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Astron-84
Written Assignment Week 2

1. The assumption of absolute time is incompatible with the consistency of the speed of light. Consider the example of a system that has a mirror at one end of a meterstick, and ticks once every time it receives a photon. Assuming idealistic conditions, The clock will tick at 2L/c seconds. However, if the clock and the meterstick are both moving in a direction perpendicular to the motion of the meterstick, then due to the consistency of the speed of light, the light will take longer to reach the mirror (as it now has a component of velocity in the perpendicular direction), leading to the clock to tick at 2L/c + t' time, where t' refers to the time it took for the light to cross the extra distance (given by Pythagoras' theorem). Thus, due to the differences in time, the consistency of the speed of light is incompatible with the assumption of absolute time.
2. Examples are mechanical clocks, which use clockwork (gears) to be able to tell the time, an atom of Caesium-133, which is able to tell time through the transitions between its hyperfine ground states, and telling time from the moment the sun rises over the horizon to the time it sets. Electromagnetic forces are involved with all three, because light is the medium through which information is transferred from the clock itself to our eyes, to allow us to observe them. In the case of the mechanical clock, the photons must bounce off the clock face and return to our eyes; in the case of the atom of Cs-133, the light must be emitted by the atom itself, and in the case of the Sun, the light must leave the Sun itself, although it encounters different observers at the same time.
3. There is no simple way that they would be able to perfectly synchronise their clocks – this is because if they are far away, due to the consistency of the speed of light, each observer will see the other clock as being delayed by x/c seconds; thus, the only way they could synchronise their clocks would be as follows; a light source is placed in between the observers (at distance x/2 m) and as soon as the light were to hit the observers, each immediately tuned his clock, and moved it back by x/c seconds. Due to light being the only possible route of information, and due to it being the fastest substance in spacetime, there is no way to synchronize clocks without it.
4. Observer 3 moving at a velocity v in the direction of separation would not see the clocks as being synchronized again due to the principle of the consistency of the speed of light. This is because (assuming 3 is heading towards 2 first, before 1) 3 will perceive the system of 1 and 2 as being in motion and herself as being stationary, and thus the light from 2's clock will reach her at y/c seconds, depending on her distance y from 2, while the light from 1 will reach her at (x + y)/c seconds, which represents a discrepancy. Another way to describe it is that times in which 3 receives the light signals is different from 2, because of time dilation. So when the light reaches 2 at time t, giving the clock x/c time, 3 considers it to have arrived at t' = (x/c)/sqrt(1 – v^2/c^2) time.