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How Violation of Newton's Third Law Can Pave Way to New Space Propulsion Mechanism via Optical Diametric Drive Experiment

[1]Victor Christianto*, [2]Florentin Smarandache

Author's Affiliations: [1]Malang Institute of Agriculture, Indonesia. Halton Arp Institute, affiliated to International Mariinskaya Academy, St. Petersburg
[2]Dept. Mathematics & Sciences, University of New Mexico, Gallup, USA.

***Corresponding author:** **Victor Christianto**
Malang Institute of Agriculture, Indonesia. Halton Arp Institute, affiliated to International Mariinskaya Academy, St. Petersburg
E-mail: victorchristianto@gmail.com

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ABSTRACT In our initial paper discussing plausible steps toward workable warp drive machines. The following article express our view on this debate. While there are still objections toward existing *warp drive* proposals, such as by G. Landis, Harold White *etc*., because they are all based on GTR, nonetheless we think it is possible by starting to see if it is possible to deviate from Newton's third law. And we discuss possible a propulsion method based on negative masses, and discuss how optical diameter drive can be first step for realistic lab-scale version of negative mass propulsion.

KEYWORDS Negative Mass Propulsion, Negative Mass Particle, Phonon Roton Superfluidity, Lab-Scale Warp Drive Experiment, Optical Diameter Drive Experiment.

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NEWTON'S THIRD LAW

Despite normally we think that action-reaction law is given, actually in some cases it can be violated, just like violation of Pauli principle (voP), perhaps we can call it with term: violation of Newton 3rd law (voN3L). In stating Newton's Third Law, we have assumed tacitly that (a) All forces are two-body forces, i.e. they act between a specified pair of objects and are not influenced by the presence of other objects; and (b) The net force on object i is the vector sum of the individual forces actingon it from all the other objects in the universe.

According to Ivlev *et al*. (2015), "There is a variety of situations in which Newton's third law is violated. Generally, the action-reaction symmetry can be broken for mesoscopic particles, when their effective interactions are mediated by a nonequilibrium environment."[1]

Terletsky/Winterberg's concept of negative mass particles

While only recently the experimental vindication of existence of negative mass particles are reported (see *Nature Communication*, 2021), actually it can be traced back to an eminent physicist from MSU, Yakov Terletsky, and also the late F. Winterberg (from University of Nevada).

Actually Terletsky wrote in his book, paradoxes in relativity theory, as follows:

"Along these lines, assuming that the parts of the vector are taken to be ar-
bitrary genuine numbers, then, at that point, equation concedes to three essen-
tially unique actual frameworks:
1. systems with positive proper mass, i.e., M2 ~ 0, E > 0;
2. systems with negative proper mass, i.e., M2 ~ 0, E < 0;
3. systems with an imaginary proper mass, i.e., M2 < o.

Thus, the system of the hypothesis of relativity advertisement
mits three sorts of basically various frameworks of which just sys-
tems of the principal kind are viewed as actually genuine."[7]

Although the notion of *negative mass* is quite controversial in the field of gravitation and cosmology studies, and by numerous authors its existence is forbidden, actually Pollard and Dunning-Davies show that it is possible to appear in Nature. [8]

Later on F. Winterberg, who was one of last finest students of W. Heisenberg, puts forth possible existence of phonon-roton model of superfluidity which are composed of positive and negative mass particles, which he coined as "*Planckions*."[8]

Although possibility of negative mass propulsion method has been discussed by several authors, including Winterberg [9]; among other things he wrote in abstract:
"Schrödinger's examination of the Dirac condition gives a clue for the presence of negative masses taken cover behind certain masses. Be that as it may, their utilization for impetus by decreasing the idleness of issue for instance, in the restriction of plainly visible bodied with zero rest mass, relies upon a specialized answer with the expectation of complimentary them from their detainment by sure masses. Apparently there are fundamentally two different ways this may be accomplished:
1. By the utilization of solid electromagnetic or gravitational fields or by high molecule energies.
2. Via looking for places in the universe where nature has effectively done this detachment, and from where the negative masses can be mined.
The first of these two prospects is for all viable means barred, since, in such a case that conceivable at all, it would rely upon electromagnetic or gravitational fields with strength past what is actually feasible, or on very huge in like manner not achievable molecule energies. As to the second chance, it has been seen that non-baryonic cold dim matter will in general aggregate close to the focal point of cosmic systems, or spots in the universe which have a huge gravitational potential
well "[9]

Although there are others who also investigate negative mass propulsion such as Robert L. Forward and Martin Tajmar and his team at Dresden University [10][11]; to these authors, an appropriate term is: "*Terletsky-Winterberg negative mass propulsion mechanism*." Nonetheless, to our knowledge we are still far to be in "operational scale" of negative mass propulsion engine as envisaged by F. Winterberg.[1]

Fortunately, there are recent lab-scale experiments using optical diametrical drive which made use of negative mass particle into practical lab experiments.

[1]This author is forever indebted to Prof. F. Winterberg who once sent his book, around 2010/2011, and to encourage him to continue further our investigation on superfluid phonon roton model of the Cosmos. But the book that he sent, with title something like: "Finititude theory of particles" was lost from trace.

OPTICAL DIAMETRIC DRIVE PROSPECT

Isaac Newton in his *Principia* expressed that for any activity there is an equivalent and inverse response. The consequences of this law of movement are presently being rethought by a group of specialists from the University of Central Florida and Germany who as of late completed an optical test that one day might help lead to new impetus frameworks.

"This strange interaction, which includes the idea of negative mass, imitates the conduct of a polar drive," said Professor Demetrios Christodoulides of UCF's College of Optics and Photonics. "Despite the fact that thoughts of this sort have been around for a long time, they have never been effectively sought after on the grounds that mass in nature is consistently a positive amount." Diametric drive alludes to the chance of an independent, space-impetus motor that works without the requirement for any outside fuel.

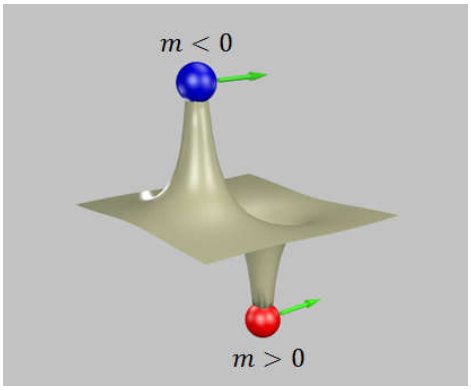

Figure 1: Diametric drive illustration [1]

The review "Optical polar drive speed increase by means of activity response balance breaking" as of late distributed on the site of *Nature Physics* and was important for a venture with other accomplice colleges. Mohammad-Ali Miri, a UCF graduate understudy in the Center for Research and Education in Optics and Lasers (CREOL), likewise took part in this work.

Another experiments, as reported by Pei *et al*.: "optical self-accelerating state driven by nonlinear coherent interaction of its constituting components with opposite "mass-sign". The coherent propulsion, highly immune to initial phase conditions, is surprisingly enhanced comparing to its incoherent counterpart."[4]

Acknowledgement
The present article is dedicated to VC's former professors at IGC, RUDN, including Prof. A. Yefremov (Director, IGC), Prof. Yu P. Rybakov, and also Prof. Yu Vladimirov. This writer can recall, back then to Dec. 2008 when he just arrived to Moscow and started to attending class of Prof. Yu Vladimirov, he asked this author: "*Where do you come from?*" I replied: "*Indonesia*." And the former professor replied: "*Ah, Indonesia? I remember Soekarno*." Although, in this article I don't cite any of his many publications on cosmology etc., but I recall that Terletsky also belonged to Moscow State University, as also great physicists like Prof. Lev Landau and Prof. Bogoliubov. MSU belongs to one of the best universities for physics studies in the world. Moreover, that simple comment by Prof. Vladimirov has motivated, somewhat in strange way, to do small experiment in Moscow streets, during early may 2009. In essence, Prof. Vladimirov helped him to become just an Indonesian scientist, not just trying to mimic someone else's figure. That is what he can say about Prof. Yu Vladimirov, he is one of such great teachers. To quote Plutarch: "*The mind is not a vessel to be fulfilled, but a fire to be rekindled*." [3]

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