MEASURING THE ONE-WAY VELOCITY OF LIGHT

(PROBABLY IT HAS ALREADY BEEN DONE)

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When Einstein (1905) introduced special relativity, he stated that if a light signal leaves a clock A at a time \( t_0 \), is reflected at B at time \( t_B \), and returns at A at time \( t_R \), clocks at A and B can be synchronized by setting \( t_B = t_0 + (t_R - t_0)/2 \), i.e., by assuming the one-way velocity \( c_+ \) from A to B is the same as \( c \), the one-way velocity from B to A with both set equal to \( c \), the round-trip velocity. This was the only way one could synchronize clocks at A and B.

Reichenbach (1927) and followers have argued that (1) Einstein’s synchronization procedure is merely conventional because, they claim, all one can measure is light’s round-trip velocity \( c \), while, with one may set its One Way Velocity to be \( c_+ \) in the \(+x\)-direction and \( c \) in the \(-x\) direction, with light’s round-trip velocity remaining \( c \), and synchronize clocks accordingly; (2) that under this ‘R-synchronization’ the laws of physics are independent of the choice of light’s One Way Velocity and, therefore, (3) that one cannot measure light’s One Way Velocity, nor that of any object. Contrary to Reichenbach’s conventionality thesis, one can measure the one-way velocity of light. The time of travel difference for two signals emitted simultaneously at A, one on a path from A to B to C, the other from A to C, allows measurement of the one-way velocity of light only in some cases. Yet, one can determine the wavelength of light and, hence, its one-way velocity by using a medium that acts as a frequency filter. Such a medium may comprise a periodic structure or constituents of known size. Also, isotropy in the one-way velocity of light probably can be inferred from data presently on hand.

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