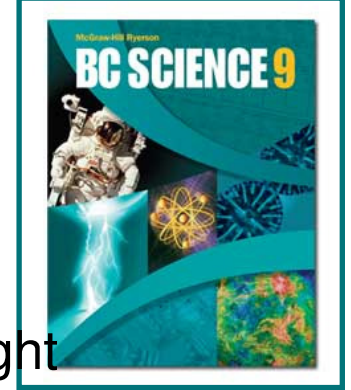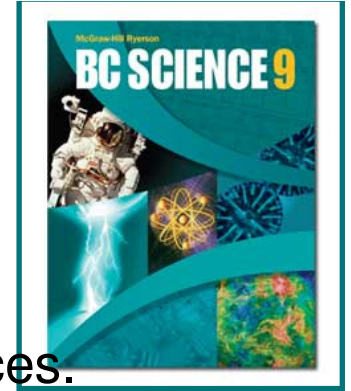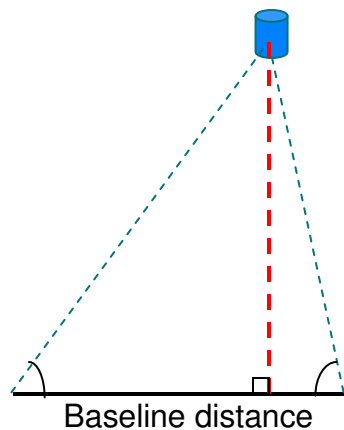# 11.3 Measuring Distances in Space

- We use AUs for distances within our solar system, and light years for distances outside our solar system.

  - A light year is the distance light travels in one year = 9.5 trillion km.
  - Even the light from the nearest stars takes several years to reach the Earth. The light that we see from more distant stars has taken thousands, or even millions, of years to reach the Earth.
  - Astronomers use red-shift to determine motion, and can use triangulation and parallax to calculate position.
    - Triangulation uses geometry to estimate actual distances between objects in space.
    - Parallax is a method that uses changing position to provide a baseline for triangulation.
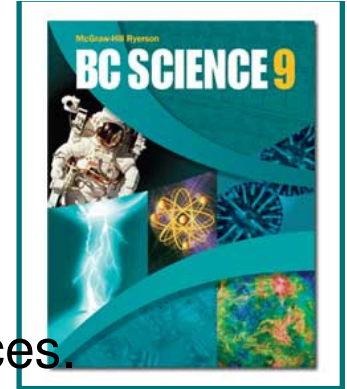
Techniques for Indirectly Measuring Distance

- Since it is impossible to measure actual distances in space, astronomers use mathematical methods to estimate distances.

  - Triangulation uses the geometry of a triangle to find the distance to far away objects.
    - First, a baseline is measured. The longer the baseline, the more accurate the distance measurement will be
    - Next, measure the angles from each end of the baseline to the object.
    - Next, draw a scale diagram that represents the baseline measurement and the two angles out to the distant point.
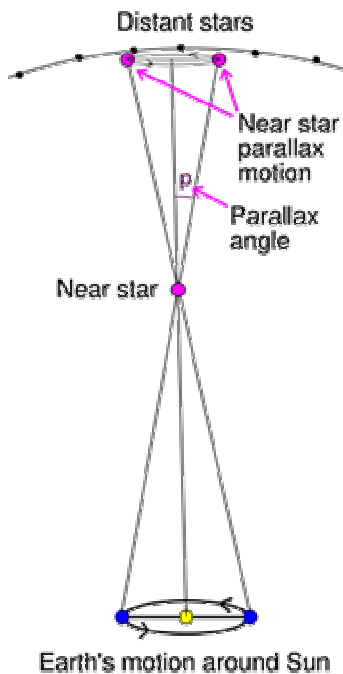   - Finally, by measuring the height of the triangle that forms, you find the distance to the object.

Baseline distance

Scale: 1 cm = 100 m

Techniques for Indirectly Measuring Distance

- Since it is impossible to measure actual distances in space, astronomers use mathematical methods to estimate distances.

  - Parallax works in a similar way to triangulation, except the baseline we use is huge - the diameter of the Earth's revolution around the Sun!

  - Parallax refers to the concept that objects closer to us appear to change position compared to objects much farther away.

  - 1. the baseline is measured. Astronomers can record the diameter of the Earth's orbit around the Sun.

  - 2. measure the angles from each end of the baseline to the object. In this case, each end of the baseline will occur 6 months apart!

  - 3. draw a scale diagram that represents the baseline measurement and the two angles out to the distant point.

  - 4. by measuring the height of the triangle that forms, you find the distance to the object.

Distant stars

Near star parallax motion

p

Parallax angle

Near star

Earth's motion around Sun

Take the Section 11.3 Quiz