B.Sc. Part I

Paper I

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Q.2 Discuss the Concept of Simultaneity (Relative character) of time. Show that there can be a disagreement about past and future between two observers in relative motion. On this basis, is it possible to Pre- the future?

Sol:-

Concept of Simultaneity: Relative character of time:-

An interesting implication of the relativistic theory is that time-intervals are the same of two observers in relative motion. This leads to an important that two events which appear to take Place simultaneously to one observers may not appear simultaneous to another observer in relative motion.

Let us seppose that two time-bombs explode at different places x_1 and x_2 but at the same time t_0 to an observer

on the ground. The situation is different to a pilot of a spaceship moving with a velocity v relative to ground to him the explosion at x_1 occurs at

$$t_1' = \frac{t_0 - \left(\frac{x_1 v}{c^2}\right)}{\sqrt{(1 - v^2/c^2)}}$$

and that at x_2 occurs at

$$t_2' = \frac{t_0 - \left(\frac{x_2 v}{c^2}\right)}{\sqrt{(1 - v^2/c^2)}}$$

Hence the two events (explosions) that occur simultaneously to one observer are separated to another observer by a time interval of

$$t_2' - t_1' = \frac{(x_1 - x_2)\frac{v}{c^2}}{\sqrt{(1 - v^2/c^2)}}$$

Now the question arises who is right? This question is meaningless in itself. Both observers are right because ~~case~~ each one measures what he sees. Hence, we ~~conclude~~ conclude that there is no such thing as "absolute time" which is same for all observers. Time is relative and is different for observers in relative motion.

Past, Present and Future :-

The relative character of time, however does not discard all of our everyday experiences regarding time. For example no observer regardless of his state of motion can see an event before it actually occurs. This is because an event sends out light signal which takes finite time to reach the observer. Similarly time never runs backward to any observer. A sequence of events that occurs somewhere at $t_1, t_2, t_3 \ldots\ldots$ will appear in the same order to all observers everywhere though not necessarily with the same time intervals $t_2 - t_1$, $t_3 - t_2$, ... etc. between each pair of events. Thus we can order events in time. Hence there is a sense of time distinguishing past, present & future.

However, it is possible that an observer has seen an event occuring at a distant place. Whereas second farther observer has yet to see it. Thus the event has occured in the past of the first observer. but has to occur in the future of the second observer. Thus, the two observers disagree about past and future. Can the first observer send a ratio message about-

This event to the second observer enabling him to predict the future? The answer is no because the radio message has to travel through space with the speed of light and can never reach the second observer before he himself becomes aware of the event. Thus in the Theory of relativity there is no way to peep into the future.