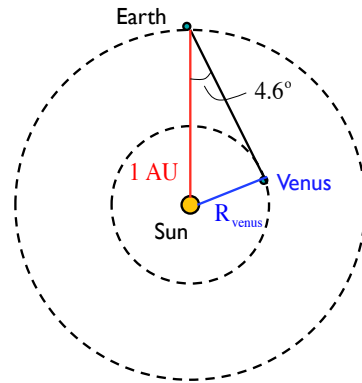


DISTANCE TO THE SUN

To determine the distance to near stars, we need the distance to our star, the Sun.

One astronomic unit (an "AU") is the distance between the earth and the sun.

We can be clever with that definition if we can determine the angle between a line connecting the earth and sun and a line connecting the earth and, say, Venus at its farthest position from the sun.



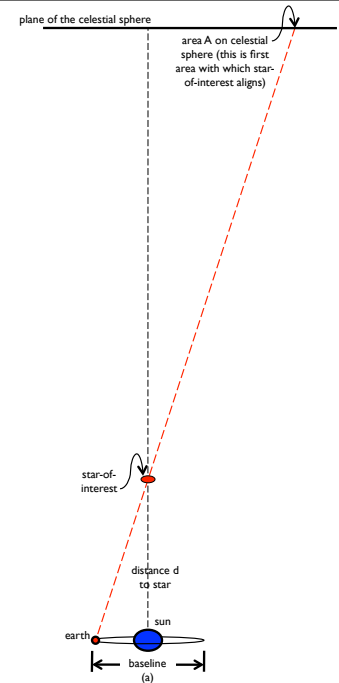
The distance between Venus and the sun, according to the trig, is .72 AU.

1.)

--The apparent shifting of position against a distant backdrop is called "parallax."

--How is this useful?

--On January 1, observe the relative position of a star of interest on the celestial sphere. Note that position (for argument sake, let's say star A exists at that point)



3.)

--The easiest way to get the distance between the earth and a planet is to bounce radio waves off the planet and see how long it takes for the echo to return to the earth.

--Note that because the sun isn't solid, radio waves don't bounce off it.

--Using the radio wave bounce to determine the distance between the earth and Venus, though, we can use the fact that Venus's radius from the sun is .72 AU and determine that radius in kilometers.

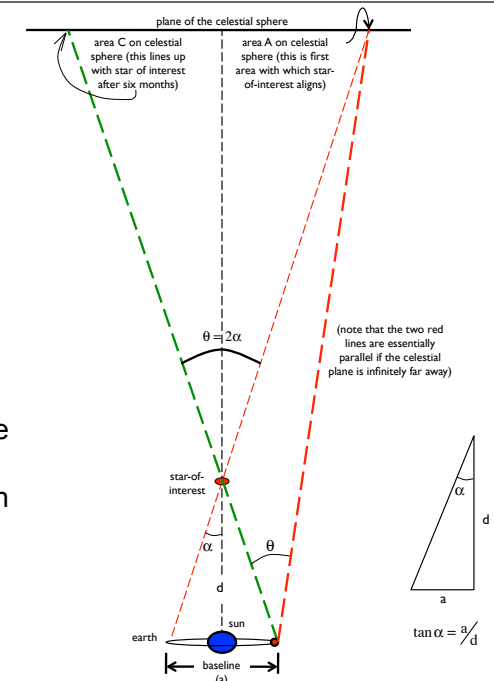
--The radar approach only works for distances inside the solar system. For outside the solar system, we need other approaches.

--Enter the idea of **PARALLAX**.

2.)

--On June 1 when the earth is on the opposite side of the sun, observe the relative position of a star of interest again on the celestial sphere. (We'll say star C exists at that point.)

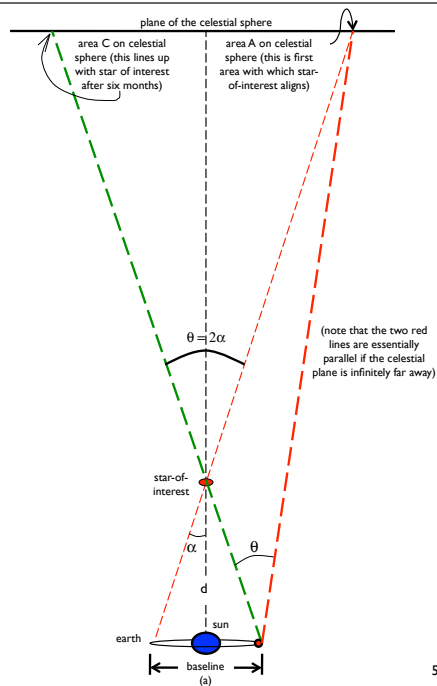
--From the relative change of position of the star on the celestial plane, we can use trig to determine the distance to the star of interest.



4.)

MINOR POINT FOR YOU INTREPID SOULS who want to know how the measurement is actually made, the angle that is actually measured is θ in the sketch. Once you know that, you know twice the parallax angle. Nifty, eh?

Also, for a camera with a given focal length, the distance between two points on the image has a specific parallax value. In other words, knowing your camera allows you to determine the parallax angle by simply measuring the distance between the dots.



--There are 360 degrees in a circle,

--60 minutes in a degree,

--60 seconds in a minute.

--An object whose parallax angle is one arc second is said to be one parallax second, or one parsec in distance away.

--One parsec is equal to a distance of 3.3 light years.

--The distance to the nearest star, Alpha Centauri, is 4.3 light years away. That is the equivalent of 1.3 parsecs.

--The farthest stars that can be measured with decent accuracy using this technique are around 1500 parsecs (around 3000 light years) away (my text says 1000 parsecs—it's ball park).