Relativity

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- Relativity is a four dimensional concept.
- Three coordinates are related with space and other is related with time.
- Relativity is divided into two classes -
- One is Classical relativity
- Other is special Relativity

- In case of relativity; concept of reference frame is important.
- To locate an object; one frame is at rest and other frame is moving along with the object.
- Interestingly coordinate system of the same object is different for the reference frame which is at rest and the frame which is moving along a direction.

- Let an object is moving along the x-direction.
- Let the coordinate of the object is (x, y, z, t) with respect to frame which is at rest and (x_1 , y_1 , z_1 , t_1) is the coordinate of the same object with reference to moving frame associated along with it.
- In case of classical relativity Galilean Transformation Equation is used.

- The Galilean Transformation are

$x=x_1 - vt$

$y=y_1$

$z=z_1$

$t=t_1$

Here v is the velocity of the object along x- direction

- As per Galilean Transformation Equation; Newton's Laws are invariant in all frames.
- In classical relativity basic thing is that length of any object remains same, mass remains same, time remains same.
- In classical relativity, the most interesting fact is that light is dependent on the velocity of medium, called 'ETHER'

- In case of classical relativity, velocity of light is varied from c+v to c-v.
- After that; Michelson and Morley Experiment was done and they found the null result, but they were unable to explained the reason behind in it.
- After that Einstein took the problems and from this point; special relativity begins.

- In case of special relativity; Lorentz's Transformation Equation was used.
- Two postulates of special theory of relativity are –
- The velocity of light is a constant quantity and does not depend on the velocity of ether i.e. medium.
- All laws of physics are same in all reference frame.
- On the basis of new concept whole things has been changed.

- The length of the object has contracted when it is in motion.
- The mass of a body has decreased when it is in motion.
- Clock has been slowed down during the motion.
- The whole concept has been changed in case of special relativity compared with classical relativity.

- Finally Einstein presented his famous theory of Mass-Energy Relation

$$E = mc^2$$

- Whwre E is the energy, m is the mass of body and c is the velocity of light.
- According to this theory if a body travels with a velocity of light the mass of that body transform into energy.
- Conversly if velocity of light is slow down then wave of light converted into energy.

Thank you