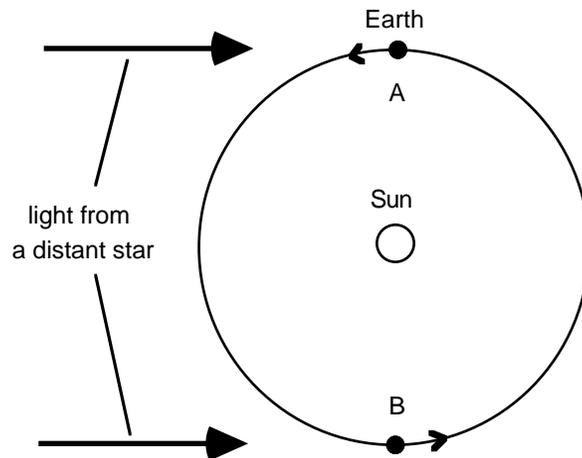


Relativity : Notes/W.S.-20

The Michelson-Morley Experiment

A very important experiment was performed in the 1880's by Michelson and Morley. They designed a device called an interferometer which was supposed to find small differences in the speed of light.



They performed an experiment over a period of several months. It was found that there was no change in the velocity of light from a distant star as the Earth moved from point A to point B.

This showed that the principle of Newtonian/Galilean relativity did not apply to light waves. The speed of light that is detected by an observer does not depend on the velocity of the observer on Earth relative to the source of the light.

In order to explain this, Einstein suggested two postulates that changed physics.

Postulate 1 : Absolute motion is not detectable.

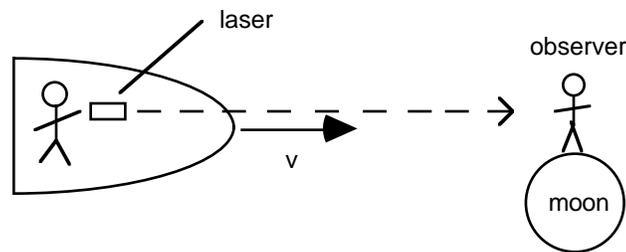
Postulate 2 : The speed of light is constant.

The first postulate is often stated in another form. That is; the laws of physics are the same for all observers that move at a constant velocity.

The second postulate says that; no matter what the relative velocity is between the source of light and the observer of that light, the speed of light (c) will always be measured to be 3.00×10^8 m/s.

Questions:

- 1) What is an interferometer?
- 2) What important experimental result did Michelson and Morley find using the interferometer?
- 3) State the two Einstein postulates.
- 4) An advanced rocket ship travels with a constant velocity of $v = +5.00 \times 10^7$ m/s as shown.



- a) What is the velocity of the moon relative to the rocket?
- b) An astronaut in the rocket aims a laser at the observer. The observer can measure the speed of the laser light. What speed does the observer find?
- c) Can the astronaut do an experiment to find out whether he is really moving?

Answers: 1) It is a device which can measure small differences in the speed of light., 2) The speed of light is constant. It does not depend on the relative velocity of the source and observer., 3) Absolute motion is undetectable., The speed of light is constant., 4)a) -5.00×10^7 m/s, b) 3.00×10^8 m/s, c) No, by Einstein's first postulate.