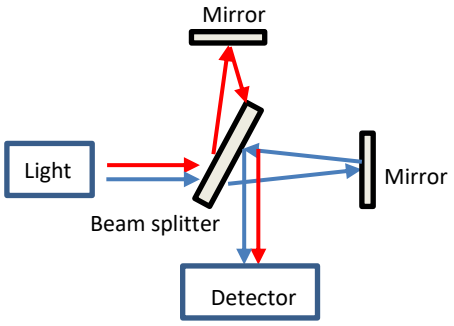
CONCEPT: SPECIAL VS GALILEAN RELATIVITY

- Galilean relativity is our classical theory of relativity
  - In Galilean relativity, we use "addition of velocities", so $\vec{v}_S =$ _____
  - This is NOT true for Special Relativity

- There is only one postulate of Galilean relativity: Measurements in any inertial reference frames must be "equivalent"
  - Einstein kept this roughly the same as the first postulate of Special Relativity
  - It's the second postulate that Einstein added that produces all the weirdness of Relativity

- Classically, all waves are thought to move in media (sound within a gas, water waves within water, etc)
  - Light, too, was thought to HAVE to move within a medium, because all other waves do
  - This medium for light was called the Aether, and was thought to permeate the entire universe

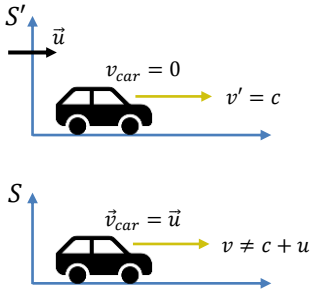
- In 1887, Michelson & Morley wanted to measure the velocity of the Aether
  - They used an interferometer to produce a diffraction patter with light
  - Light traveling to the top mirror will have one speed
  - Light traveling to the right mirror will have a different speed
  - These speed differences are caused by the Aether



- However, Michelson & Morley found no evidence of the Aether's existence
  - Einstein used this result to form his second postulate of relativity

- Since light truly moves without a medium, then a change of inertial frame should yield no change in the speed of light
  - This means that regardless of what inertial frame you measure light in, you always get the same result
  - Einstein's second postulate is simply this: the speed of light is _____ of choice of inertial frame

- Imagine someone in a car moving really quickly, at a speed of u
  - We will consider the same reference frames as for the previous example
  - If the person in the car shined a light, in S' the speed of the light would be c
  - In the S frame, the EXPECTED speed would be _____, but it turns out to be _____
  - This change of inertial frame DOES NOT change the measured speed of light



- There are two main consequences of the second postulate that dramatically differ from what is expected:
  - Time dilation: the fact that speed affects the measurement of time
  - Length contraction: the fact that speed affects the measurement of length