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Theory of Relativity: The Fallacy of the Principle of Equivalence

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ABSTRACT

In the recent work, we will criticize the mental experiment that A. Einstein proposed, with the name of the principle of equivalence, to justify the validity of his theory in the case in which the reference systems do not move with uniform and rectilinear speed.

Keywords: General Theory of Relativity, Principle of Equivalence

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INTRODUCTION

Einstein's equivalence principle (Einstein, 2003; Einstein & Larrucea, 2005) states the validity of the equivalence principle. According to this principle, Einstein stated that;

"*We imagine a large piece of empty space, so far from stars and large masses that we can say with sufficient certainty that we are facing the case foreseen in the fundamental law of Galileo. For this part of the universe, it is then possible to choose a reference body of Galileo for which the points at rest remain at rest and the points in motion remain constantly in a uniform and rectilinear movement. As a body of reference, we imagine a large drawer in the shape of a room, and we assume that there is an observer Equipped with devices for it, naturally there is no gravity. It has to be fastened with ropes to the floor, under penalty of being thrown to the ceiling at the minimum hit against the group. Suppose that in the center of the ceiling of the drawer, on the outside, there is a hook with a rope, and that a being, of which we are indifferent, begins to pull on it with a constant force. The box, together with the observer, begins to fly "upwards" with a uniformly accelerated movement. Your speed will increase with time ... always-great heights to judge everyone from another body of reference that does not pull a rope. However, the man who is in the drawer, how do you judge the process? The floor of the drawer transmits the acceleration pressure on the feet. Therefore, you must counteract this pressure with the help of your legs if you do not want to measure the ground with your body. Then, you will be standing in the drawer as a person in any room of a dwelling. If you release a body that previously had in your*

hand, the acceleration of the drawer will stop acting on it, so it will approach the ground with an accelerated relative movement. The observer is also convinced that the acceleration of the body with respect to the ground is always as great regardless of the body that performs the experiment. On the basis of his knowledge of the gravitational field, as we have discussed in the last section, man will come to the conclusion that he is, together with the box, within a fairly constant gravitational field. For a moment, you will be surprised, however, that the drawer does not fall into this gravitational field, but then discover the hook in the center of the roof and the tight string attached to it and correctly infer that the drawer hangs at rest in that field. Is it permissible to laugh at man and say that his conception is an error? I think that if we want to be aware, we cannot do it, but we must admit that his explanation does not attack reason or the mechanical laws known. Even if the box accelerated with respect to the space of Galileo considered in the first place, it is possible to see it as immobile. So we have good reasons to extend the principle of relativity to reference bodies that accelerate with respect to others, thus has won a powerful argument in favor of a postulate of generalized relativity."

This idea is also exposed in (Infeld, 1971). We are going to carry out our critism using this text, but before starting, we are going to graphically express the exposition of this text to better try to highlight the idea that it pursues. For a better interpretation of what is transcribed above, we can reach to the conclusion below figure 1.

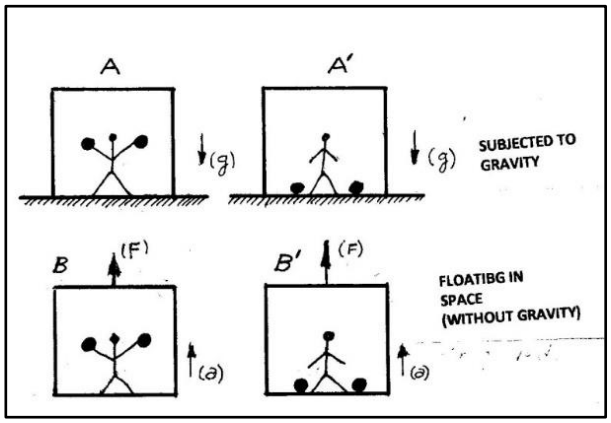

Fig 1

The Fig1 simply represents the action describe

"... If he release a body that he previously held in hes hand, the acceleration of the drawer will stop acting on it, so it will approach the ground in relative accelerated motion ...".

This represents a physical phenomenon occurring within two boxes present in two different situations. In the situation $(A - A')$, the box is on the ground. The masses held by the person inside (A) are a subject to the pull of gravity. If this person releases these masses, they will fall on the floor of the box, as shown in the figure (A').

In the situation $(B - B')$, the box is floating in the sidereal space and because of a rope tied to its roof, it is pulled up by a force that gives it a certain acceleration. If the person inside the box releases the masses that it holds (B), these masses will touch the elevator floor (B').

The result of the event of the relase of these masses is the same as the two different interpretations of the force acting on the lift: force of attraction or gravity field (g),elevator $(A - A')$ or contact force, traction or also called inertial force F, elevator $(B - B')$.

The idea that these four images intend to communicate is that when the person releases these masses, they fall on the floor of the elevator due to: in the case of$(A - A')$, to the force of attraction of gravity g, and in the case of $(B - B')$, due to a constant traction force F on the elevator that generates in an acceleration a in it. The result that manifests itself in both figures, that is, in both cases, is the fact that the reason that these masses hit the floor of the elevator must be because of the equivalence of the two types of forces that have acted on it. Considering this interpretation, this allows us to assimilate the two types of causes: Inertial and Gravitational force with the same effect. Consequently, in the bodies that move with a certain acceleration, to calculate the response of the formulas in which their mass is involved, we could apply the same formulas that we would apply if a gravitational force were to act. Observe that in the case of $(A - A')$, we have underlined the word fall, and in the case of $(B - B')$, we have underlined the word touch. These are concepts that we will later use to criticize these conclusions. Here we begin our criticism. We must realize that in the physical phenomena that we believe can be produced within an Inertial Reference System (IRS), and that are a subject to Newton's Laws, there is always an attraction force (FA) intervened. For example, the Force of Gravity (FG). Figure 2 is intended to represent our previous statement. In this case, the physical phenomena of the parabolic shot and the oscillation of a pendulum in a Fixed Reference System (FRS), and the same phenomena within a Mobile Reference System (MRS), such as the train car, which is represented, moves with a constant speed v and is rectilinear.

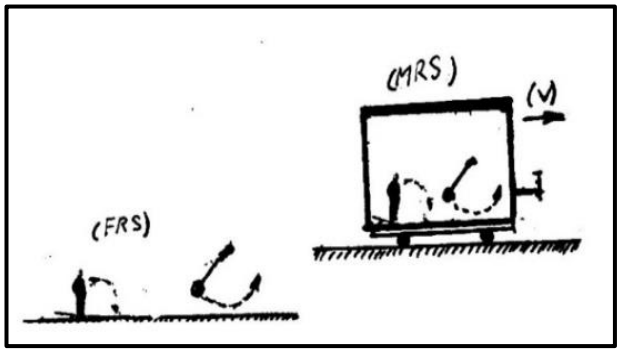

Fig 2

If instead of the train car we assume that the referred physical phenomena develop within, or in the field, of a body that moves in outer space, we should consider the same condition. This is to say that there is a force of attraction coming from this body. We will show that the mistake of the aforementioned Physicist is to pretend to establish an equivalence between a traction or contact force and an attraction force. As we will justify, this is not possible. Recall the following types of forces regarding its way of acting on the mass. The forces of attraction, as they are the gravity or magnetism, act at a distance on the mass. That is, it causes the force to act on the mass without a direct contact of the agent. On the contrary, we will define another type of force in which the agent generating it maintains a direct contact with the Mass. We will call these type of forces traction or contact forces.

To complete this summary of the study of the intervention of forces, let us also remember newton's third law, the principle of action and reaction. This principle indicates the association of an action force with its corresponding reaction force. We can realize that the concepts of traction force or contact, and the action and reaction of this force, could be grouped within the same context. What we cannot say is that a traction force, or contact force, is associated with another type of attraction. This is simply because they are of a different nature. Considering the elevator as the example of this physical phenomena, but one which, in this case, moves with acceleration, that is, one without a constant speed, we can think that A. Einstein tried to supply the need that inside the elevator, where we can pretend that the physical phenomena is regulated by Newton's Laws, the generation of a force of attraction occurs. From the text that this author exposes as a hypothesis to try to affirm the principle of equivalence, we extract the following paragraph:

"...But the man who is in the drawer, how do you judge the process? The floor of the drawer transmits the acceleration pressure on the feet. Therefore, you must counteract this pressure with the help of your legs ..."

According to this part of the text, we draw Fig 3

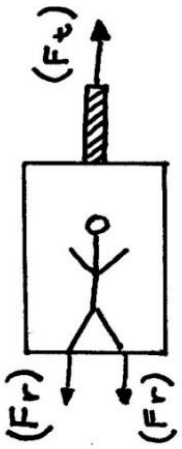

Fig 3

This drawing represents the elevator with the rope that pulls it with an accelerated speed and one in which the person inside the elevator feels the pressure on his feet. It has been represented as the force of reaction (Fr). To demonstrate that this mental experiment is a false hypothesis to try to justify the principle of equivalence, we can say; The traction force, or contact force, exerted by the rope on the roof of the elevator, is transmitted through its casing, to the floor of the elevator. This floor transmits the action of the pulling force of the rope to the feet of the person inside the lift. This person's feet experience the reaction of the aforementioned action.

Has the reader observed if any attraction force generated allows us to apply Newton's Laws to the masses and, consequently, to the formulas of the physical phenomena that are supposed to occur within the elevator?

We believe that the argument we have presented, demonstrating the lack of existence of the aforementioned force of attraction, invalidates, by itself, the hypothesis that we are analyzing. However we can still choose another paragraph of this hypothesis that can help with the confusion that has occurred within us about the physical referred. This is the next paragraph of the hypothesis:

"If you release a body that you previously had in your hand, the acceleration of the box will stop acting on it, so it will approach the ground with an accelerated relative movement."

Figure 4 aims to demonstrate that this does not happen. What happens is precisely the reverse of how it is assumed in the aforementioned hypothesis.

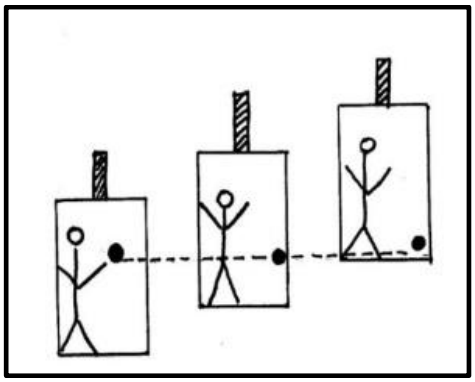

Fig 4

The figure represents three respective and ascending positions of the elevator in its way towards the same direction. As the figures change, we can observe the mass closer to the floor of the lift. We can say that: It is not that the body that initially held the mass in its hand is the one that approaches the ground, but it is the soil that approaches the body. We then ask ourselves; Where is the force of attraction generated that is a part of the physical phenomena that fulfills Newton's Laws?

We observed that by accepting such a hypothesis, we would be willing to change the feeling that we imagine the person inside the elevator experiences, due to the reality of the phenomenon [see (Viladesau E.M, 2018)].

Somewhere, We have expose the following argument that could confuse the reader. As difentes masses inside the elevator, which is subjected to the tension of the rope, would need the same time to touch the floor of the elevator, and this simultaneity of arrival occurs precisely when the force of gravity acts outside the elevator, we can establish an equivalence between them. It is clear that what we can establish is a similitude of results, not an equivalence. It is evident that only in the case in which the acceleration produced by the tension of the string does not change, any mass will take the same time to touch the ground and, that this is also true if the acceleration produced by the string is equal to the that produces the force of gravity. In this case, we can say that both actions are similar. However, we know that the action of the force of gravity is the same for all the masses in their free fall since the constant K of universal gravitation intervenes. In the book (Viladesau, 2018), it is explained using physical-mathematical reasoning the constancy in the free fall of masses, which was demonstrated with Galileo's experiment. Cutting out the last paragraph of the principle that we are criticizing, it says:

"... So we have good reasons to extend the principle of relativity to reference bodies that accelerate with respect to others, and thus has gained a powerful argument in favor of a postulate of generalized relativity".

It seems that the creator of the mental experiment is confusing the container of the physical phenomena that can develop in it, ie the elevator, by the mass itself or content that is inside the container. We end up saying that this assumption is false. To highlight the fallacy that we are commenting on, we ask ourselves: How can we justify the movement of a pendulum, without considering the existence of a force of attraction, which is not generated by the carcass of the elevator, and which acts on the mass of the pendulum? It is assumed, in the absence of friction, that this force is what allows us to exchange the potential energy into kinetic energy, maintaining the movement. From what we have said, we can conclude that the statement which appears in the last paragraph that we transcribed at the beginning of this study is false.

"...So we have good reason to extend the principle of relativity to reference bodies that accelerate with respect to others, thus has won a powerful argument in favor of a postulate of generalized relativity"

LOGICAL REASONING-CRITICISM TO A MENTAL EXPERIMENT

In this chapter, we will devote ourselves to analyze things from a point of view containing logic, the description of the mental experiment that the physicist A. Einstein talks about to try to convince us about the Principle of Equivalence. According to what we have explained in the previous chapter, we know that we need the existence of a force of attraction so that the physical phenomena that is regulated by the fulfillment of Newton's Laws can develop. Perhaps, we could think that in the description of the mental experiment, when mentioning that the person who goes inside the elevator notices a pressure on his feet, is enough to make his equivalence to a force of attraction. It is here where a fallacy occurs. By pretending to build a logistic syllogism, if one of the hypothesis is false, the conclusion is a fallacy. So for example, if we plan the following proposition:

1- The force of attraction allows us to use Newton's Laws,

2-When the elevator is accelerated, a force of attraction is generated.

CONCLUSION

When accelerating the elevator, it allows us to use Newton's Laws. In this proposition, the second hypothesis is false. The conclusion that is reached contains a fallacy. Using Fig 3, we can support ourselves even furtur by saying that it is a fallacy if we establish a syllogism in which the second hypothesis says: The mass falls on the floor of the elevator. With no other pretension than trying to clarify something else the validity of a syllogism, simplifying the description of concepts to their maximum, we can put togheter the following reasoning that we believe could be accepted as;

1-Masses are attracted by the force of gravity.

2-A stone is attracted by the force of gravity a mass.

We see that the fallacy we have discussed is generated with the description of the author of the mental experiment. But, in addition to this type of fallacy, we may be the readers themselves who, without realizing it, commit another type of fallacy. To detect the existence of this type of fallacy, we have relied on the reading of some treaties on logica. Among them is the book (Copi, Cohen, & McMahon, 2016). Different types of fallacies are described and commented on this book. One of the fallacies that can be committed in a logical reasoning, are those that are committed because of the lack of logical attention. Fallacies due to lack of logical attention are:

"It's those arguments that somehow lack the logical relationship between the elements of reasoning, so it tends to deceive. "

Within the reasonings that are not logical, we find a type of fallacy called argunentum and hominen. This type of fallacy is presented when there is an attempt to convince us to accept a falsehood, invoking a person of prestige that has manifested as true but is in doubt. For example, a priest or a physicist of recognized prestige. In these cases, we can not build a logic logo that is correct, when its hypothesis do not keep a logical patience with the conclusion. Alert, we should not be willing to accept and validate incorrect reasoning, even if they are proposed by geniuses of physics.

REFERENCES

Copi, I. M., Cohen, C., & McMahon, K. (2016). *Introduction to logic*: Routledge.

Einstein, A. (2003). *The meaning of relativity*: Routledge.

Einstein, A., & Larrucea, M. P. (2005). *Sobre la teoría de la relatividad especial y general*: Alianza Editorial.

Infeld, L. (1971). *The evolution of physics*: CUP Archive.

Viladesau E.M. (2018). Theory of relativity-atomic watches and time dilation. *International Journal of Fundamental Physical Sciences (IJFPS), 8*(1), 1-4.

Viladesau, E. M. (2018). *Theory of Relativity;The Fallacies of the Expansion of Time and the Principle of Equivalence*: LAP LAMBERT Academic Publishing.