Albert Einstein and the Concept of Motion: A *Proton Pseudos* of Modern Physics.

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I On the origin of the scientific concept of motion

Albert Einstein, in his famous book "The Evolution of Physics" published together with Leopold Infeld in the year 1938 [1], correctly understood "motion" to represent the most elementary problem for man's aim to read the "book of nature". The passage reminds one in a way of Galileo's use of this metaphor, and of his introduction to the "Third Day" of the "Two New Sciences". There he begins the chapter *On Local Motion* announcing that he will introduce "de subiecto vetustissimo novissimam scientiam", i.e. *a most novel science concerning a very old subject*. Galileo investigates his subject in a *quantitative manner,* i.e. by considering the quantities of spaces traversed and times elapsed during a body's *uniform,* and *accelerated, motion.* The underlying definition of motion is: *change of place of a body in space and in time,* determined as the body's "velocity" through quantities of space traversed and time elapsed in relation to each other, and to scaled standards of space and time.

The quantitative definition of motion: Some years after Galileo, in the late 1660ies, scientists investigated the question if and how *the moving body itself* might determine the quantity of its motion. Christopher Wren, John Wallis and Christiaan Huygens, who had independently studied the rules of the collisions and reflections of hard bodies, in 1669 communicated their corresponding results to the London Royal Society. Accordingly the quantity of "motion" must be measured *through the product* of the velocity v of a moving body *with its quantity of matter, or mass, m*, so that e.g. the motion mv of a body m with velocity v is equal to the motion $2m \times v/2$ of the double body, and as well to the motion $m/2 \times 2v$ of the half body. This quantitative definition of "motion" became part of Sir Isaac Newton's "Philosophiae Naturalis Principia Mathematica" of 1687, and here it reads: "Quantitas motus est mensura eiusdem orta ex velocitate et quantitas materiae coniunctim." [2]. That is: *The quantity of motion is the measure of the same that arises from the velocity and quantity of matter conjointly.* In modern symbols, using p for "motion", we obtain

$$p = mv$$

as the classical quantitative definition of motion *p*. Evidently this definition is equal to the definition of "momentum" of classical and modern physics, especially so as the *vector character* of this quantity is already a part of Newton's teaching, as is well-known.

So it is a centuries-old, experimentally discovered fact that the quantity of motion of a body *is not given through just its velocity*: Rather the motion e.g. of a truck of 3 tons weight with velocity 20 km/h is *double the motion* of a car of 1,5 tons with *equal velocity*, and an ocean liner moving very slowly into the harbour will exhibit the gigantic destructive quantity of its motion should it meet the pier out of control.

Albert Einstein, alas, in the said book "The Evolution of Physics", showed that he had not understood the necessity to clearly distinguish between "velocity", *v*, and "motion", *mv*. Though he in the first instance correctly states that equal forces will produce *different velocities*, v_1, v_2, of bodies of different mass, m_1, m_2, [3], he is obviously not aware of the fact that *the generated motions*, m_1v_1 and m_2v_2, of these bodies will be *equal* (according to their proportionality to the provided *equally acting* forces). This ignorance comes to the fore when he refers to the example of equal free fall of bodies [4]. There he alleges that "the motion" of a falling body would not depend from its mass. This, however, is not true for "motion", but only for "velocity". Let a stone of 10 grams mass fall on your feet, and then another one of 1 kilogram from the same height. The stones may well arrive with *equal velocity*, but you will feel the difference of their respective motions.

II Einstein explains the equal free fall of different bodies.

One might suspect Einstein's error to be just due to a loose usage of words. But his ensuing explanation of the experience of equal free fall of different bodies exhibits the contrary.

Einstein first states correctly that a body at rest, if acted on by an external force, will move and attain a certain velocity. But next he holds that the body's mass would *resist* the "motion" according to its quantity [5]. And this, again, is not true.

If a body *m* moves with velocity *v*, its motion *p* is given through the product *mv*. If the double body, 2*m*, moves with velocity *v*/2, its motion is also *mv*, since $2m \times v/2 = mv$. Unfortunately, this lessening *of the velocity* of motion in proportion to the increase of the moving body's mass is often misunderstood as if to augment the mass of a moving body would at the same time mean to diminish not only *its velocity, v*, but also *its motion, mv.* The truth is just the opposite, according to experimental experience: A determinate finite force to act on a body in order to make it move, will always generate *the same quantity of motion*, i.e. *the same product mv*, proportional to that force, *no difference be the body huge or small*. Galileo reports this fact, stating that even the smallest force could make even the hugest body move, with a *proportional motion* - not *velocity, of course, since the velocity would be the smaller the greater the moving body is.* Accordingly, *equal* forces acting on *equal* bodies will produce *equal* velocities and *equal* motions, while equal forces acting on *different* bodies will produce *different velocities*, but yet *equal motions* of these bodies (due to the proportionality between force and produced motion, i.e. Newton's Second Law). And *different* forces acting on *equal* bodies will produce *different motions* with *different velocities,* while different forces acting on *different* bodies will of course produce *different motions, but not necessarily equal velocities.* This follows easily from $p = mv$ (provided the considered force is proportional to *p* as it must be according to Newton's Second Law), since the force that is proportional to p_1 may be measured by m_1v_1, while the different force that is proportional to p_2 may be measured by m_2v_2, so that one obtains $p_2 \neq p_1$, and also $v_2 \neq v_1$.

Consequently, from the observed *equal velocity only* of *different* moving bodies, as in the case of equal free fall, one *cannot* infer the equality or inequality of the active motion-generating forces.

But so does Albert Einstein. Obviously ignorant of this basic truth, from the observable *equal velocity* of different falling bodies he erroneously infers that *different forces* should act on these different bodies [6]. Now, since he believes that a force should always generate not motion, *mv,* but *velocity, v,* say a *constant increase of velocity only* called "acceleration", his consideration immediately results in alleging that (not the motion *mv*, but) *the acceleration,* and consequently *the velocity v* of a falling body *should vary in proportion to its mass*. Which result evidently contradicts the experience which he himself correctly presupposes as taken for granted, namely that different bodies fall with *equal* velocities.

Einstein, however, knows that this result is contradictory and wrong. So he looks for help in order to make it conform with experience. This help seems to be at hand, if one remembers the above exhibited erroneous idea of mass to serve as an obstacle to motion. Einstein shared this misunderstanding of "mass". Implicitly alleging that mass, according to this its "motion-resisting" quality, should *cancel* the increase of acceleration and velocity which it generates on the other hand (according to his supposition "acceleration proportional to mass"), he simply pretends, as a result, that "the acceleration of a falling body increases in proportion to its heavy mass, and decreases in proportion to its inert mass" [7], inferring the exact equality of both antagonistic effects from the experience of equal velocities of falling bodies, and attributing to mass as its properties at will *two different and antagonist effects on the acceleration of falling bodies to cancel each other*, so that none of them would have any real effect; which is certainly pure physical nonsense, since bodies actually *do fall in an accelerated manner, according to the real actions of a real force.*

Evidently the underlying concept of "mass" to be responsible for a same quantity of acceleration and deceleration of falling bodies as well, nonsensical as it is, additionally raises the unanswered question why a body should fall *at all*. Not even Steven Hawking, who fully shares Einstein's explanations of the problem of equal free fall, has ever answered it [8].

III Isaac Newton's explanation of equal free fall.

Sir Isaac Newton, in his "Principia" of 1687, Def. 7 and 8, gives a clear explanation of the equal free fall of bodies [9]. According to his teaching, the always equally acting force of gravity, interacting with each of the single elementary material particles of a body, generates the same accelerating quantity of each of these particles, so that the *acceleration and velocity* of the *whole* body must of course be the same. The *motive quantity* of the force *of gravity,* however, which is measured through the body's weight, is given through *the sum of its actions* on all the equal elementary particles, and so the proportional *quantity of motion* of the whole body (different from its *velocity* of fall) is given as well.

Evidently Albert Einstein cannot have studied this teaching of Newton. Indeed he, in his last interview ever given, two weeks before he died, frankly admitted that he, as far as Newton's "Principia" is concerned, never had read it, but always only had relied on secondary literature, textbooks etc. [10]. It is well-known, however, that such sources often "disdainfully and cavalierly dismiss the whole corpus of historical Newtonian scholarship, relying exclusively on (and quoting extensively from) comments by scientists, many of whose statements on historical issues are long out of date and cannot stand the scrutiny of critical examination" [11]. As a consequence, the study of only such secondary sources is generally seen as untrustworthy, and unscientific.

IV Conclusion: *Difficile est satiram non scribere.*

Einstein's ignorance of Newton's authentic teaching should warn against his various comments on "Newton", and against the idea that he should have invented, and corrected by his own findings, a shortcoming of Newton's theory of motion. Moreover, the fact that he did not even understand to clearly distinguish the concept of "motion" from that of "velocity", or of "acceleration", and his resulting nonsensical theory of equal free fall, discloses so fundamentally a lack of judgement that one should deeply mistrust the famous theories he developed on this deficient foundation, and the scientific competence of this "man of the 20th century" [12] in general. His Special Relativity, for instance, rests on a treatment of "motion" far from reality, namely considering in the first nine of ten paragraphs of his famous 1905 paper not the motions *mv*, i.e., but only the relative *velocities v* of different bodies of reference [13]. So relativists following this manner e.g. assert that, according to Einstein's principle of relativity, *the motion of the earth with respect to the sun* would be interchangeably the same as *the motion of the sun with respect to the earth* [14], which of course is true if one considers only *the velocities*, but is not true with respect to the *motions* "mass times velocity" of these two very different masses. Behind this erroneous consequence lies the relativist idea to make the judgement on the motion of a body depend on the observer's position, and so on his state of motion, which agnostic view even concerns our world picture. It comes to strip the truth of the Copernican system.

References

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[5] Ibid. p. 55/6.

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[8] Stephen Hawking, A Brief History of Time, 1988 (London); the 1992 ed., p. 16/7.

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