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Einstein's Special Theory of Relativity and Its Futuristic Aspects

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Abstract:- This research paper focuses on the study of Einstein's Special Theory of Relativity and its aspects in the future. Special Theory was the result of Einstein's thought to connect the classical principle of relativity in Newtonian mechanics to the modern principle of constancy of light by Maxwell. This research paper discusses the idea of 'Time's arrow' and 'Black Hole' that were the results of 'The Theory of Relativity'.

I. INTRODUCTION

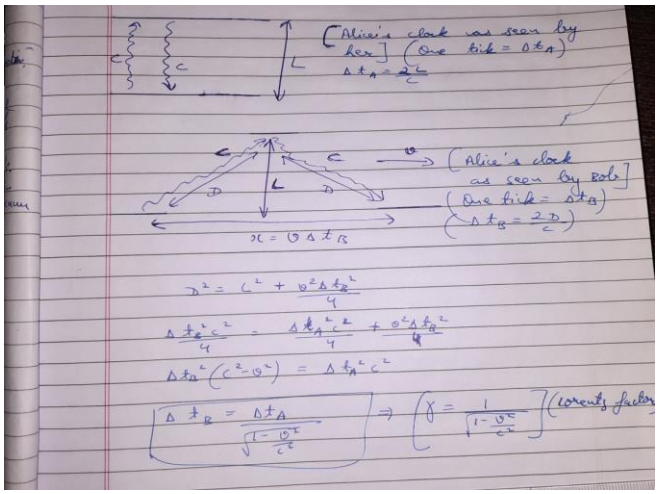
Special Theory was the by-product of Einstein's obsession for explaining 'The Principle of Relativity' in Newtonian mechanics and 'The Principal of Light Constancy'. Einstein was obsessed by the idea that how two equally accepted, but contrasting theories can be true at the same time.

I. SPECIAL THEORY OF RELATIVITY

Einstein's special theory of relativity published in the so-called 'Miracle Year' of 1905 led to the idea of 'Time Dilation' and 'Length Contraction'. It asked the question of what must happen to our notion of space and time, so that when light travels a given distance in a time period, the answer always comes out as 3*10^8 m/s. For example: If a light beam is fired in vacuum at an object moving towards the light beam with half the speed of light, then the speed of light would not become one and a half the speed of light as suggested by 'The principle of Relativity' in Newtonian mechanics, instead it will continue to travel with 3*10^8 m/s. The only two ways that Einstein could find were that the distance becomes greater than its original value or the time starts to run slow. However, he realized that both happens i.e. Space 'contracts' and time 'dilates', which he called as 'Length Contraction' and ' Time Dilation' respectively.

II. TIME DILATION AND LENGTH CONTRACTION

Let's consider a light clock in which 1 second means the time taken by the light beam to come back to the same point from where it started from. Let Alice have this light clock and she is moving with 'v' speed which is close to the speed of light 'c'. Another person named Bob who is stationary w.r.t to the earth is watching Alice going past her and this leads to 'Time Dilation' as follows;



And, this leads to:

$$(\text{Elapsed time})_{moving} = [(\text{Elapsed time})_{rest}]/[\text{Lorentz Factor}]$$

This result was quite surprising because it was in contrast to what was earlier thought by Physicists. This result says that time is not absolute. It depends on the frame of reference from which the person is seeing the motion. But this dilation in time can only be seen when the speed of the moving object is close to the speed of light. This effect can't be seen in day-to -day life, in which the speed of the moving object is very less than the speed of light i.e. v<<<c.

This 'Time Dilation' also leads to 'Length Contraction':

T_b = [Lorentz factor] T_a { From the derivation above}

L_b/c = [Lorentz factor] L_a/c {As, Time = Distance/c}

$$L_{moving} = L_{rest}/(\text{Lorentz factor})$$

This 'Length Contraction' happens only along the direction of motion.

III. FUTURISTIC ASPECTS OF 'THE THEORY OF RELATIVITY'

The Special Theory of Relativity thus proves that time travel in the future is possible if a person is moving with a very fast speed which is close to the speed of light.

Let's consider two identical twins that are standing on a railway station. Let their names be 'Peter' and 'Jack'. Peter is going to sit on a train whose speed is nearly equal to the speed of light and Jack is going to remain on the platform. Thus, by the Special Theory of Relativity, Peter's age is going to increase slowly than his brother Jack. When Peter will come back to the platform, hoping that only some days or months have passed, he will find that his brother has gone older than him and he has just travelled through time in the future.

However, The Theory of Relativity is unable to tell about travelling through time in the past, which means this theory is unable to explain the 'Time's arrow' or 'the forward direction of Time'. 'Time's arrow' is an unsolved question from 'The theory of Relativity' which tells that time only flows in the forward direction and it is not possible to change this direction of time. The concept of 'Time's arrow' was born out of the '2nd law of thermodynamics' which says that the entropy or spontaneity of an isolated system can only increase. For example: The universe will always grow bigger or a broken cup cannot be joined by itself to its original shape. 'Time's arrow' is the current topic of research among physicists. Another topic which 'Theory of Relativity' predicts is 'Black Hole'. The Theory of Relativity predicts that when a star dies, it becomes a black hole which has a very large mass and which can deform the Space-time. The Theory predicts that nothing can travel through this black hole, even light cannot escape the black hole. The theory says that time stops inside the black hole. This black hole is said to be in the centre of the galaxy and this topic is under the research of many physicists around the globe.

IV. CONCLUSION

This research paper, in the best way, discusses the ideas that led Einstein to the Special Theory of Relativity. It gives an insight of 'Time Dilation' and 'Length Contraction' and gives their derivations, which are the basic pillars of the special theory of relativity from the principle of light constancy and the principle of relativity from the Newtonian mechanics. This research paper also gives some idea about 'Time's arrow', 'Black Hole', and 'Time Travel'. This research paper, by the very starting, discusses the Theory of Relativity and its futuristic aspects, so that this research paper can help to unveil the mysteries of the nature and can help the physicists to achieve their goals. I hope that this research paper can help the physicists to give new theories about the nature and space-time and the universe.

REFERENCES

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