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Pure Physical Proof of Simultaneity Preservation at Relative Inertial Motion

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Abstract

Pure physical proof of simultaneity preservation at relative inertial motion is performed in this paper.

Key words: simultaneity preservation, relative inertial motion

Setting

Let two distant observers A and B are located rest on a horizontal axis of inertial reference frame S where along this horizontal axis moves an inertial reference frame S' with its horizontal axis coinciding with the one of S. In the reference frame S A and B simultaneously start an identical uniform acceleration in the direction of motion of the inertial reference frame S' and simultaneously finish it becoming the distant rest observers of this reference frame located on the horizontal axis of S'.

Proof

In the reference frame S a couple of stopwatches of A and B activated simultaneously at the moment of acceleration starting and deactivated simultaneously at the moment of acceleration finishing can theoretically measure differently from any clock permanently rest in S, but because of the identical physical conditions for both stopwatches they compared each other have to measure identically in this reference frame and so display the same time elapsed after simultaneous deactivation. In accordance to above, if in the reference frame S' would the stopwatches not be deactivated simultaneously – one of the couple deactivated later for A and also for B, so for A and also for B this stopwatch would have to measure more slowly than the other. If for A and also for B this stopwatch would measure more slowly than the other, so this stopwatch would measure more slowly than the other independently on the mutual motional state stopwatch – observer. But it means that also for any rest observer of S this stopwatch would have to measure more slowly than the other, what

contradicts that in the reference frame S because of the identical physical conditions for both stopwatches they have to measure identically. This contradiction can be eliminated only if the stopwatches are in the reference frame S', so as it is in the reference frame S, deactivated simultaneously.

Conclusion

If some in the direction of mutual motion distant events are in some inertial reference frame simultaneous, so these events have to be simultaneous in the other inertial reference frame as well.