

(1)

## Generalized Relativity Extended

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### ABSTRACT:

The present document starts from the relative existence of the electromagnetic field, reaching through mental experiments to its connection with the gravitational field, without the necessity to resort to other space - time dimensions or supplementary "exotic" particles.

**The main idea is:** Generalized Relativity says, through the Equivalence Principle, that local we cannot distinguish between the effects of an accelerated movement (effects of an acceleration field) and the effects of a gravitational field. Knowing that an electron located in a field of acceleration (accelerated) will radiate in report to an observer outside of the acceleration field effect, then through the aforementioned equivalence, and an electron being at rest in a gravitational field, has to radiate in reference to an observer who is outside of that gravitational field.

In conclusion, it explain why we have expansion "super-accelerated" of the universe, without the necessity of dark energy.

**Keywords:** connection ~ union; acceleration field ~ effects of an acceleration; commoving observers - moving together; "exotic" particles - elementary particles „invented”; assembly ~ bring together (jointing); expansion of the universe – astronomy; quantum mechanics –the mechanics of elementary particles; dark energy- hypothetical form of energy with controversial existence (with controversial properties) [12][13][14][15].

(2)

## I. INTRODUCTION:

As support for the theory set out in the title, I have two other theories tested and accepted today, as follow:

- 1) – The Electromagnetic Field Theory completely defined by the four Maxwell's equations, which state that, a variable electric or magnetic field (namely in accelerated motion) radiates electromagnetic energy (an electromagnetic field);
- 2) – The Theory of Generalized Relativity formulated by Albert Einstein who starting from the local equivalent of a non-inertial reference system with a gravitational field, was able to generate the General Principle of Relativity which states that all systems of reference are, in principle, equivalent between them (no matter the form of motion, rectilinear and uniform or accelerated). By which he meant that an event in a reference system must be seen as an event in all other reference systems (accelerated or not), it remains this way (namely an event) even if seen in a diverse form. [1] (Furthermore, the equivalence principle says that an event (phenomenon) that can be carried out in a non-inertial reference system takes place in an inertial reference system located in a gravitational field (eg the Earth)).

## II. THEORETICAL STUDY:

In order to better understand my reasoning, imagine an "U" Universe where there are only two observers - the "A" Observer placed in a box, equipped with various devices for testing and observation, together with an static electric field (electrical charge jointly with floor box), and in another box the "B" observer with the same experimentation and observation apparatus, situated at a considerable distance one to the other. The two observers communicate between them using two devices, which do not influence the experiment. [7]

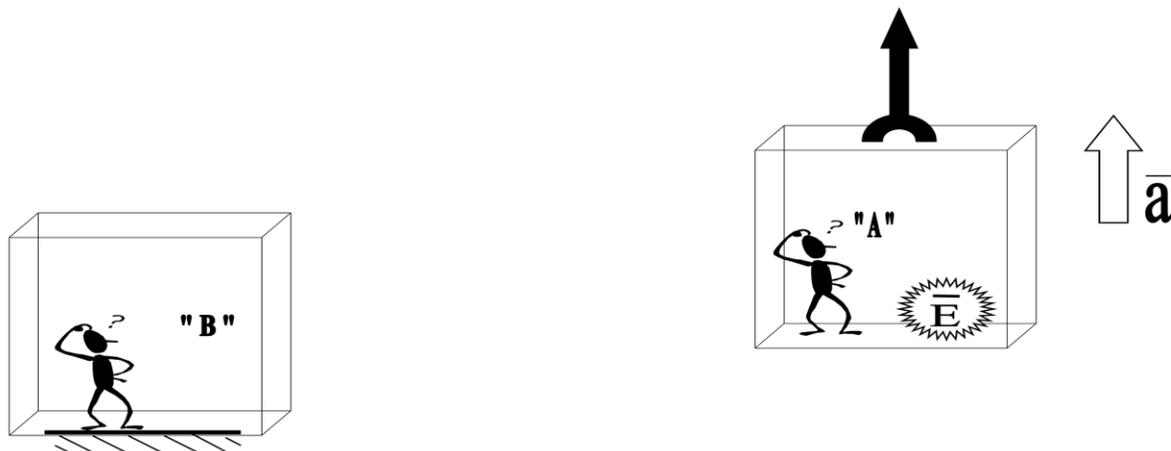
Initially, these two observers with their boxes, are at rest, one compared to the other.

By communicating one with other, the observers will have:

- Observer A to B: I observe (I detect) only an electric field in this Universe.
- Observer B to A: I also observe only an electric field in this Universe.

Consequently, the two observe only a single phenomenon in the whole universe - an electric field. Without a light source, they will not be able to see between them.

At a certain point, the box of the "A" observer begins to move in report to the box of "B" observer, with a constant acceleration (how it moves, it doesn't matter) (fig.1).



**Fig.1:** The box of the "A" observer begins to move in report to the box of "B" observer, with a constant acceleration .

(Figures were drawn by M.A.)

(3)

Observer "A" located in our box together with an electric field, feels a force (acceleration) directed "down" through the legs and if he lets different bodies from different masses to drop, observes that all bodies "fall down", all touching the floor box at the same time, no matter composite matter or physical state of the bodies in question, as it Galileo concluded that happens in the gravitational field.

After a while (let's say ten seconds from the accelerated movement of box), the change of information between the two observers will be:

- Observer B to A: - I do not know what you see, but for me the things have changed and now I observe radiation of electromagnetic energy (an electromagnetic field).

- Observer A to B: - And for me things have changed. Someone introduced me, entirely with the box and electrical field, in a field of acceleration. For this field of acceleration, I have the two explanations:

-1). – The box in which I am (along with testing and observation appliances and electric field) is accelerated;

-2). -- I was introduced within the box in a gravity field. The principle of equivalence says that I cannot make a distinction between these two cases (1 and 2).

- Observer B to A: - If things are for you this way, it means that to explain the appearance of electromagnetic field, the principle of equivalence makes that I also have the two equivalent cases:

- 1'). – The case in which your box (along with testing and observation appliances and electric field) is accelerated, a normal case (if an electric field is accelerated, it will radiate an electromagnetic field). This means following formula:

electric field accelerated = electromagnetic field (radiation of electromagnetic energy)

or better said:

$$\mathbf{E} \times (\text{multiplied by}) \mathbf{a} = \mathbf{W}_{EB} , \quad (11.1)$$

where:

-  $\mathbf{E}$  - describes the electric field;

-  $\mathbf{a}$  - describes the acceleration;

-  $\mathbf{W}_{EB}$  - describes the electromagnetic field.

- 2'). – The case in which you (box and electric field) have been introduced within a gravity field, a very interesting case. If you (the "A" observer, together with the box and electric field), have been introduced in a gravity field, and I observe (I detect) the appearance of the electromagnetic field, it means that this new field that I see, is actually the result of interactions between the electric field with the gravitational field. Therefore, I can say that a combined field of gravity with an electric field generates an electromagnetic field. This means following formula:

electrical field **in a** gravitational field = electromagnetic field ,

or:

$$\mathbf{E} \cdot \mathbf{g} = \mathbf{W}_{EB} \quad (11.2)$$

where:

-  $\mathbf{g}$  - describes the gravitational field.

(4)

This represents **Generalized Relativity Extended** (G.R.E.) to a electromagnetic field or "The Unification (Connection) Theory of the electromagnetic field with the gravitational field (U.T.E.F.G.), that can expressed like this:

*When introducing an electric field in a gravitational field (acceleration field), an electromagnetic field always appears*

or:

*There is no method to distinguish between an electric field combined with a gravitational field (electro-gravitational field) and an electromagnetic field.*

*[One can say that the electro-gravitational field and electromagnetic field, are complementary - once you are inside of the "electro - gravitational field" ("commoving observers" ) one can notice a manifestation in a decomposed mod of the field, and when you are outside it, you notice a manifestation as a unique field (i.e. and electromagnetic field).*

*We can also see that an observer, who sees from the left side of the equality member - "commoving observers" [8][9][10]- (gravity field + electric field) doesn't see from the right side of the equality (electromagnetic field ). These events have a dual character, cannot be seen any time at the same time. The two fields are different manifestations of the same single field. ]*

Mach claims that the acceleration "felt" by a body is due to the gravitational attraction exerted by all masses in the Universe on that body. That means that gravity "generates" acceleration - acceleration doesn't exist without gravity. So the two cases (1 and 2) get down to one. Therefore, the case connected to gravity is the real case.

But, given the fact that there is equality, the terms on the left should describe the same thing as the right terms of the equality. So, to say that an assembly of gravity field with an electric field generates an electromagnetic field, is the same thing as admitting that you cannot make a distinction between combination of gravity field with an electric field (I named it electro-gravitational field) and (compared to) an electromagnetic field. Therefore the two fields are equivalent.

### **III. DEVELOPMENT of the THEORETICAL STUDY:**

**3.1** To better understand that which is stated above, it is necessary to undertake another mental experiment:

We take a disk large enough to bear a "X" observer, who is anchored at that disk.

This disk is equally divided in two colours - yellow and blue. Suspended somewhere above the disk, there is another Y observer, that sees the disk and the colours on it, but it doesn't see the X observer.[3]

Initially, the two observations will be:

- observer X to Y - I see a disk divided in two colors, yellow and blue;
- observer X to Y - I see a disk divided in two colors, yellow and blue, which means seeing the same thing, blue + yellow = blue + yellow.

At one point the disk begins to rotate around the imaginary centre, and the two observations will be:

- observer X to Y - I see a disk divided in two colors, which I could see initially, but there has also appeared a field of acceleration, which I can feel;
- observer X to Y - I see a coloured disk in a single color - green. I think that I actually see the result of interactions between the field of acceleration and the two colours. This means that equality has changed and now we have the blue + yellow (which we initially noticed) • (multiplied by) field of acceleration (which you feel) = (generates) green (which I see).

(5)

Thus, the two say that (blue + yellow) • (multiplied by) field of acceleration (mixture) generates green, but notice that one can say (yellow + blue) • mixture (field of acceleration) is equivalent to green. The two see the same thing but describe it differently (the same phenomenon described in two different ways). The same goes for us. We have two different ways of description of an electrical load located in an acceleration field (electrical load accelerated). On the one hand we describe an accelerated electrical load, and on the other hand, describe an electromagnetic field (which is actually the result of accelerated electrical loads). This is our relative interpretation [14] [16] in fact the two descriptions refer to the same phenomenon.

Special Relativity tells us that space generates time.[1]

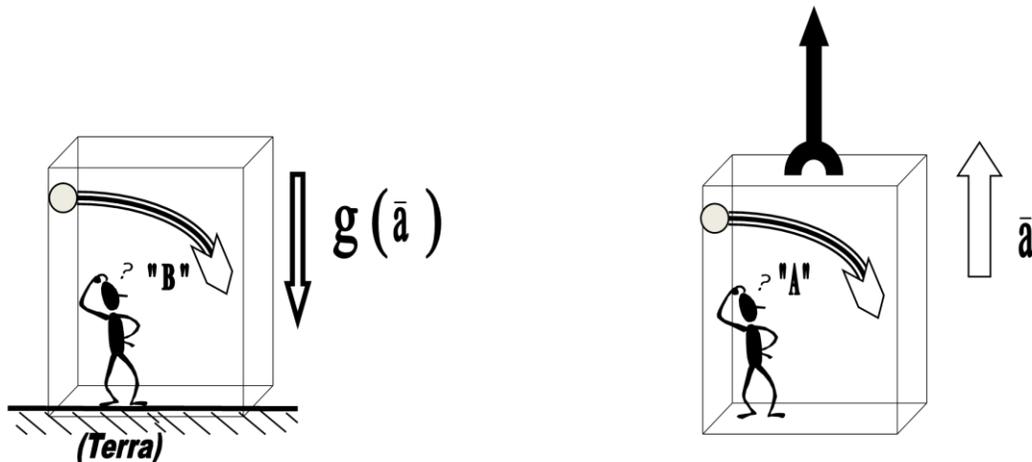
General Relativity says that a gravitational field is equivalent to a field of acceleration, but in the same time the theory says that field of acceleration generates a gravitational field and the gravitational field generates acceleration.[6]

G.R.E. says, an electrical charge in a gravity field generates an electromagnetic field, but it also shows that the assembly of gravitational field with an electric field generates electromagnetic field.[7]

Since the equivalence between a field of acceleration and a gravitational field is local, this character is transmitted and G.R.E.

**3.2** The same result (see **II.2**) can be reached with another experiment, as it follows:

A non-inertial reference system is locally equivalent to an inertial reference system located in a gravitational field. This is Einstein's equivalence principle which, placing on an equal footing the two reference systems (inertial and non-inertial) tells us that there is no experiment helping us to distinguish between them and that any event which can be observed in a part, will be observed in the other part as well (example of the curvature of light ray from fig.2, observed by both observers, "A" and "B"). [6]

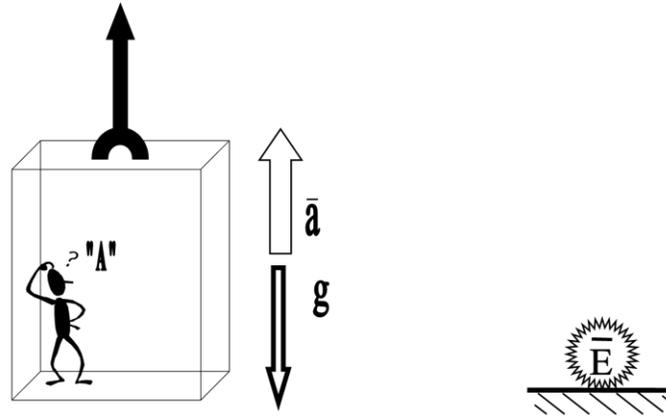


**Fig.2:** A non-inertial reference system(right side) is locally equivalent to an inertial reference system located in a gravitational field (left side) - Einstein's equivalence principle. Example of the curvature of light ray, observed by both observers, "A" (right side) and "B" (left side) .

(Figures were drawn by M.A.)

(6)

We take again the box that Einstein used in his examples, including the “A” observer and his apparatus of observation, far away from any type of influences. Outside the box there is a stationary electric field (with its own reference system), as in fig. 3. [1]



**Fig.3:** The box that Einstein used in his examples, including the “A” observer and his apparatus of observation (left side), far away from any type of influences. Outside the box there is a stationary electric field with its own reference system (right side). If the box is at rest in report with the electric field, the “A” observer will realize only the presence of an electric field . (Figures were drawn by M.A.)

When the box is at rest in report with the electric field, the “A” observer will realize only the presence of an electric field.

We will begin to move the box in accelerated way (“up”) in report the reference system of the electrical field. Our observer from the box will have no way of knowing that it moves in an accelerated manner.

By gradually replacing the acceleration field with a gravitational field he will not realize this change (not making any distinction between an acceleration field and a gravitational field) and he will draw the following conclusion: [1]

-when someone introduces me and integer my box in a gravitational field, the electrical field that I observe, disappears and in its place an electromagnetic field appears.[8][9][10] So, electrical field • gravitational field = electromagnetic field, that is what we obtained earlier (see **II.2**).

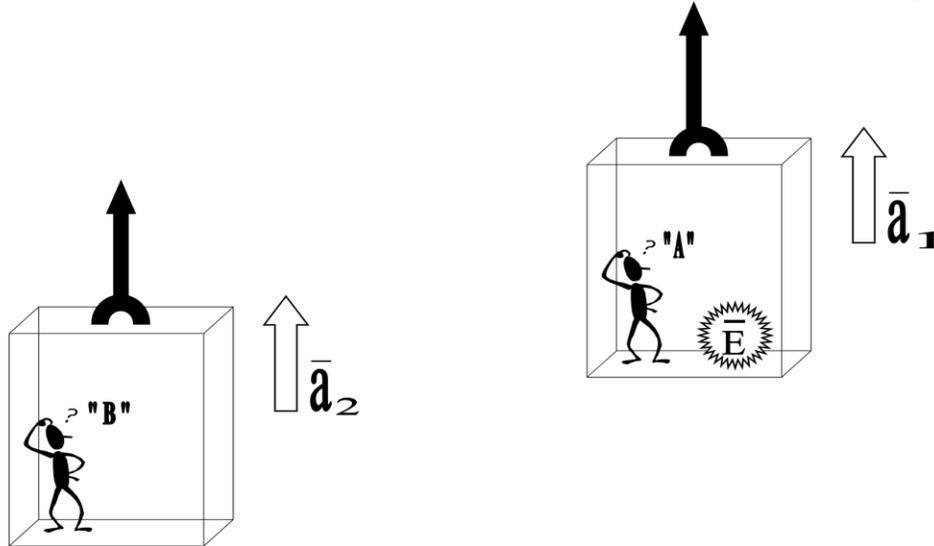
This second experiment shows that the local equivalence existence makes that the “A” observer to “see” the same phenomena and when the acceleration field is gradually replaced by a gravitational field. If he could observe any slight change in the substitution of the two fields, then it could be possible to make a distinction between an acceleration field and gravitational field, what is in contradiction with the Equivalence Principle. [1]

(7)

#### IV. THEORY CONFIRMATION and DARK ENERGY:

G.R.E. is one theory, which has visible effects only at cosmically level, and it can explain, without the necessity to resort at introduction of so-called dark energy, why apparently some stars appear to be moving with a higher acceleration (low energy of light spectrum) than the one calculated by Hubble's law (that means a shift of stellar light to the red light spectrum), but it also can explain and the shift of stellar light to the blue part of lights spectrum (high energy of light spectrum).

To explain the above mentioned phenomenon, we take the example of two identically constructed boxes, but which have (as a value) different rates of accelerations [7], as in fig.4.



**Fig.4:** The example of two identically constructed boxes, but which have (as a value) different rates of accelerations. In the box which has inside "A" observer, we introduce an electric field (right side). (Figures were drawn by M.A.)

We introduce an electric field in the box no. 1, which has inside "A" observer, and will draw the following conclusions:

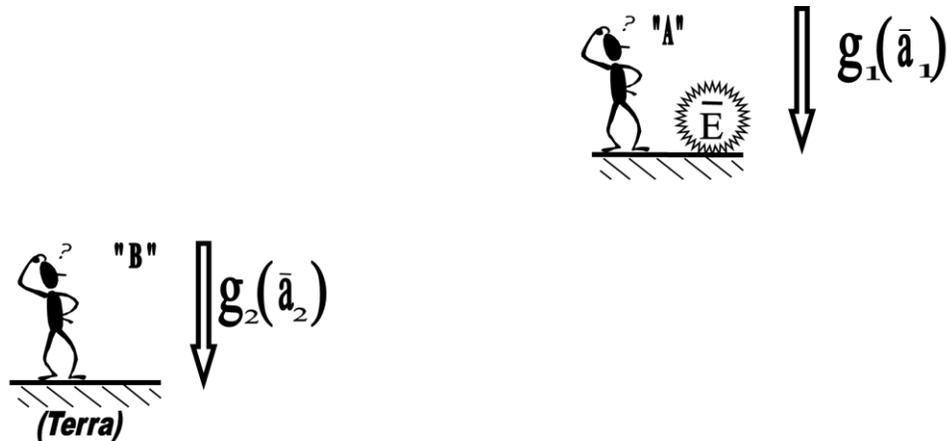
- if  $a_2 > a_1$ , box no. 1 in report with number 2 box, has a value of acceleration ( $a_2 - a_1$ ), that is an positive acceleration (namely, the source is approaching), and formula **II.1** has a positive value, determined precisely by the positive value of acceleration;

- if  $a_2 < a_1$ , box no. 1 in report with number 2 box, has a value of acceleration ( $a_2 - a_1$ ), that is an negative acceleration (namely, the source moves away), and formula **II.1** has a negative value, determined precisely by the negative value of acceleration;

- if  $a_2 = a_1$ , box no. 1 in report with number 2 box, has a value of acceleration ( $a_2 - a_1$ ), that is null acceleration and therefore "B" observer will note the same things like "A" observer, this means electrical field •(in)gravitational field = electrical field •gravitational field, resulting that it sees only gravitational field (multiplied by) electrical field; ( how boxes have the same speed and the same direction, it is as if the two observers were be in the same box, and therefore they see the same thing).

(8)

As an accelerated reference system is locally equivalent with a gravitational field, our examples mentioned above can approximate with two gravitational fields with different value of intensities – (see different accelerations of the two boxes) fig.5.



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**Fig.5:** The two gravitational fields with different value of intensities. The box with "B" observer inside (left side), may be considered that is Earth whit our astronomers.  
(Figures were drawn by M.A.)

The box with "B" observer inside may be considered that is Earth whit our astronomers, and we have:

- if  $g_2 > g_1$  (that is  $a_2 > a_1$ ), terrestrial gravitational field intensity is greater than the source of the electromagnetic field and so we see source is approaching(formula **II.2** has a positive value);
- if  $g_2 < g_1$  (that is  $a_2 < a_1$ ), terrestrial gravitational field intensity is smaller than the source of the electromagnetic field and so we see the source moves away(formula **II.2** has a negative value);
- if  $g_2 = g_1$  (that is  $a_2 = a_1$ ), terrestrial gravitational field intensity is equal to the source of the electromagnetic field and so we see two separate fields – electrical and gravitational.

So, G.R.E. tells us that, when we have a gravitational field different from ours, and an electric field is combined(united) with that gravitational field, we will always see an electromagnetic energy (an electromagnetic field) positive or negative (which brakes or which accelerates).This means that anywhere where we will have an electric field inserted (united) in a gravitational field (different from ours), will appear an electromagnetic radiation (an electromagnetic energy).

But that's everywhere all around us. All the cosmic space is full of electric fields, gravitational fields, and combinations of them. So, the Universe is filled with an “energetic liquid”, resulting from the combination of that two.

Electromagnetic field (electromagnetic energy - energetic liquid) predicted by G.R.E. is, in fact, additional energy which is subtracted or added at the electromagnetic energy radiated by a body. The energetic fluid present all over the Universe, it will break or accelerate the radiation emitted by any body.

(9)

This means that, is no need introduction of dark energy to explain the „super-accelerating" expansion of the Universe. It's just the effect of the connection between an electric field, a gravitational and an electromagnetic field, predicted by G.R.E.

This energy is different from that caused by the gravitational redshift.

## V. COMPLETION FORMULA OF G.R.E.:

At the beginning of this material, in the chapter “Theoretical Study”, I imagined, an "U" Universe where there are only two observers, situated at a considerable distance one from the another, equipped with various devices for testing and observation, but we did not take in consideration the influences of the environment.

If we want to keep in mind the influence of the environment, we notice (in **II.2**) that the only term which can be influenced by the environment, it is the radiation of electromagnetic energy (  $W_{EB}$  ).

This energy (  $W_{EB}$  ) it can be scattered, absorbed or other changes, on his way till to the observer. That means it depends on the action of the surrounding environment. It depends on the permissiveness of the environment or better said, it depends on the „transparency” of the environment. Might be said, energy depends on a "constant of transparency" of the environment, which I have noted with “ $k_t$ ”.

This means that:  $W_{EB} \sim$  (it depends by)  $k_t$  **(V. 1)**,

where, constant of transparency ( $k_t$ ) it can have values from 1 (one) - total transparent environment (ideal transparency) – to 0 (zero) - total opaque environment (ideally opaque).

We will introduce now in formula **II.2**, the dependence of electromagnetic energy by the constant of transparency (**V.1**) and the difference of gravitational fields’ intensity (discussed in Chapter IV), and we will have:

$$\mathbf{E} \cdot (\mathbf{g}_E - \mathbf{g}_S) = (\pm) W_{EB} \cdot k_t \quad \text{(V. 2)}$$

, where:

- $\mathbf{E}$  - describes the electric field;
- $\mathbf{g}_E$  - describes the Earth's gravitational field;
- $\mathbf{g}_S$  - describes the gravitational field of the source;
- $W_{EB}$  - describes the electromagnetic field;
- $k_t$  - constant of transparency.

Electromagnetic energy predicted by G.R.E. is, in fact, additional energy which is subtracted or added at the electromagnetic energy radiated by a body, the plus or minus sign, being exactly given by the difference of gravitational fields’ intensity. The energy will break or accelerate the radiation emitted by any cosmically body.

Formula **V.2**, represent the connection between electricity, gravity and electromagnetism or the extension of General Relativity.

## **CONCLUSION:**

Generalized Relativity says, through the Equivalence Principle, that local we cannot distinguish between the effects of an accelerated movement (effects of an acceleration field) and the effects of a gravitational field.

Knowing that an electron accelerated (located in an acceleration field) it radiates, then through the aforementioned equivalence, and an electron being at rest in a gravitational field have to radiate. If this electron being at rest in a gravitational field do not radiating, then the Equivalence Principle is not universally valid.

In conclusion, one can say that from the assertion from two different observers (one in the gravity field -comoving observer- and other outside influence), is inferred, that the electromagnetic field has a relative existence (but it doesn't disappear, it just „ turns”). The electromagnetic field and the electro-gravity are actually two different aspects of a single force. These two manifestations of this unique force have a dual and complementary character at the same time, they cannot be observed simultaneously.

Also, G.R.E. tells us that, when we have a gravitational field different from ours (is not “comoving”) and an electric field united with that gravitational field, we will always see electromagnetic energy (positive or negative). This means that is no need introduction of dark energy to explain the energetic liquid present everywhere in the Universe.

„Illusion” of expansion "super-accelerated" of the universe is confirmation of G.R.E..

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