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Galileo's fall

In November 1985 Liguori Editore of Napoli published one of my works from the title **Considerations on the Principia of General Relativity**, in which I showed the Law of fall of the bodies formulated by Galileo Galilei around four hundred years ago, according to which, in absence of air, a feather and an armed wagon, if allowed to fall together from a certain height, they would reach the ground contemporarily, it doesn't correspond to the truth. It's immediate to reach this conclusion according to which the heaviest body would reach the ground before the feather in an infinitesimal lapse of time, and that's still nowadays of difficult experimental determination. That's what can be theoretically established and with well precise formulas according to the Law of Universal Gravitation of the insuperable Newton (v. **I Principia** UTET) who did not mind it (v. **On Newton's Paradoxes** Longobardi Editore (2002) or www.carlosantagata.it).

The Official Science, despite the various solicitations, by hiding itself behind a finger, persists to defend the formulation given by Galileo even because **it constitutes one of the fundamental postulations of the General Relativity and therefore, to all loss of the consequent and thick scientific progress that is behind this first newtonian result, it denies matters of inestimable scientific greatness and the motive is easily realized**.
In 1986 in a Conference held at Palazzo Serra in Cassano (Naples), the great Italian physicist Tullio Regge agreed with me (see Kepler's third law deducted from Newton's theory that contains the masses of the planets) that with Newton the law of Galileo suffers a re-reading as already said, but, as good defender of the General Relativity, He sustained that the effect was so small to be significant for Einstein's theory.

But the science, as Regge sustains himself, cannot be done as a referendum, neither it can grow fond with unbearable intuitions only sustained with an experiment (where do we put Galileo's experimental method ?). Let's notice that in July the 9th 2009 Piero Angela's SuperQuark show, the physicist Paco Lanciano showed how suggestively two pendulums of very different weight (1 Kg. and 10 Kgs) oscillate in unison.

With Newton it's showed **that synchronism is only apparent** and then if physics does not want to set at the same level of an good illusionist, as it's still doing, it has to take count, once for all, that with Newton it's had what follows. On the subject let's observe that in comparison to an inertial system anchored to the fixed stars or to the barycentre of the two gravitationally interactive masses, the existing strength among them is equal to

$$F = G\frac{M\,m}{d^2}. \qquad (1.1)$$

This involves the two masses to be subject to the accelerations, in comparison to the said system of reference

$$a_m = G\frac{M}{d^2} \tag{1.2}$$

$$a_M = G\frac{m}{d^2}. \tag{1.3}$$

So according with Newton, the non inertial observer anchored to the mass M attributes a general acceleration to the secondary mass m equal to

$$a = \frac{GM}{d^2} + \frac{Gm}{d^2} = \frac{GM}{d^2}\left(1+\frac{m}{M}\right) = g\left(1+\frac{m}{M}\right) \tag{1.4}$$

Therefore the corrective coefficient

$$\left(1+\frac{m}{M}\right) \tag{1.5}$$

it corrects Galileo's law of fall.

Then the law of the pendulum becomes

$$T = 2\pi\sqrt{\frac{l}{g\left(1+\frac{m}{M}\right)}} \tag{1.6}$$

and because the relationship m/M, in the case of the bodies on earth, is always very small, we can also write

$$T = 2\pi\sqrt{\frac{l}{g\left(1+\frac{m}{M}\right)}} = 2\pi\sqrt{\frac{l}{g}}\sqrt{\frac{1}{\left(1+\frac{m}{M}\right)}} \simeq 2\pi\sqrt{\frac{l}{g}}\sqrt{\left(1-\frac{m}{M}\right)} \simeq 2\pi\sqrt{\frac{l}{g}}\left(1-\frac{1}{2}\frac{m}{M}\right) \tag{1.7}$$

Insofar two pendulums having the same length but with masses equal to a gram and to a million grams (one ton) they will report, neglecting the mass of a gram in comparison to the one of the Earth M, a temporal difference equal to

$$\Delta T = 2\pi\sqrt{\frac{l}{g}}\frac{1}{2}\frac{m}{M}. \tag{1.8}$$

If pendulum length is such that

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$$2\pi\sqrt{\frac{l}{g}} = 1\sec. \tag{1.9}$$

It's also had

$$\Delta T = \frac{1}{2}\frac{m}{M} \tag{1.10}$$

If the mass of the second pendulum is equal, as first said, to a million grams It's also had

$$\Delta T = \frac{1}{2}\frac{m}{M} = \frac{1}{2}\frac{1.000.000}{5.95\times10^{27}} = 8.38\times10^{-23}. \tag{1.11}$$

This means that to record a difference of time between the two pendulums equal to a second, it is necessary to hold for a lapse of time equal to

$$T = 8.38\times10^{23}\sec \tag{1.12}$$

Minding that a platonic year (25920 year) is equal

$$1\ \textit{platonic year} = 8.17\times10^{11}\sec \tag{1.13}$$

to notice the delay of a second we would need to still hold

$$1\times10^{12}\ \textit{platonic years}! \tag{1.14}$$