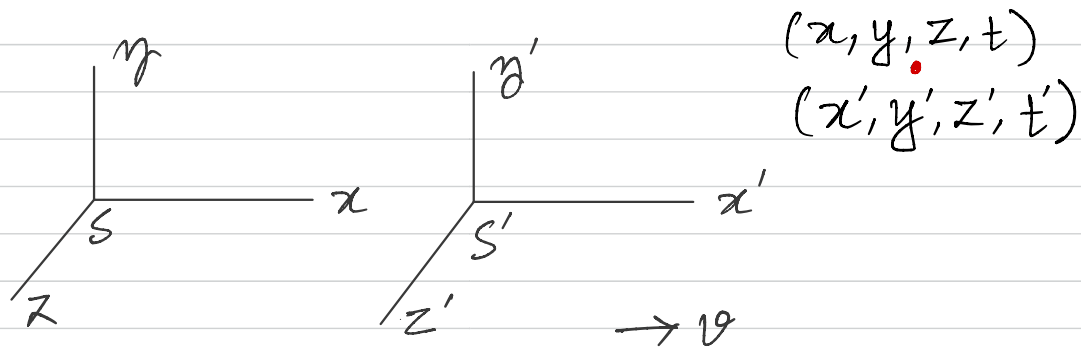* Limitations of Newtonian Mechanics: Relativity & Quantum Mechanics.

* Galelian Relativity :

The laws of motion are same in all inertial frames. Inertial frames are defined with respect to an absolute space. Inertial frames have universal time.
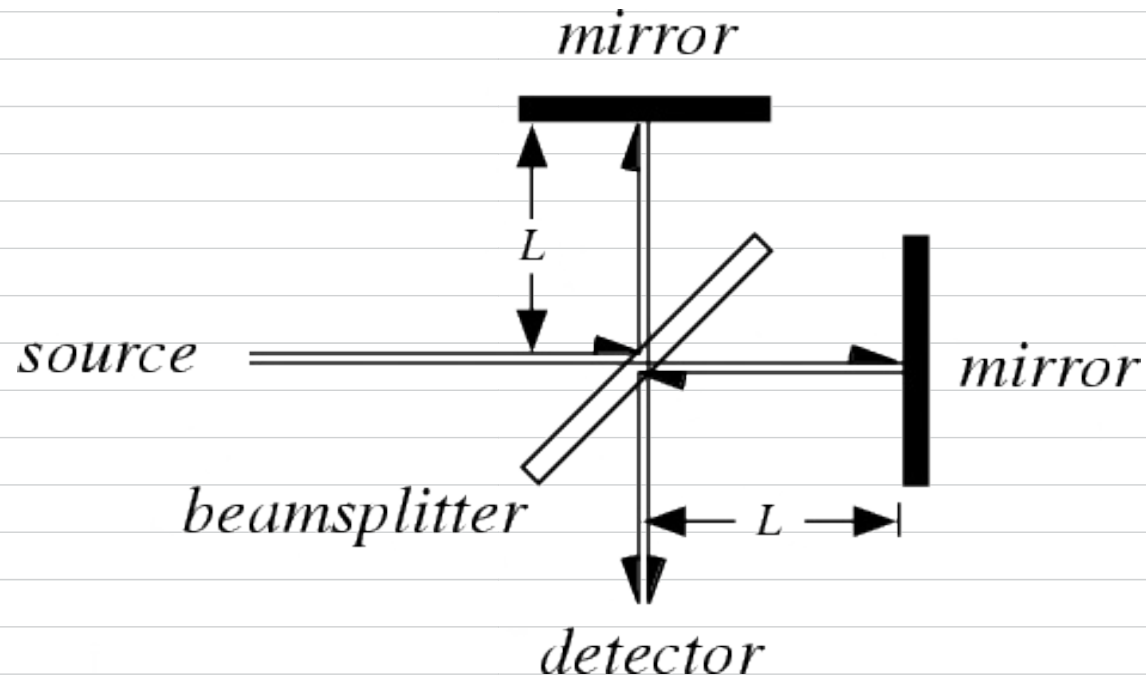
* Galelian Transformation (GT) :

(x, y, z, t)
(x', y', z', t')

$$x' = x - vt$$
$$y' = y, \quad z' = z$$
$$t' = t$$

* Michelson - Morley Expt: Read from book/internet

mirror

L

source

beamsplitter

L

mirror

detector

Conclusions of the expt ⇒ there is no ether medium

the speed of light is same for all observer

* Postulates of Special Theory of Relativity:

  a) Laws of physics are invariant in all inertial reference frames

  b) The speed of light (in vacuum) is same for all observers, irrespetive of the relative motion of light source & the observer.

* Galelian transformation violates the Einstein's postulates.

* Lorentz Transformation (LT)

(x, y, z, t)
(x', y', z', t')
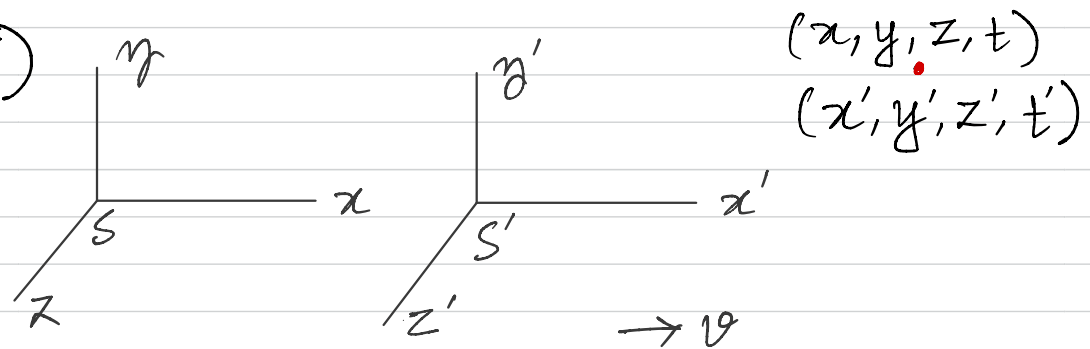
Transformation of the measurements made in the S frame to the corresponding measurements in the S' frame

$$x' = \frac{x - vt}{\sqrt{1 - v^2/c^2}} \quad ; \quad t' = \frac{t - \frac{v}{c^2}x}{\sqrt{1 - v^2/c^2}}$$

$$y' = y \; ; \; z' = z$$