

Peer Review

Review of: "Entangled Simultaneity: Testing Lorentz and Light-Speed Invariance with Quantum and Classical Entanglement"

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The paper by Professor Spavieri and colleagues on entangled simultaneity is interesting and stimulating. The paper shows that the Lorentz transformation with absolute simultaneity (LTA) performs better in certain circumstances than the standard Lorentz transformation (LT) and those with the one-way velocity of light determined arbitrarily by conventions. One such circumstance is the entangled simultaneity when clocks at two ends of a rotating rod can be synchronized instantaneously, as developed in their paper. They have also demonstrated that LT cannot satisfactorily account for the results of the linear Sagnac experiments. I find no problems in their mathematics and derivations and generally agree with the authors' conclusion that Einstein's relative simultaneity fails to explain some phenomena. The entangled simultaneity model developed in the paper, however, may not be able to convince mainstream relativist researchers. I think the relativist researchers with mainstream views may raise the following two points against the model:

First, researchers with mainstream views may argue that the ideal rigid body is a classical concept and that interaction cannot be transmitted with infinite velocity in special relativity. The rotating rod in the model requires a rigid body. Thus, researchers with mainstream views may dismiss the model because rigid bodies are theoretically impossible within special relativity.

Second, researchers with mainstream views may contend that clocks in S' are not synchronized to the observers in S because of relative simultaneity in special relativity, even if the rotating rod is rigid and used for synchronizing clocks in S' . Similarly, clocks synchronized in S are not synchronized to observers in S . Furthermore, the length L' transformed from L cannot be used directly in S' because

the two ends of L, simultaneous in S, are no longer simultaneous for L' transformed from L. A length with two ends simultaneous in S' has to be found. Researchers with mainstream views may reject the authors' results because of the complex relativity of simultaneity.

These two issues may need to be explained to convince researchers with mainstream views.

Declarations

Potential competing interests: No potential competing interests to declare.