Question about light clock and derivation of time dilation

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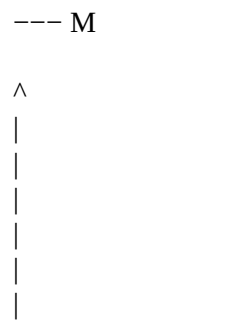
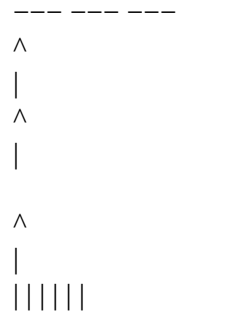
- *Date*: 3 Jul 2005 07:32:44 −0700

Time dilation is typically the first SR effect derived in text books, and it is usually done with the example of a light clock as follows, where S is the source and M is a mirror. Since it appears to be so important, I'm trying to understand every aspect of this example.



The well−known derivation is based on the fact that, to an observer B moving horizontally w.r.t. the clock, the light is taking a longer path from S to M as shown below:



But the speed of light is constant and dimensions perpendicular to the direction of motion don't change. Therefore, B concludes that the time for the light to go from S to M is longer than the time determined by an observer stationary w.r.t. the clock.

Fine, but I am trying to reconcile B's observation of the light path with the fact that the light source is pointed in the vertical

direction. Doesn't that tell B that the light is "really" just moving up and down? Wouldn't B have to see the light source tilted to make sense of his observation of the light path?

To make this more concrete, let's suppose that the source S and mirror M are connected with a narrow fiber optic (with some scattering material included so that B can still observe the light). How can B reconcile the observation that the light path is tilted with his knowledge that the light is confined to move in the fiber? Doesn't he "really" know that the light is just moving straight up and down?

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