Question to Physical Societies That Believe Special Relativity Is Consistent

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Most physical societies seem to firmly believe that the special theory of relativity (STR) has been experimentally verified and dose not have any inconsistencies. However, the equivalence of inertial frames under light speed constancy is mathematically infeasible. I present a basic question of STR to show it, and ask the societies, especially the American Physical Society, to answer the public question.

Question

It is easy to see from the following basic question that the special theory of relativity (STR) is mathematically infeasible.

Given four inertial frames S_i with relative velocities $\boldsymbol{\beta}_{ji}$, $i, j = 1, \cdots, 4$, what are the relationships between their coordinate vectors?

The $\boldsymbol{\beta}_{ji}$ normalized with respect to c, where c is the speed of light in the isotropic frame S, denotes the velocity of S_j as seen in S_i. I believe any physicists, if they are unable to give consistent answers to this easy question, would not think that the equivalence of inertial frames under light speed constancy is mathematically feasible, unless they are blind believers in the sacred tenet of the postulates of STR. I publicly ask the American Physical Society to answer the basic question.

Proof of the Mathematical Infeasibility

In case the inertial frames S_i and S_j are connected via an intermediate frame S_k, the velocity of S_j relative to S_i is expressed, by the velocity composition law of STR [1, 2], as

$$\begin{aligned}\bar{\boldsymbol{\beta}}_{ji/k} &= \frac{1}{1+\boldsymbol{\beta}_{ki}^T\boldsymbol{\beta}_{jk}}\left[\boldsymbol{\beta}_{ki} + \frac{\boldsymbol{\beta}_{jk}}{\gamma_{ki}} + \frac{\gamma_{ki}(\boldsymbol{\beta}_{ki}^T\boldsymbol{\beta}_{jk})\boldsymbol{\beta}_{ki}}{1+\gamma_{ki}}\right]. \\ &\equiv \boldsymbol{\beta}_{ki} \oplus \boldsymbol{\beta}_{jk}\end{aligned} \tag{1}$$

where $\gamma_{ki} = (1-\beta_{ki}^2)^{-1/2}$ with β_{ki} denoting the magnitude of $\boldsymbol{\beta}_{ki}$. Consider another intermediate frame S_m. According to the composition law, $\boldsymbol{\beta}_{jk} = \boldsymbol{\beta}_{mk} \oplus \boldsymbol{\beta}_{jm}$ and $\boldsymbol{\beta}_{mi} = \boldsymbol{\beta}_{ki} \oplus \boldsymbol{\beta}_{mk}$. Using these relationships and (1), we have [3]

$$\overline{\boldsymbol{\beta}}_{ji/k} = \boldsymbol{\beta}_{ki} \oplus (\boldsymbol{\beta}_{mk} \oplus \boldsymbol{\beta}_{jm}) \tag{2a}$$

$$\overline{\boldsymbol{\beta}}_{ji/m} = \boldsymbol{\beta}_{mi} \oplus \boldsymbol{\beta}_{jm} = (\boldsymbol{\beta}_{ki} \oplus \boldsymbol{\beta}_{mk}) \oplus \boldsymbol{\beta}_{jm} \,. \tag{2b}$$

The composition operation is not associative [2]. Thus $\overline{\boldsymbol{\beta}}_{ji/k} \neq \overline{\boldsymbol{\beta}}_{ji/m}$, which shows that STR is mathematically infeasible. Not only the direction but also the magnitude of the composite velocity is dependent on the intermediate frames. Hence, the proper time also depends on them and is not uniquely determined. These inconsistencies result from the postulates of STR. The actual speed of light is anisotropic in inertial frames [3–5]. Under the unique isotropic frame [3–6], there are no inconsistencies and no contradictions. Nature itself reveals the uniqueness.

References

1. C. I. Mocanu, On the relativistic velocity composition paradox and the Thomas rotation, Found. Phys. Lett. **5**, 443 (1992).
2. A. A. Ungar, The relativistic velocity composition paradox and the Thomas rotation, Found. Phys. **19** (11), 1385 (1989).
3. Y.-H. Choi, Uniqueness of the isotropic frame and usefulness of the Lorentz transformation, J. Kor. Phys. Soc. **72** (10), 1110 (2018).
4. Y.-H. Choi, Consistent coordinate transformation for relativistic circular motion and speeds of light, J. Kor. Phys. Soc. **75** (3), 176 (2019).
5. Y.-H. Choi, Theoretical analysis of generalized Sagnac effect in the standard synchronization, Can. J. Phys. **95** (8), 761 (2017).
6. Y.-H. Choi, Coordinate transformation between rotating and inertial systems under the constant two-way speed of light, Eur. Phys. J. Plus **131** (9), 296 (2016).