A Comment On arXiv:1110.2685

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This brief paper traces comments on the article arXiv:1110.2685. It seems there is an intrinsical misconception within its claimed solution, since an intrinsical proper time reasoning leads to the assumption the OPERA collaboration interprets a time variation as a proper time when correcting time intervals between a GPS frame and the grounded baseline frame.

AN INTRINSICAL PROPER TIME REASONING, MISCONCEPTED BY THE OPERA COLLABORATION?

The author of the article arXiv:1110.2685 uses the designation: *from the perspective of the clock...* Within the approach used by the author, via special relativity, the GPS frame of reference must use ***two*** distinct but synchronized clocks to tag the instants at A and B. The Eq. (2) in arXiv:1110.2685 should be obtained via the Lorentz transformation for the neutrino events of departure from A and arrival to B. Let (x_A, t_A) and (x_B, t_B) be the spacetime events of departure and arrival of the neutrino in the baseline reference frame K, respectively. The time interval spent by the neutrino to accomplish the travel in the arXiv:1110.2685 GPS reference frame K' is:

$$\delta t' = \left(1 - v^2/c^2\right)^{-1/2} \left[(t_B - t_A) - \frac{v}{c^2}(x_B - x_A)\right], \quad (1)$$

in virtue of the canonical Lorentz transformation for time in K' as a function of the spacetime coordinates in K, where v is the assumed boost of K' in relation to K in the baseline direction AB, c the speed of light in the empty space. With $\delta t = t_B - t_A$, $\delta x = x_B - x_A = S_{baseline}$, $\delta x = v_\nu \delta t$, where v_ν is the neutrino velocity along the AB direction, the eq. (1) reads:

$$\delta t' = \left(1 - v^2/c^2\right)^{-1/2} S_{baseline} \left(\frac{1}{v_\nu} - \frac{v}{c^2}\right). \quad (2)$$

With $v_\nu = c$, $\gamma = \sqrt{1 - v^2/c^2}$, $\delta t' \stackrel{!}{=} \tau_{clock}$, as defined in arXiv:1110.2685, the Eq. (2) here becomes the Eq. (2) in arXiv:1110.2685:

$$\tau_{clock} = \frac{\gamma S_{baseline}}{c + v} \Rightarrow c\tau_{clock} + v\tau_{clock} = \gamma S_{baseline}. \quad (3)$$

But:

- $\delta t' \stackrel{!}{=} \tau_{clock}$ is not a proper time (it is a time interval measured by distinct clocks at different spatial positions in K'); hence: why would the OPERA collaboration correct $\delta t' \stackrel{!}{=} \tau_{clock}$ via $\delta t = \delta t'/\gamma$, as claimed via the Eq. (5) in arXiv:1110.2685?
- Such correction would be plausible if the events of departure and arrival of the nenutrino had the same spatial coordinate $x'_A = x'_B$ in the GPS K' frame of reference, but it is not the case.

Concluding, it seems unlikely that the OPERA collaboration has misinterpreted a GPS time interval.

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