

PHYSICS

PAPER-6 (SSE 611)

Special and General theory of relativity, Statistical mechanics, Wave mechanics and Nano physics

Programs	B.Sc
Subject	Physics
Semester	V
University	Kuvempu university
Session	01

Special theory of relativity: Module-01

Topics Covered:

- Concept of Newtonian Mechanics.
- space, time, mass and frame of reference.
- Concept of Newtonian and Galilean Relativity

Recap of Previous semester

- Newton's laws of motion.
- Galilean transformation equations.
- Relative motion.
- Coordinate system.
- Frames of reference.

Learning objectives

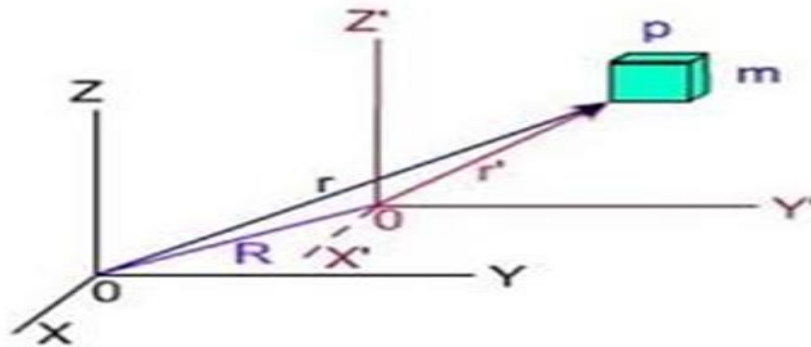
- Understanding the concept of Absolute and relative motion.
- Concept of Absolute Space, time and mass.
- Understanding the true nature of Newtonian mechanics.
- Concept of Space, time and mass according to Newtonian and Galilean relativity.

Session outcomes:

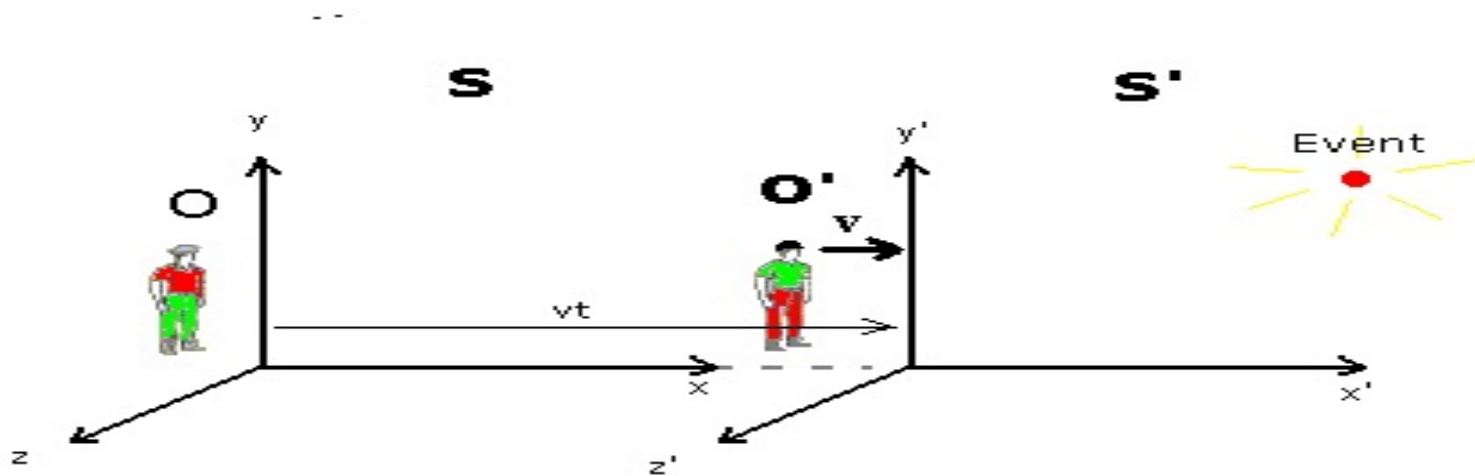
- Absolute Space, time and mass.
- Relativistic Space, time and mass.
- Drawbacks of Classical mechanics.
- The mass of the body depends on its relativistic velocity.
- The fundamental laws physics are identical in all inertial frames of references.

Newtonian or Classical Mechanics

- Concept of Space, Time and Mass.
- The laws of motion are the same in all inertial frames.
- Newtonian mechanics is invariant under Galilean transformation.
- A system of coordinate axes which defines the position of a particle in two or three dimensional space is called as frame of reference.



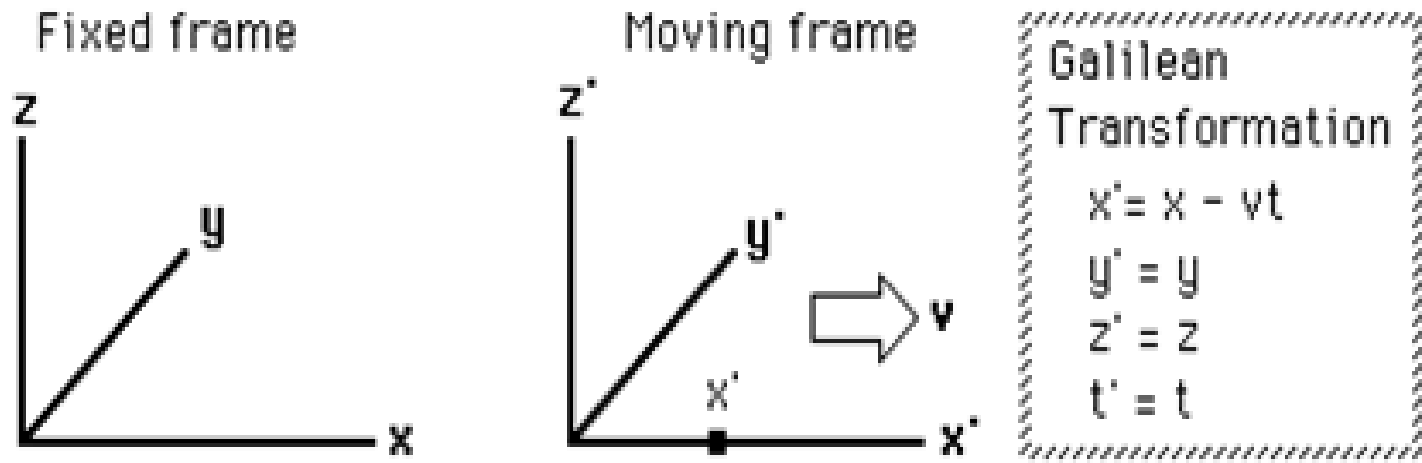
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The coordinates in one system at rest (x, y, z, t) (In S frame) and another system moving (x', y', z', t') (in s' frame) with constant velocity (v) with respect to S .

Limitations of Newtonian Mechanics



The primed frame moves with velocity v in the x direction with respect to the fixed reference frame.

The reference frames coincide at $t=t'=0$.

The point x' is moving with the primed frame.

The Galilean transformation gives the coordinates of the point as measured from the fixed frame in terms of its location in the moving reference frame.

The Galilean transformation is the common sense relationship which agrees with our everyday experience.

MCQs

1. A particle travels at the speed of light, we conclude that
 - a) Its energy is infinite
 - b) Its violates relativity
 - c) Its energy is zero
 - d) Its rest mass is zero

Answer: d) Its rest mass is zero

2) According to theory of relativity, laws of physics can be formulated based on

- a) Inertial frames of reference
- b) Non inertial frames of reference
- c) Both inertial and non inertial frames of reference
- d) None of the above

Answer: a) Inertial frames of reference

3) In physics, frames of reference are classified by two main types

- a) Fast and slow
- b) Inertial and non inertial
- c) Real and imaginary
- d) None of the above

Answer: b) Inertial and non inertial

4) According to special theory of relativity, physical laws are same in frames of reference in which they are

- a) Move in an ellipse
- b) Move in a circle
- c) Accelerate
- d) Move with uniform velocity

Answer: d) Move with uniform velocity

5) The theory of relativity was proposed by

- a) Newton
- b) Galileo
- c) Einstein
- d) Michelson and Morley

Answer: c) Einstein

References:

- Arthur I. Miller “ Albert Einstein’s Special theory of relativity”
- Robert W. Lawson “The special and General theory” -1920
- C L Arora and Dr. P S Hemne “ physics for degree students”
- R Murugesan, Kiruthiga Shivaprasath Modern physics