Lecture 6

Very important notes:

An event is a point in both space and time. Always think in terms of events!

When two or more observers are present at the same event (at the same place in space and at the same time), their 'stories' must match. Example: Anne and Bart look at each other's clocks when they while passing really close to each other. Anne says later "my clock was three minutes fast compared with Bart's" and Bart says later "my clock was three minutes slow compared to Anne's".

Their 'testimonies' are in agreement even if their clocks did not show the same time.

To observe an event, an observer must be present at that point (their spacetime trajectory must intersect it). Observing from a point away from the event observed results in distortions since light must take time to reach the observer from the event.

On the diagram below, the clocks below are in Anne's frame of reference and the ones on top and shaded are in Bart's FoR Bart



Time dilation: a single moving clock runs slow when compared to an array of stationary clocks

-> Clicker question (again, same as last lecture)

Hint: think in Bart's frame of reference and focus on events I and II. Which is the single moving clock and which are the stationary clocks now? which clock runs slow? can you see the answer now?

Answer:

There are two events: Anne's clock shows 12:00 at I and then 12:02 at II. Bart's (synchronized) clocks show 12:00 at I and ??? at II. Anne's clock is being compared with two stationary clocks. Anne's clock should be running a factor of 2X slower than Bart's and Co, so ??? = 12:04.

-> clicker question

Answer: Even though they might not be synch'ed in Anne's FoR (don't show 12:00 at the same time), all of Bart's FoR clocks run at exactly the same rate (same time dilation factor applies to all)

Let's look at all this from the point of view of spacetime diagrams:



$$x = 40, \quad \frac{V}{c} = 0.99969$$

Relativity of simultaneity: two events which happen at the same time (but not' at the same place) in one FofR don't happen at the same time in other ForR



On the RHS, the two light pulses strike observers B1 and B2 at the same time. In the FoR in which B1 and B2 are moving, on the LHS, the two light pulses do not strike at the same time.

But we already knew that moving clocks look 'not-in-synch'. The two facts agree:

