results might be compatible with momentum conservation, but doesn't examine in dept the idea.
Let's now examine the behavior of the torsion balance in its light and reactive "split configuration "; the figure is taken from page 7 of the experimental report [2]:

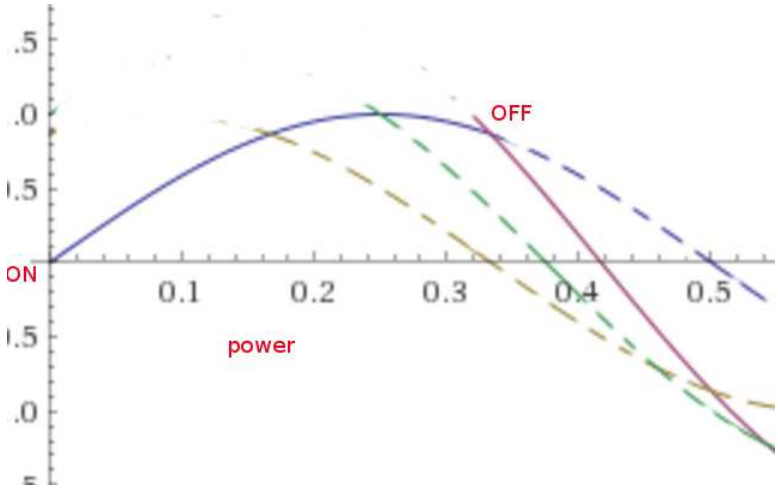


c) 60W forward thrust run at vacuum for split configuration

A possible theoretical interpretation

Unfortunately the behauviour of the torsion balance bearing the EmDrive can be discussed here qualitatively only, due to the lack of mechanical and electromagnetic data, needed for a quantitative analysis.

Neglecting the presence of an unsuitable damper, the balance is a harmonic oscillator having its own proper period; amplitude and phase of the oscillations may change as result of the impulses acting on the system. According to the dissertation developed in the fundamental article [1], if the electromagnetic field generated by the magnetron in the conical resonant cavity has a non-null axial linear momentum, we have to expect an axial internal impulse at the instant of the "power on" and an equal and opposite impulse at the time of "power off".
The behaviour of the oscillator (trivially calculable) is illustrated, in arbitrary units, in the following figure :



The oscillation is triggered by the "power on" at $t = 0$; the continuous line corresponds to a "power off" occured shortly after the maximum elongation, as in the previous experimental figure.
As you can see, the experimental behavior of the system seems to be compatible with the general theory developed in the paper [1], at least from a qualitative point of view.

References

[1] Elio Proietti
Momentum conservation in electromagnetic systems
vixra:1706.0107

[2] H.White, P.March, J.Lawrence, J.Vera, A.Sylvester, D.Brady, P.Bailey
Measurement of impulsive thrust from a closed radio-frequency cavity in vacuum
Journal of Propulsion and Power (2016)

[3] Giuliano Bettini
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