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Contradiction between FitzGerald-Lorentz length contraction and time dilation: A GPS-compatible lorentz transformation

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The Global Positioning System (GPS) measures distances using timing information obtained from atomic clocks. The justification for this procedure comes from relativity theory, in particular Einstein's light-speed postulate. There are two distinct methods for predicting distance relationships, however, and the present work calls attention to a general lack of internal consistency between them. An illustrative example is considered in which the length of a rod is measured by twoobservers in relative motion. The rod had a length L at the beginning of the exercise when both observers were in the same rest frame as the rod. It was then carried away by one of the observers (A) until he attains a constant velocity in the x direction relative to his colleague (B). According to the relativity principle, A measures the same value L for the length of the rod, independent of its orientation to B. The Fitzgerald-Lorentz contraction (FLC) phenomenon of relativity theory states that B will also obtain a value of L if the rod is lying in a perpendicular direction to their relative velocity (_yB = _yA = L). The other way to measure the length of the rod is by multiplying the elapsed time for light to pass between the termini of the rod with the speed of light, c=2.99792458 ms-1. Because of time dilation in the rest frame of A, the elapsed time is greater for B (_tB > _tA). Since the speed of light is the same for both, it follows that _yB =c_tB >c_tA =_yA= L, i.e. _yB>L. The contradiction for these two values of _yB shows that Einstein's Lorentz transformation (LT) is invalid because it predicts both FLC and time dilation. Closer examination shows that the reason for the above contradiction [clock riddle: R. J. Buenker, Apeiron 19, 84 (2012)] in relativity theory can be traced to an additional assumption Einstein made in his original derivation of the LT, namely that a parameter required to specify a normalization constant in the general space-time transformation that leaves Maxwell's equations invariant (and also guarantees that the speed of light is constant for all observers and light sources) be exclusively a function of the relative speed v of the two inertial systems. This assumption (third or "hidden" postulate) leads directly to the LT and therefore to the above contradiction in the theory. The problem is removed by simply making another assumption which is based on actual experiments with time dilation that were not available in 1905. Specifically, it is assumed that clock rates in different inertial systems are strictly proportional to one another (_tA = _tB/Q). This change in the derivation of the space-time transformation still leads to the same velocity transformation as in Einstein's version of relativity theory and thus to a large number of its previously successful predictions such as the aberration of starlight and the Fresnel light-drag experiment. It is also consistent with Thomas spin precession, as well as with all other confirmed predictions of the theory to date.

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