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## THE OVERWHELMING EMPIRICAL EVIDENCE OF PREINERTIA

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**Abstract.**-After recalling the Galilean origin of the concept of preinertia, and recalling the concept itself (still unknown to contemporary physics), the article explains the enormous empirical evidence of the concept, as well as the experimental possibility of demonstrating its existence by means of a new scientific instrument, the inertioscope. And although very briefly, the formal necessity of its existence is also explained. Finally, the physical relevance of preinertia is considered: it allows to demonstrate the impossibility of detecting absolute motion and the absolute nature of motion.

**Keywords:** Galileo Galilei, preinertia, relative motion, absolute rotations, absolute motion, inertioscope.

### 1 Reintroducing Galileo's preinertia

Whenever I write about preinertia I have to begin by explaining what this universal and very significant property of all physical objects, including photons, consists of. And I have to do so because, although it was introduced by Galileo in 1632, modern physics (which started precisely with Galileo) has not yet rediscovered it. So, also in this one, I will begin by giving the definition of preinertia, although in this case in an intentionally incomplete form (to be completed later):

**Definition 1 (of Preinertia)** *Property of all physical objects by which they inherit the velocity vector of the reference frame from which they are set in motion.*

The incompleteness of the definition lies in the fact that, it does not indicate what type of velocity, relative or absolute, is being inherited. The complete definition will be given at the end of the article, which will have been justified by the discussion that precedes it in the rest of the article.

But before continuing, let us recall the words of Galileo (in the mouth of Sagredo) with which he introduces the concept of preinertia, not with that word but with others, all of them referring to the famous stone dropped from the top of the mast of a ship in motion with respect to the dock (*italics and color are mine*):

SAGREDO. If it is true that the impetus with which the ship moves *remains imprinted on the stone after it has separated from the mast*, and if it is also true that this motion does not hinder or slow down the straight downward motion natural to the stone, *it is bound to follow a marvelous effect in Nature*[1, p. 228].

This *marvelous effect in Nature* is, in fact, preinertia.

### 2 Inductive, empirical and formal evidence of preinertia

Aristotelian mechanics, still in force in Galileo's time, gave as proof of the immobility of the Earth the fact that an object thrown vertically upwards would fall back to the same place where it had been thrown. Galileo refuted this proof by introducing preinertia (although not with that word): the object inherits the velocity of the Earth when it is launched (preinertia, a marvelous effect of Nature in Galileo's words) and maintains it as it rises and falls (inertia, according to Newton). The same is true for any object that is dropped, or launched, here on Earth. So the empirical evidence for preinertia is overwhelming: *billions of times every day here on Earth!*

Returning to the case of Galileo's stone dropped from the top of a ship's mast (at rest or

in uniform motion with respect to the port), and assuming that the fall lasts one second and there is no preinertia, the stone would fall more than 30 km away from the base of the mast, considering only the translational motion of the Earth; or more than 370 km away considering the motion of the Earth in the direction of galactic coordinates (264. 4, 48.4) of the cosmic microwave background (CMB) anisotropy. Without preinertia it would be impossible any act involving mechanical take-off from the Earth, however brief, such as jumping, sweeping, watering, practicing any sport that requires throwing objects, etc. etc. I will shortly present an instrument, the inertioscope, already built in its domestic version, which makes it possible to verify in experimental terms the preinertia of the photons of a laser beam. Thus, to the empirical overwhelming evidence of preinertia, we will have to add its experimental evidence.

Even in the theoretical terms of fundamental physics, preinertia becomes unavoidable: consider, for example, an object  $B$  of mass  $m_b$  (e.g. a ball) at rest on another object  $A$  (e.g. the Earth) of mass  $m_a \gg m_b$ , both in uniform motion of velocity  $\vec{v}$  with respect to an inertial reference frame. If  $B$  is set in motion from  $A$  with a velocity  $\vec{u}$  with respect to  $A$  that does not include  $\vec{v}$  among its components (i.e. without preinertia) the Principle of Conservation of Energy, and the Principle of Conservation of the Linear Momentum applied to the system  $A + B$  would be violated. Compliance that inevitably requires that  $B$  inherits the motion of  $A$  when it is set in motion from  $A$ , simply because it was a part of  $A$  before setting in motion.

We have, then, an impressive empirical evidence for preinertia, which is confirmed both experimentally and formally. In the next section it will be shown that, moreover, its physical relevance is extraordinary, since it is the cause that makes the detection of absolute motion impossible and, at the same time, the reason that allows us to deduce in formal terms the absolute nature of all motion.

### 3 Physical relevance of preinertia

Absolute motion does not exist! contemporary orthodox physicists shout with some anger at those of us who dare to question that dogma of contemporary physics. What is certain that does not exist, at least until now, is the possibility of detecting absolute motion. And that possibility does not exist because of preinertia, perhaps the most universal physical property of all physical objects, discovered by Galileo, published in 1632 and ignored by physics ever since. In this section it is shown, among other things, that preinertia makes the detection of (possible) absolute motions impossible. Impossibility already demonstrated in other works of the author [2, 3, and others]. But before dealing with this impossibility, and in order to help open the minds of the readers most attached to the non-existence of absolute motion, I reproduce here a short text on the absolute nature of the rotations of all cosmic objects [5]:

In the case of the Earth, the first rotation to be considered is its rotation around an internal axis (the Earth's rotation axis). It is a real rotation because it produces observable and measurable effects: the apparent rotation of the Sun and the rest of the cosmic objects around the Earth. In each rotation of the Earth around its internal axis of rotation, each of its points describes a unique circle, with a unique center of rotation that will be a unique point on the unique Earth's rotation axis. And since in a single rotation a point cannot rotate at the same time around two different centers of rotation without being in different places at the same time, the motion of rotation of each of the points of the Earth around its corresponding center of rotation is unique and can only be referred to that unique center of rotation, which will therefore be an absolute center of absolute rotation. And this is true for every point of the planet. The rotation of the Earth around its internal axis of rotation is, therefore, a real and absolute rotation. Although, as we shall see, that absolute internal axis of absolute rotation is in turn rotating around other centers of absolute rotation external to the planet.

Instead of considering the points of the Earth, let us now consider the Earth as a whole, the Earth as a planet. The planet Earth, as a whole, now rotates in an elliptical orbit around the Sun (which occupies one of the two foci of the ellipse). That

(so-called) translational motion of the Earth around the Sun also produces apparent motions in the rest of the cosmic objects. And although they are apparent, not real, appearances as such appearances are real: they are observable and measurable. And for the same reason as in the case of the points in the rotation of the Earth around its absolute internal axis of absolute rotation, the elliptical orbit of the Earth is also a unique orbit around its two unique foci (although it is not stable and in time may oscillate with respect to certain equilibrium positions). So, also in this case, the rotation of the Earth around the Sun is a real and unique motion that can only be referred to the absolute geometrical elements of its unique absolute elliptical orbit (its two foci). It is therefore another real and absolute motion.

According to everything we know about the observable universe, the vast majority of its trillions of physical objects are subject to rotational motions (from one revolution every 100 quadrillion years in the case of some galaxies, to one quadrillion revolutions per second in the case of electrons). And the above argument applies to all of them. Therefore cosmic objects do not rotate WITH RESPECT to the sphere of fixed stars, as advocated by E. Mach. [7, p. 83-84] [8, p. 45] and many contemporary physicists, but each of their rotations is a motion AROUND a unique and absolute axis, or center/foci, of rotation. They are, therefore, real absolute rotations, real absolute motions [4]. Thus, the vast majority of motions in the observable universe are absolute, not relative.

And here I reproduce another very recent text of the author from which one can only conclude that, indeed preinertia makes the detection of absolute motion impossible, and at the same time it is the proof that motion can only be absolute [6]:

As already announced, the first physical consequence of preinertia is the impossibility of detecting absolute motion. To demonstrate this, let us consider the possible detection of the absolute motion of an object *A*, for example the Earth, by setting in motion from *A* other physical objects *B*, *C* *D* etc. In doing so, and due to preinertia, they all inherit the motion of *A* to be detected, therefore they will move during all the time in the same way as *A* moves with the motion to be detected, so that from *A* only the relative motion of objects *B*, *C* *D* etc. with respect to *A* can be detected, exactly the same as if there were no absolute motion to be detected. A more formal version can be seen in [2, p. 421-426]. Thus, preinertia would make it impossible to detect absolute motion if such motion existed. One may wonder how different the history of modern physics would have been if Newton had rediscovered Galileo's preinertia (his *marvelous effect in Nature*).

But the same preinertia that makes impossible for us the detection of absolute motion, serves us to demonstrate, now in formal terms, the absolute nature of the motion of all physical objects in the universe. Indeed, let us consider any one of these objects, for example the object *A* of the previous paragraph, and suppose that another object *B*, which is at rest in *A*, is set in motion, obviously from *A* (or is created in *A* just before being set in motion, as could be the case with photons, which are also preinertial [2, p. 385-404]). If all motions are relative, *A* maintains literally trillions of such relative motions, one for each of the trillions of cosmic objects with respect to which it moves. And if *B* is to inherit the relative motion of *A* when it is set in motion (preinertia) which of those trillions of relative motions will it inherit, and why not another? What memory and what mechanism determines that inheritance? From everything we know about the physical world, neither that memory nor that mechanism exists. Therefore, if there is neither memory nor mechanism for that inheritance of relative motion, the only motion that *B* can inherit from *A* is the absolute motion of *A* **THROUGH** (NOT WITH RESPECT TO) the same real physical space<sup>1</sup>, which was also the absolute motion of *B* when *B* was part of *A*, before it was set in motion from *A*. It must be concluded that preinertia, whose physical reality is

<sup>1</sup>From the empirical detection of gravitational waves it can only be deduced that physical space is real: what does not exist cannot deform, nor vibrate, nor be the transmitting medium of its own vibrations, nor produce real effects in the real interferometers that detect its vibrations.

unquestionable, demonstrates the absolute nature of motion.

Obviously, the different absolute motions of the different cosmic objects through the same real physical space determine the different relative motions of those objects to each other, relative motions which, for the time being, are the only observable motions due to preinertia (more details in [2, 4]). Finally, one may ask, what universal quality of all physical objects could be the cause of their preinertia?

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