

motion—an interaction which is characterised by the Lorentz factor in its quantitative value.

In addition to Ives and Rossi there is a third “test” which is frequently quoted as direct evidence of Einsteinian time dilation. This is the so-called Hafele-Keating experiment. It is based on the carriage of atomic clocks in aeroplanes around the Earth and a comparison of their readings with a reference clock on the surface of the Earth. Hafele and Keating have come up with results which are supposed to fit in well with the predictions of Einstein, but when the details of their procedure, and all assumptions on which it is based, are closely examined, it is at once evident that there cannot possibly be any connection between their results and the theory of special relativity.

In the first place, it is not convincing to make claims of scientific proof on the basis of one experiment only. Whatever the merits of an experiment may be, only its repeated performance by various researchers and the corroboration of its results can establish its contribution to the enrichment of scientific knowledge.

Secondly, the procedure used by Hafele and Keating assumes not only that Einstein’s first theory, i.e. special relativity, is affecting the clocks, but also his second theory, i.e. general relativity. By a process which can only be characterised as completely arbitrary Hafele and Keating establish the “value” of the general relativity factor and adjust their readings for the special relativity results accordingly. This procedure is purely speculative and very strange indeed because in order to obtain a result supporting the special theory it is assumed that the general theory, which in turn presupposes the special theory, is true. For this reason alone the Hafele-Keating results cannot be used as evidence in favour of relativity.

Thirdly, although the introduction of general relativity into the argument and the quantitative assessment of accelerated motion help to disguise the consequences of non-inertiality, the violations of the principle of inertiality are all too obvious. The violations occur not only because the experiment takes place in the gravitational field of the Earth, but also because the transport of clocks in an aeroplane is very distant from the concept of inertiality. In addition, we have to consider the relatively rough handling of the highly sensitive clocks during placement on, and removal from, the plane and their response to take-off and landing and to physical influences during the flight. It is simply not possible to assess or calculate all causes of non-inertiality and to obtain a useful result at the level of accuracy equal to the precision of time measurement achieved by atomic clocks.

Fourthly, an aspect of the Hafele-Keating experiment which is particularly damaging to its association with special relativity is the appearance of time condensation as well as time dilation in the calculation of the results. As is well known, Einstein tried to keep away from any suggestion of time condensation despite the fact that the logical consequences of certain stages of his argumentation pointed clearly towards it. It is not difficult to see why time condensation has to be avoided. It has futurologistic implications. It requires an explanation as to what is happening to a time and event sequence, or to motion representing time,

which has disappeared or has not as yet occurred. Einstein was not willing to burden himself with an intractable problem and to expose himself to criticism which might have undermined his theorising at the very beginning. He, therefore, boldly asserted that time condensation does not exist and structured his formalism accordingly. Einstein's moving clocks are permitted only to go slow. Hafele's clocks go slow as well as fast. This cannot be in harmony with relativity theory.

Fifthly, the systems set-up used by Hafele and Keating is contrary to the Einsteinian theory. The set-up implies that a point on the moving surface of the Earth where the reference clock is located is one of the two systems of an Einsteinian doublet. This inference appears incompatible with the relativistic concept of a system. A point on the terrestrial surface is not sufficiently isolated from any other point on it, it has its own motion in relation to the centre of the Earth, and its motion is circular and not rectilinear. Consider, for instance, the case when the plane with the travelling atomic clocks flies at the same speed as the revolution of the Earth so that the distance between the travelling clocks and the stationary reference clock remains constant. Why is the travelling clock in such case still supposed to go slow while the reference clock travelling at the same speed will continue to produce "stationary" time? There are numerous questions, but no answers. If there can be any reference to a stationary system, then perhaps it should be to the surface as a whole or to the Earth as a whole. But in this case the plane would be part of the system and the experimenters would not be able to inject a quasi-relativistic doublet into the picture. It is very difficult to determine what the system concept required by relativity actually means in the Hafele-Keating set-up.

Sixthly, Hafele and Keating are not only silent about the reciprocity of observations in their set-up, they actually engage in a further serious violation of the fundamental requirement of relativity, namely that an observer in each of the two systems should be able to consider himself stationary and the other moving. This is an essential requirement associated with Einstein's negation of absolute space and absolute rest. In fact, it turns out that in the Hafele-Keating set-up the "stationary" reference clock is considered as moving in relation to what is euphemistically called "non-rotating space" and what is in reality an absolute reference frame based on the solar system. And the flying clocks are also moving in relation to "non-rotating space". Consequently, we are not dealing with an Einsteinian doublet and relative motion at all. We are dealing with a Newtonian triplet and absolute motion. This triplet has nothing in common with special relativity.

The preceding analysis of the "experimental proofs" of time dilation discloses quite clearly that the claims advanced by relativists in support of their theory are without any foundation. Some of the experiments appear to be indicative of an internalised microprocess characterised by the Lorentz factor, but they do not favour any propositions of the theory of special relativity. On the contrary, they provide additional and convincing evidence that the theory is either irrelevant or wrong.