Supplementary Material 1

Experimental design

The configuration is as the Figure 1. It is noted that the body need be inside in the electric/magnetic field.

**1. Device and condition**

1) For magnetic field

A Stable uniform magnetic field with $B\geq 20 Tesla$; A magnetic insulation body with 50g; A scale with the precision of 10-6g.

2) For electric field

 An uniform electric field with $E\geq 10^{4}kV/m$; A body of 50 g with $ε\_{r}=34000$; A scale with the precision of 10-6g.

3) It is noted that, as the electric/magnetic field is not uniform, the energy density of the field need be revised according to Eq.(1) or (3).

2. **Method**

To measure the difference of the weight of the body between inside and out of an electric/magnetic field.

3. **Possible measured result**

1) For the magnetic field

According to Eq.(2) or the Table 1 in Ref.[], in a magnetic field with 20T, the gravitational acceleration of the Earth should be varied $∆g=1.2×10^{-5}ms^{-2}$. It should make the weight of a body with 50g varied almost $6×10^{-5}g$.

2) For the electric field

According to Eq.(4), there should be $△g=1.18×10^{-6}ms^{-2}$ as the weight of the body is 50g.

4. **Modern technology for the experiment**

1) For the magnetic field, there are the stable magnetic field with 40 T in Hefei of China and in American. For the electric field, $E\geq 10^{4}kV/m$ need $V\geq 10^{2}kV$ and $d=10^{-2}m$.

2) Modern gravity meter is with the precision of $10^{-8}ms^{-2}$, so the variation of gravitational acceleration of

$△g=1.18×10^{-6}ms^{-2}$ can be easily measured. The METTLER-TOLEDO precision balance is with a range from $10^{-6}g-52g$. So, the variation of $6×10^{-5}g$ of a body with 50g can be easily measured.

5. **Difficulty for the experiment**

The difficulty is to avoid the interference of the electric/magnetic field on the device.

1) The magnetic insulation materials are usually produced with Ni-Fe Alloy. It is a well-developed technology now.

2) The strong magnetic field has an interference on the scale. We can use a long magnetic insulation line to pend the sphere into the magnetic field.

3) The scale need be specially designed and manufactured.

6. **Further test for Eqs. (5) and (6)**

 To test Eq.(5), the body in the electric/magnetic field can be replaced with superconductivity and the materials of $ε\_{r}\rightarrow \infty $ and $μ\_{r}\rightarrow 0$. For example, put a superconductivity inside a magnetic field.

 To test Eq.(6), there two ways. First, making the electric/magnetic field varied. Second, let the body moved in the electric/magnetic field.

An instantaneous large $△g$ may be observed for that a very large initial electric/magnetic field can be produced by that a switch is on or off.

 It is noted that, an instantaneous initial electric/magnetic field is unknown. It need be measured immediately.

7. **Conclusion**

This is a simple experiment. Modern device and instruments can make the measured result with very high precision.

Supplementary material 2

A simple review on the experiments for the gravitational effect of electric/magnetic field

It was reported that the gravitational effect of electric/magnetic field was observed in experiments.[2-17] There are these features in these experiments: 1) The hypotheses for the reasons to produce the gravitational effect are different; 2) The experimental designs with the device and instruments are different; 3) The values of the electric/magnetic fields are different. 4) The operations of the experiments are different; therefore, 5) The observed results are different. At the same time, the experiments of null results were reported.[17-19] Therefore, it is very difficult to assess whether or not this effect does exist and what is the exact express of this effect.

Many hypotheses are presented to explain these experiments. However, these hypotheses are difficult to be generally accepted.

We think, the key is to clarify whether or not there is the gravitational effect of electric/magnetic field.

From the gravitational redshift, it can be concluded that, the gravitational acceleration of the Earth could be affected by the strong electric/magnetic field. Theoretically, as the energy of the photons is shifted by gravitational field through gravitational redshift, the energy of the gravitational field is of course shifted correspondently by the photons. For the reason, we think, the experiments in Refs.[2-5] could be understood and explained with our Eqs.(2), (5) and (6).

For Eq.(5), the gravitational effect of superconductivity should be possible. For superconductivity, there is $μ\_{r}=0$. As $μ\_{r}\rightarrow 0$, from Eq.(5), there is $∆g=\sqrt{fG/μ\_{r}μ\_{0}}B\rightarrow \infty $. From Figure 3 we know, a $∆g$ close to the value that was observed in the experiments of [2-5] may be possible.

For Eq.(6), the varying electric field was used in 4 experiments.[2,3,6,13] First is Podkletnov and Modanese’s [2,3] experiment. It was observed that the gravitational effect is varied with the varying electric field. Second is experiment [6, 13]. In their experiment, the effect is varied with the discharge. As pointed out, a very large initial electric/magnetic field can be produced by that a switch is on or off. Therefore, a large gravitational effect may be produced in these experiments.[2,3,6,13]

We noticed that, in 3 experiments[17-19] the null result was reported. But, the conditions, such as the value of the electric/magnetic field, in these are different. In Ref.[20], after reviewing the experiments and theories for the gravitational effect of superconductivity, Solomon had a conclusion for the conditions that need to be met for any future experiments. Of his 7 conditions, there are: “First, an electrical field with surface field strength on the order of 107 N/C. Second, a magnetic field on the order of 15T.” The analogous conditions are also listed in the Table 1 and 2 in Ref.[21] Therefore, we think, the experiments in Refs.[2-5] may be the supporters of our work. And, it is too arbitrary to claim that the gravitational effect of the electric/magnetic field has been unproven.

 From Eq.(5) and Figure 3, we know, to arrive at $△g=1×10^{-3}ms^{-2}$, it is needed that $B=1T$ and $μ\_{r}=10^{-10}$, or $B=10T$ and $μ\_{r}=10^{-8}$. In this case, the weight of a body may be changed on the level about 0.01%. In a very rough standard, the predicted result is accordant with the experimental results in Refs.[2-5].

For these reasons, we have the conclusions: 1) The current experiments could show that, in a high probability, the gravitational effect of electric/magnetic field is possible. 2) These experiments may be understood and explained with the equations in our works. Therefore, these experiments may be supporter of our work. 3) So, further experiment is needed. 4) As pointed out in Refs.[20,21], in future experiment, these conditions need be stressed: the electric field need be $E\geq 10^{6}kV/m$, the magnetic field $B\geq 10T$. Considering Eqs.(5) and (6), as $ε\_{r}\rightarrow \infty $ and $μ\_{r}\rightarrow 0$, less E and B can be possible. Therefore, superconductivity may be a prior choice. The possible result can be known from Eqs.(5) and (6) and Figure 3. It is noted that, it is difficult to know the value of $ε\_{r}$ and $μ\_{r}$ which need be measured immediately.

Table 1. Experiment of superconductivity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Podkletnov 1 | Podkletnov 2 | Rounds | Tajmar |
| magnetic field |  | 2T | 0.5T | 20mT |
| Weight variation (%) | 0.05-0.3 | 0.3-2.1 | 0.05-0.1 | 10ug |

Supplementary material 3

Comment on “Put Strong Limits on All Proposed Theories so far Assessing Electrostatic Propulsion: Does a Charged High-Voltage Capacitor Produce Thrust?”

Yin Zhu（朱寅）

Agriculture Department of Hubei Province, Wuhan, China

Email: waterzhu@163.com

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**Abstract:** Prof. Tajmar and co-worker claimed that, our result in the paper “Gravitational-magnetic-electric field” was ruled out by their experiment. But, factually, their conclusion about our work is simply and clearly wrong.

 In the paper “Put Strong Limits on All Proposed Theories so far Assessing Electrostatic Propulsion: Does a Charged High-Voltage Capacitor Produce Thrust?”,[1] Prof. Tajmar and co-worker claimed that, our result[2] was ruled out by their experiment. But, factually, their conclusion about our work is simply and clearly wrong.

 First, it is clear wrong that Tajmar and co-worker classified our work into the Ivanov’s model. Our work is radically different from Ivanov’s although Ivanov’s equations[3] are $F\_{g}=\sqrt{Gε\_{r}ε\_{0}}E$ and $F\_{g}=\sqrt{Gμ\_{r}μ\_{0}}H$ while our equations are $∆g=\sqrt{fGε\_{0}}E$ and $∆g=\sqrt{fG/μ\_{0}}B$. But, it is noted that, Ivanov’s equations are different from ours physically and mathematically. In physics, Ivanov’s equations[3] means that “Strong gravitational force induced by static electromagnetic fields.” Our equations means that the local gravitational acceleration of the Earth could be changed by a magnetic or electric field. In mathematics, in our equation, there is a gravitational redshift factor ƒ$≈6.95×10^{-10}$. This factor makes that the possible measurable force in our equations is much less than that in Ivanov’s.[3] And, in our work, the variation of the gravitational field is just because of the gravitational redshift. So, the factor ƒ$≈6.95×10^{-10}$ is not only a mathematic constant, but an description of the process of physical interaction.

 Second, in the Table 2 of our paper[2], we clearly showed, to test our work, the electric field need be E=1×106kV/m to make a measurable variation of $∆g=1×10^{-7}ms^{-2}$. But, in Tajmar and co-worker’s experiment[1], there is only $E\leq \frac{1}{7}×10^{4}$kV/m. According to our work, as $ε\_{r}=4200$ is considered, Tajmar and co-worker’s electric field is still too little to make the variation of $∆g=1×10^{-7}ms^{-2}$.

Third, Tajmar and co-worker’s[1] balance cannot measure the variation of the gravitational acceleration on the level of $∆g=1×10^{-7}ms^{-2}$ which is correspondent to that the variation of the weight of 1kg is $1×10^{-5}$g. But, Tajmar and co-worker’s balance only can measure the variation of the weight larger than 0.3$×10^{-3}$g and the weight of the body they used only is 2$×5.8g$.

It seems that Tajmar and co-worker misunderstood the physics and mathematics in our equations and neglected the gravitational redshift factor ƒ$≈6.95×10^{-10}$ in our equations. Then, how can they obtain their conclusion about our work?

**References**

[1] Tajmara M., Schreiber T., Put Strong Limits on All Proposed Theories so far Assessing Electrostatic Propulsion: Does a Charged High-Voltage Capacitor Produce Thrust? Journal of Electrostatics 107 (2020) 103477

[2] Zhu Y., Gravitational-magnetic-electric field interaction, Results in Physics, 10 (2018) 794

[3] Ivanov B.V., Strong Gravitational Force Induced by Static Electromagnetic Fields, 2004. <http://arxiv.org/abs/gr-qc/0407048>.