Is it possible to control gravitation using an electromagnetic field?

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Abstract

American interest in 'gravity control propulsion research' intensified during the early 1950s. Literature from that period used the terms anti-gravity, anti-gravitation, barycentric, counterbary, electrogravitics (eGrav), G-projects, gravitics, gravity control, and gravity propulsion. Their publicized goals were to develop and discover technologies and theories for the manipulation of gravity or gravity-like fields for propulsion. Although general relativity theory appeared to prohibit anti-gravity propulsion, several programs were funded to develop it through gravitation research from 1955 to 1974. The names of many contributors to general relativity and those of the golden age of general relativity have appeared among documents about the institutions that had served as the theoretical research components of those programs. This question is intended to explore possibilities to control gravitation using an electromagnetic field.

Introduction

The present paper consists of some answers to a question raised above concerning possibility to control gravitation using electromagnetic field. Hopefully you will find some interesting hints on this question. Of course, these answers are not the final words on this very interesting issue.

Answers:

1. **Theophanes Raptis**

We are currently trying something to this direction...

Http://iopscience.iop.org/0264-9381/30/23/235004/

http://arxiv.org/abs/1310.5029

2. **Arno Gorgels**

I humbly believe yes. I believe (subject to proof) that the earth magnetic field is a result of the dependance of gravitational and electro-mechanical fields. See my last publication of today if you wish.

3. **Rudy Marty**

As you may know the chiral symmetry breaking effect in nuclear matter (for example in a proton) give a strong increase of the mass, which is a gravitational mass (i.e. it is affected by gravitational field). Then the trick would be to find a solution for the opposite effect, that is to say we have to apply a field (what kind ?) on atoms which affects the nucleus up to reach a "negative mass".

From purely theoritical point of view, the gravity is a scalar/tensor field (which affects velocity and acceleration), whereas the chiral symmetry gives scalar/pseudoscalar fields, and electromagnetism gives scalar/vector fields. From this consideration I doubt seriously that someone can master the gravity with *only* an electromagnetic field.

4. **James Dwyer**

Gravitational effects can be offset by opposingly directed magnetic field effects - like mag-lev trains, etc. Unless there was a EM component of gravitational effects, it's not likely that any direct control mechanism could be implemented.

Even cold bodies in the absence of magnetic fields exhibit gravitational effects in proportion to the gravitational constant, as do bodies with global magnetic fields. This seems to indicate that there is no relation between EM and gravitational effects.

5. **Musaab Alshargabi**

Lenz's law may help! we can control the gravity of an object . Just the concept may deliver some ideas I guess.

6. **Mark Kennedy**

I guess we will need to wait for the next Einstein to give us a Grand Unified Theory or a Theory of Everything.

That is unless a great engineer comes along and simply builds a working device before the theory is developed to explain it (as has often happened in the past). In this case I would expect this to be unlikely, assuming the required device to be rather complex in nature.

Of course we can consider electromagnetic fields which of course can transmit energy (photons), which by definition also have mass and hence gravity.

If we could somehow 'invert' an electromagnetic field to harvest energy, perhaps it would give rise to anti-particles of negative mass. Sounds a lot like Sci-Fi.

Of course we have things like the Casimir effect, the Lamb shift and vacuum energy, which show that the universe is a truly strange place.

7. **Antonio Alfonso-Faus**

One can have a propulsion system for rockets based upon the directed emission of photons, electromagnetic waves. One example would be a flashlight inside an orbiting artificial satelite: the astronaut, in free fall with no gravity acting, may hold the flashlight and "drop" it. Then the flashlight would be accelerated through the room propulsed by photons. It could easily acquire a velocity of the order of one centimeter per second, and accelerating. The principle of equivalence establishes that an accelerated system is equivalent to a system at rest but acted by a gravitational field. In general electromagnetic fields carry momentum, and a change in their properties imply a momentum change which is a force. And we can use this force to counterbalance gravity.

8. **Ning Wu**

Dr. Podkletnov had already done an experiment of gravity impulse. In that experiment, a gravitational impulse is generated in a high voltage discharge equipment. It is a way
to control gravity using electromagnetic method. This phenomenon can be explained in gauge theory of

gravity.

9. **Alexander Burinskii**

In my paper:(A.~Burinskii, The Dirac-Kerr-Newman electron, Grav. Cosmol. 14 (2008) 109, [arXiv:hep-th/0507109 v.4) was considered wonderrful thing that the Dirac equation may be implemented as a master equation in the Kerr-Schild fomalizm for the rotating black hole solutions. Since Dirac equation is controlled by the EM field, there appears the possibility of control also the gravitational objects. The details of the corresponding modification of the Kerr-Schild formalizm are now under consideration and I expect to publish it .

10. **Afaq Ahmad**

Dear Victor Christianto, I am not knowing whether it is possible or not to control gravitation using an electromagnetic field. But I have come across a paper entitled "Gravity Control by means of Electromagnetic Field through Gas or Plasma at Ultra-Low Pressure".
The paper is accessible via link provided below.

http://arxiv.org/ftp/physics/papers/0701/0701091.pdf

11. **SMJ Mortazavi**

Dear All
Technologies such as magnetic levitation trains do not indicate that we can fully control the gravitation. The forgotten point is the strength of a magnetic field decreases dramatically with increasing distance from the source. By the way, the key question will be how to prevent the rapid fall of magnetic fields at long distances.

12. **Sundaresan Muthuswamy**

I have an instinctive feeling that electromagnetic field or waves is one of the variants of gravity itself. In the universe electromagnetic waves and gravity co-exist. No gravity means no universe and no electromagnetic waves means no life or the physical existence of the world based on evolution. There is nothing like reverse gravity. But there is attraction and repulsion in magnetic fields in a gravitational field. Perhaps examining the reason for magnetic fields, its source and creation may throw some light. Levitation is one offshoot as such. As the world principle arises from gravity concept I think it will be impossible to beat it as long as we live on this Earth.

13. **Roger Ellman**

Yes. See my ResearchGate Article: Gravitational and Anti-gravitational Applications.
It is also available at http://www.the-origin.org/SciencePapers.htm "Applications".

14. **Xiang Liu**

Thanks, for the interesting topic, I imagine the there might be some relation between the electromegnetic energy (force) and gravitational enegery (force), to study this field in astronomy may be possible.

15. **Theophanes Raptis**

btw, the Chinese claimed to have made their first breakthrough

http://www.wired.co.uk/news/archive/2013-02/06/emdrive-and-cold-fusion

Incidentally, Minotti have managed to provide an explanation in the context of scalar-tensor theory

http://arxiv.org/abs/1302.5690

16. **Laurent Damois**

Electromagnetic Field = Electromagnetic Energy
If you create around a device, an asymetrical Energy distribution you create an Energy gradient, so you create a force (very easy to do, low cost and homemade possibility)
So the answer is YES.
I am working on with success (great thrust for low input power).
The device is similar to asymetric capacitor (apparent reactionless thruster, tested with success by NASA in vaccum)
The device works in AC or DC (thrust is propotionnal to the square of the voltage or the square of the intensity)
Force = gradient(Energy)
Energy = Energy of an asymetric Coil or Capacitor
Asymetry = Asymetry of the shape, Asymetry of the material (core, dielectric)

17. **Theophanes Raptis**

@ Laurent
This reminds of the old Bieffeld-Brown effect which was recently shown to be due to air ionization. Even a recent NASA patent that made similar claims for sat navigation shown not to be able to produce the same effects in a vacuum chamber

http://techtran.msfc.nasa.gov/technology/MFS31887-Cylindrical-Asymmetrical-Capacitor.php

18. **James Dwyer**

Theophanes,
Very interesting, but I'm also skeptical (any theoretical associations aside) - if the microwave thruster was interacting with a gravitational field then its thrust should vary with altitude/mass separation distance...

19. **Theophanes Raptis**

@James

Perhaps but the situation is a bit complicated when you try to make actual calculations with the modified Maxwell equations due to some hard nonlinearities. At first sight, it seems that the type of coupling implies the ability of a strong EM field to excite it's own gravito-electromagnetic components in the surrounding space. Unfotrunately, we do not yet have performed the simplest experiments to get a hold on real data.

20. **Laurent Damois**

@Theophanes
In vaccum the asymmetric capacitor create a thrust (gradient of energy) without ions (no air), in air we have an additive thrust with ions
http://www.youtube.com/watch?v=G359-G4SZlE
@James
the thrust created by the asymmetric capacitor is not necessary a "anti-gravitationnal" force we are in "similar equibrium" when we write that Charge * E Field = Masse * Acceleration, we have equilibrium but E Field is not an anti-gravitationnal Field.

@Theophanes and James
see the third report
http://www.gravitecinc.com/document.html

21. **Sundaresan Muthuswamy**
    I have a basic question as to how a magnet and magnetic field gets formed, what makes a source and a sink? Can we simulate artificial gravity?. What is the difference between an armature coil spinning inside a magnetic field and the earth spinning in an universal field: and is there any link however small it maybe?

22. **Victor Christianto**
    Dear Sundaresan, perhaps this link can help answer your question:
    http://en.wikipedia.org/wiki/Gravitomagnetism

23. **Theophanes Raptis**
    The subject of electromagnetic mass was treaten by the late Barut Zanghi models. Yet, there are problems with self-energy which are now discussed again by me and Dr Kingsley - Jones in the context of Maxwell - Dirac theory. The trick is to find whether there are stable solutions under the condition of hydrodynamic stability known as force-free condition. It is notable that Einstein was the first to propose the curl eigenfields as a possible alternative for elemetnary particles. Check also this link http://krwjones.com/wordpress/2013/06/10/beltrami-fields/

24. **Arkadiusz Jadczyk**
    Interesting read, Theophanes. Maxwell-Dirac theory may be not enough. Going beyond U(1) electrodynamics to a higher gauge symmetry may be needed for obtaining stable solutions. At least that is my intuition. Of course already Maxwell-Dirac is difficult enough!

25. **Theophanes Raptis**
    Perhaps that would be necessary, especially if forthcoming experiments show tha validity of Mpelek - Lachieze-Ray modification of scalar-tensor gravity. Only that I am not sure what kind of conserved quantities should be associated to these hgher symmetries - and I am not that optimistic with SUSY approaches.

26. **Kimmo Rouvari**
    Interesting question. Based on my own research it would be worthwhile to study behaviour of matter with great nuclear spin in horizontal magnetic field.

27. **Alexander Burinskii**
    Dear Christianto and Arkadiusz,
    I would like to pay your attention to my paper Dirac-Kerr-Newman electron
    hep-th/0507109 v4, where Dirac eqs plays the role of a master equation controlling the motion of the Kerr spinning particle.
    The problem is that there is no accelerated Kerr solution, and I work on that now.

28. **Arkadiusz Jadczyk**
    Perhaps it may useful to draw the attention of all of you who are interested in the subject to an old paper by A. K. T. Assis "Deriving gravitation from electromagnetism", Can. J. Phys. 70, pp. 330-340 (1992). He derives something that resembles the Newtonian gravitational force from the fourth order effects in a generalized Weber's force law.

29. **Arkadiusz Jadczyk**
Dear Alexander, I will dare to be a little bit more precise: I had in mind something of the kind "The relation between F (R) gravity and Einstein–conformally invariant Maxwell source" (http://arxiv.org/abs/0907.2520 , Sec. IV.). Perhaps glancing over this paper will help you in some way. That was my feeling .... but I may be also completely off the the road here. Anyway: good lack with your project!

30. **Victor Christianto**
Dear Arkadiusz, i find Assis,s paper in 1992, but cannot obtain his pdf because it needs authorization. But i can obtain his newer 1995 paper at http://www.ifi.unicamp.br/~assis/gravitation-4th-order-p314-331(1995).pdf. While his idea seems interesting, i am not sure how it explains about how one can control gravitation using electromagnetic field, furthermore there is no hint of experimental result. Can you perhaps explain his ideas further? Thank you

31. **Arkadiusz Jadczyk**
Dear Victor,

I do have Assis' paper, 92 paper, but probably the newer version is enough for you to get the idea. Now, IF gravitation is indeed a fourth order effect of a (perhaps generalized) electromagnetism, then all what we know about gravitation needs to redone, and this should open new door towards the issue of "controlling gravitation).
If there was some experimental confirmation, we would have either Nobel Prize or another case of a research that gets deeply buried on purpose!
So, instead of asking whether there are experimental confirmations, it is better to ask if there are experimental refutations. Not that I know about.

32. **Arkadiusz Jadczyk**
Dear Victor, let us hope that CERN"s AEGIS experiment will be completed one day.

In the meantime we can contemplate astrophysics lessons. To quote from Vilata's paper:

Gravitational interaction of antimatter

"This theoretical prediction of antigravity between matter and antimatter supports cosmological models attempting to explain the observed accelerated expansion of the Universe through such a repulsion between equal amounts of the two components.
The gravitational repulsion would prevent the mutual annihilation of isolated and alternated systems of matter and antimatter. The location of antimatter could be identified with the well-known large-scale (tens of Mpc) voids observed in the distribution of galaxy clusters and superclusters. Indeed, Piran [25] showed that these voids can originate from small negative fluctuations in the primordial density field, which (acting as if they have an effective negative gravitational mass) repel surrounding matter, and grow as the largest structures in the Universe. These new cosmological scenarios could eliminate the uncomfortable presence of an unidentified dark energy, and maybe also of cosmological dark matter, which, according to the Λ-CDM concordance model, would together represent more than the 95% of the Universe content.

If large-scale voids are the location of antimatter, why should we not observe anything there? There is more than one possible answer, which will be investigated elsewhere."

33. **Victor Christianto**
Dear Arkadiusz, thanks for citing paper by Villata. I find his idea on antimatter interesting, however it lacks detail of the observables as result of his hypothesis.

Btw, I just found an interesting but rather old paper by Tajmar and de Matos (2001), with title: Coupling of Gravitation and Electromagnetism in the Weak Field Approximation, http://arxiv.org/abs/gr-qc/0003011. Tajmar is from Austria, while de Matos is from ESA. In case you are interested, i include here their paper.

Their abstract is as follows:
"Using the weak field approximation, we can express the theory of general relativity in a Maxwell-type structure comparable to electromagnetism. We find that every electromagnetic field is coupled to a gravitoelectric and gravitomagnetic field. Acknowledging the fact that both fields originate from the same source, the particle, we can express the magnetic and electric field through their gravitational respective analogues using the proportionality coefficient k. This coefficient depends on the ratio of mass and charge and the ratio between the electromagnetic and gravitic-gravitomagnetic permittivity and permeability respectively. Although the coefficient is very small, the fact that electromagnetic fields in material media can be used to generate gravitational and gravitomagnetic fields and vice versa is not commonly known. We find that the coupling coefficient can be increased by massive ion currents, electron and nuclear spin-alignment. Advances in material sciences, cryogenic technology and high frequency electromagnetic fields in material media may lead to applications of the derived relationships."

Their more recent papers discussing gravitomagnetic effects of rotating superconductors. Their model is based on Maxwell/Proca equations.

34. **Victor-Otto De Haan**
Experimentally, gravity between anti-matter and matter has not been esthablished yet, nor has anti-graity. AEGIS is trying to perform such an experiment, although not with elementary particles, but with compound ones that might react differently then elementary (anti-)particles. I wrote a proposal to repeat an experiment with electrons and positrons, based on the experiment done by Witteborn and Fairbanks. A first draft of this proposal is outlined in : arXiv:1101.2063v1 . I have a cost estimate available for a complete experiment, which would be of the order of 10 MEuro. Extremely moderate costs compared to experiments at large scale facilities...

35. **Arkadiusz Jadczyk**
Dear Victor, I have had some exchanges with de Matos in the past. They are using linear approximation, so the effects they reliably get are small. On the other hand there may exist large non-linear effects. Then the question is: how stable they are?
Concerning possible antigravity/antimatter question (mentioned by Victor-Otto Haan), I really do not understand why Witteborn-Fairbanks experiment has not been repeated till now!

Concluding Remarks

While this discussion is not conclusive yet, apparently we can draw a preliminary summary that there is perhaps similar features between gravitation and electromagnetic field, and that it is possible to control gravitational field using electromagnetic field. We hope that future research will confirm this with experiments, such as what have been done by Podkletnov etc.

References:

[1] De Aquino, F. (2007) Gravity Control by means of Electromagnetic Field through Gas or Plasma at Ultra-Low Pressure, arXiv:physics/0701091, URL: http://arxiv.org/ftp/physics/papers/0701/0701091.pdf

[2] De Aquino, F. (1999) Gravitational Spacecraft, arXiv:physics/9904018

[3] M. Tajmar, C.J. de Matos (2003) Gravitomagnetic Field of a Rotating Superconductor and of a Rotating Superfluid, Physica C385 (2003) 551-554. Also arXiv:gr-qc/0203033

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