

OTHER UNITS USED IN ASTRONOMY:

1 astronomical unit or AU = 150 million km (distance Earth-Sun)

1 parsec or pc = about 3 light years = 3×10^{13} km

Small angle formula :

$$A = D / d$$

The angle A (angular diameter) is in radians

(180 degrees = 3.14159... radians or π)

- D is the linear dimension of the object

- d is the distance to the object

Stars are so far away that the angle is really small.

Example: angular diameter of the moon is 0.5 degrees

But the angular size of proxima is 0.00000028 degrees or 0.000157 radians

WE NEED ANOTHER UNIT : the arcsecond.

1 arcsecond or 1 " is 1/3600 of a degree. 1 " = 1 degree/3600

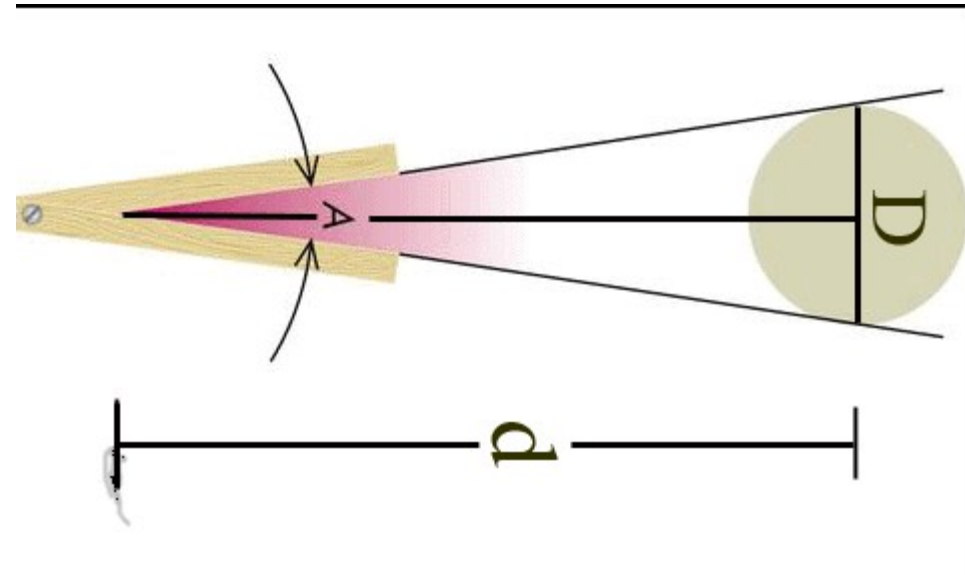
The formula becomes:

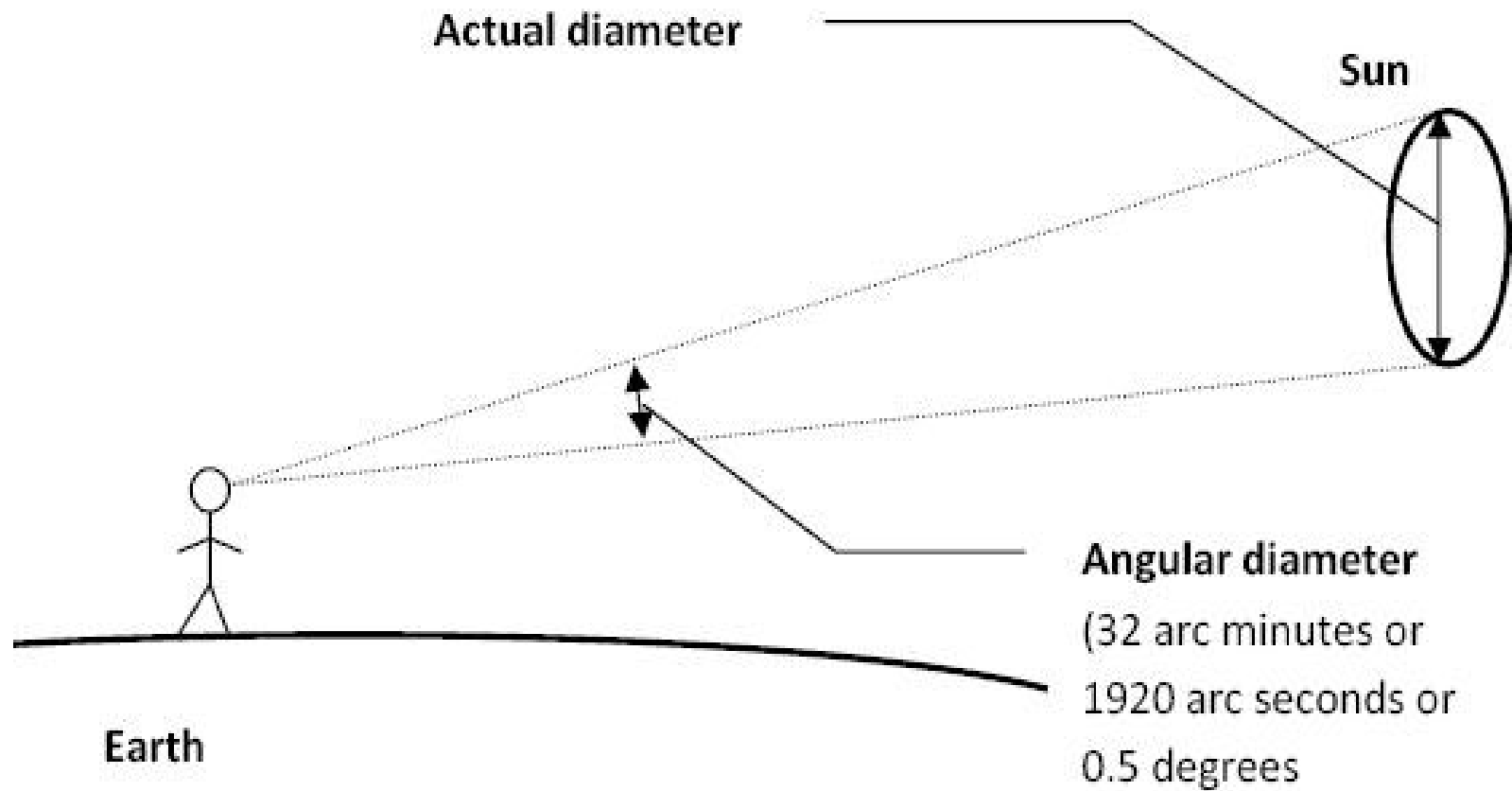
$$A = (206,265 D) / d$$

The angle A is in arcseconds (")

1 degree is 3600 arcseconds. 1 radian = 206,265 arcseconds.

(1 arcminute = 60 arcseconds)

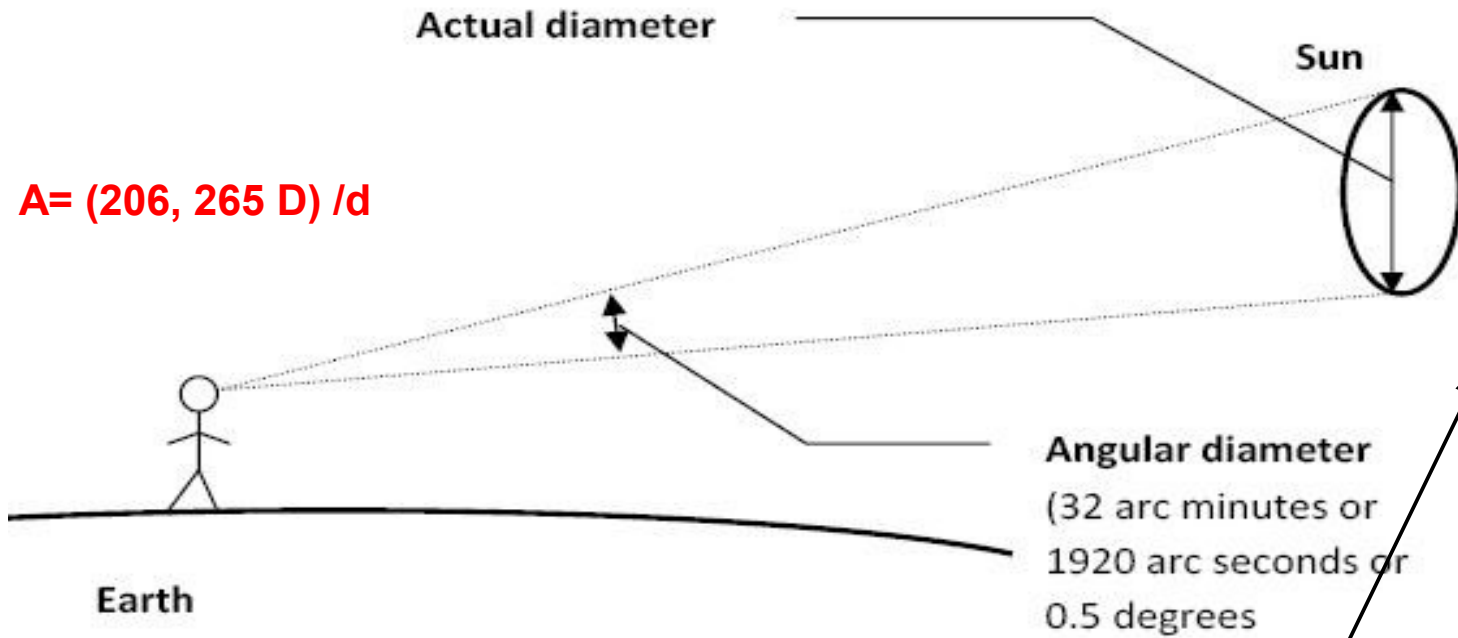




$$A = (206,265 D) / d$$

Use the formula to find the physical size of the sun (km)

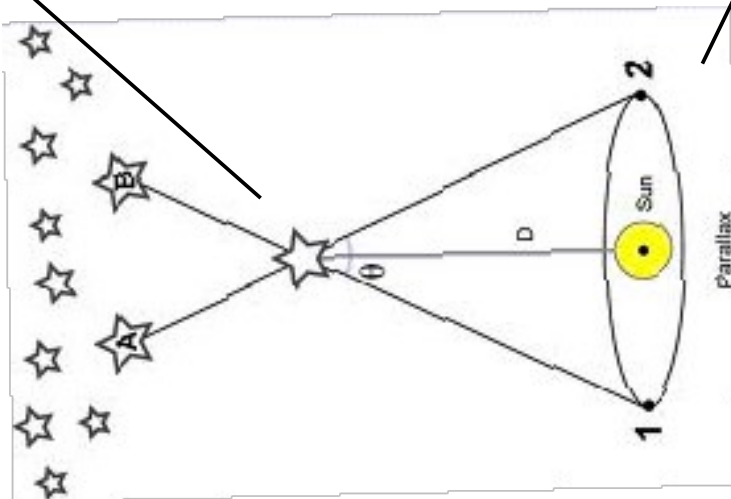
.d = 150 million km = 150,000,000 km

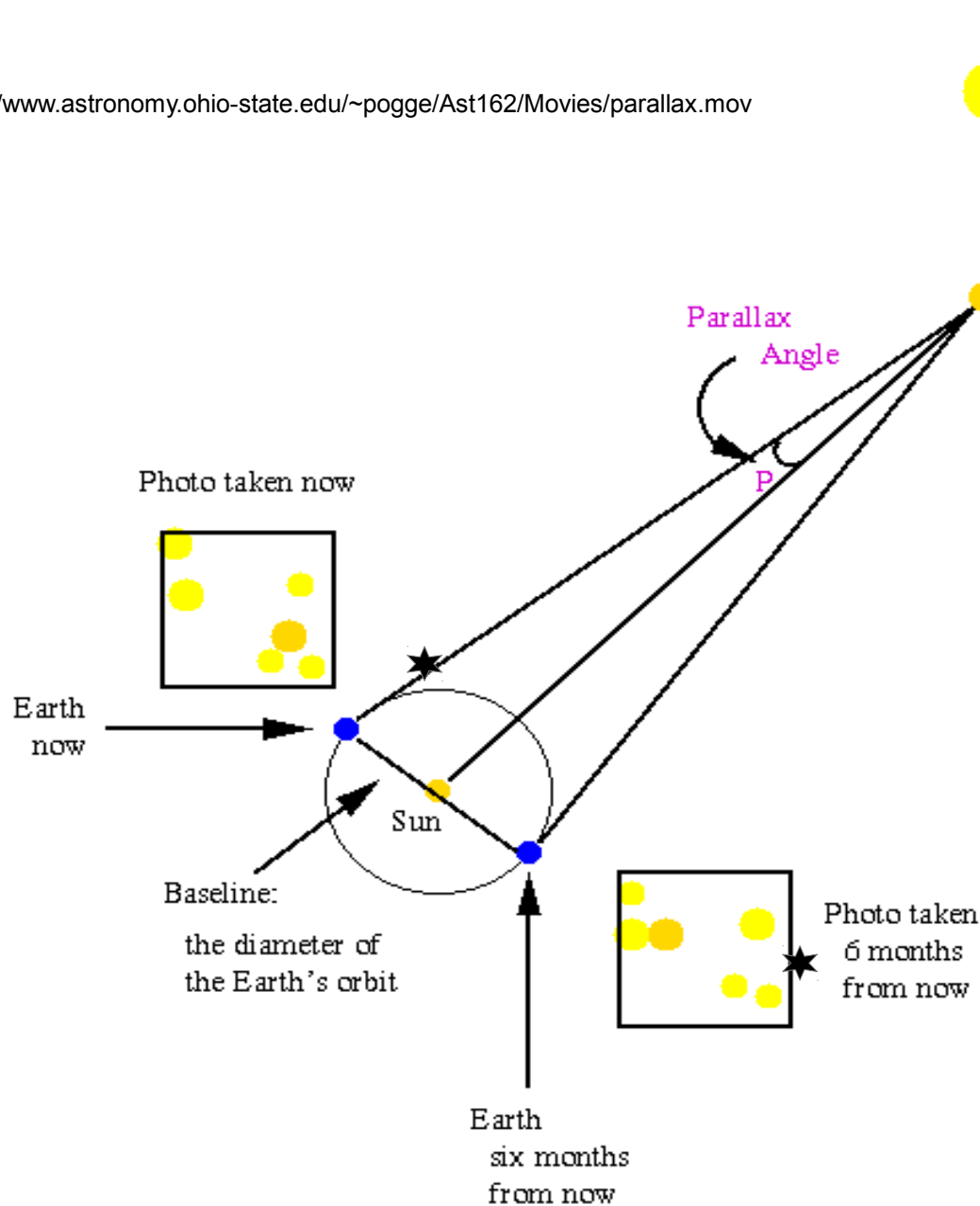


We can use the same Math to compute Distance to a star (if not too far)

Replace the observer by a star

The size is now 2 opposite Positions of Earth on its orbit Around the sun.



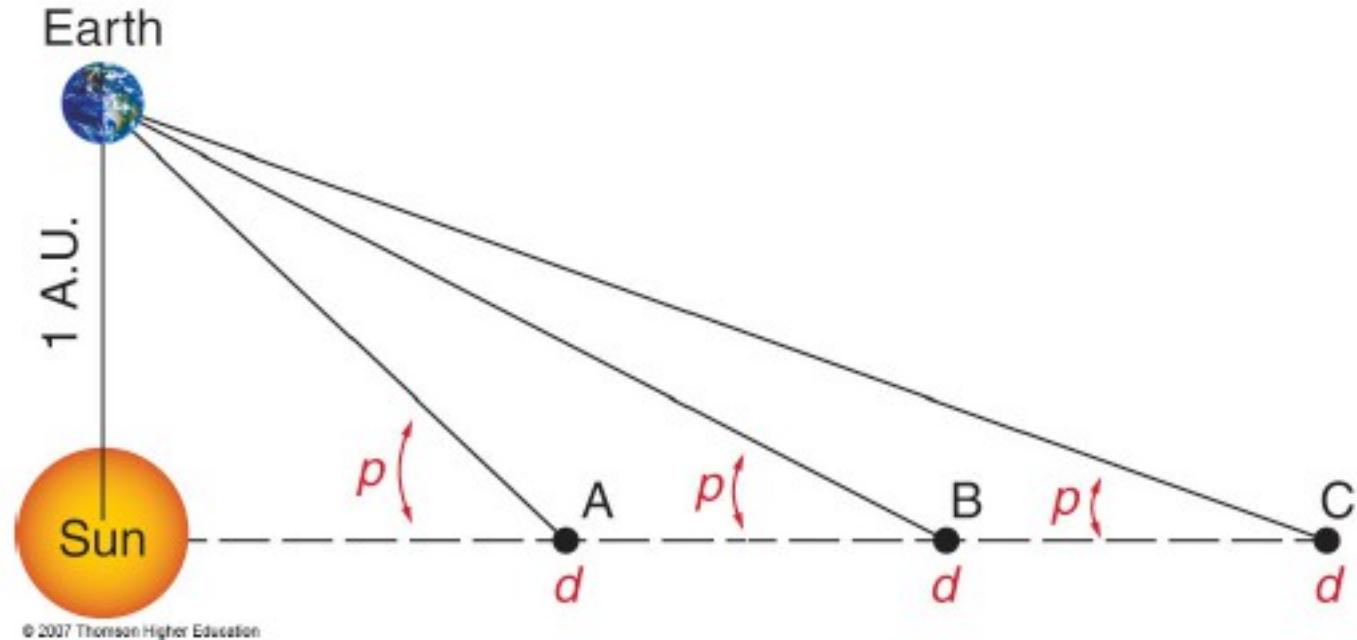


$$A = (206,265 D) / d$$

$d = 1 \text{ AU}$
 $A = 206,265 D$
With D in AU s

Note:
 $206,265 \text{ AU s} = 1 \text{ parsec}$
 $= 3 \text{ light years} = 3 \times 10^{13} \text{ km}$

As distance *increases*, parallax *decreases*



The distance for which a 1 AU
Baseline has a one arc second (1")
Parallax is called 1 parsec (pc)

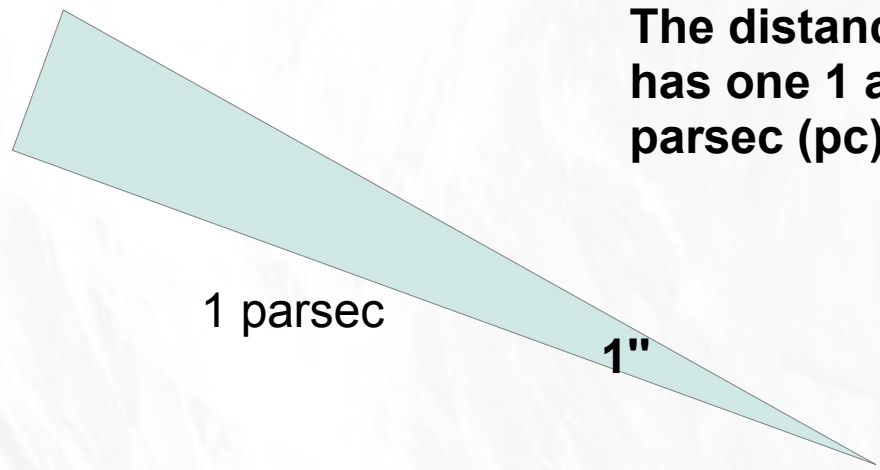
1 parsec is about 3.26 light years

$$d = 1/p$$

where d is in parsec
and p is in arc sec

1" is 1 arc second
1" = 1/3600 degrees

1 AU



The distance for which 1 AU baseline has one 1 arcsecond (1") is called 1 parsec (pc) 1pc is about 3.26 ly

$$.d=1/p$$

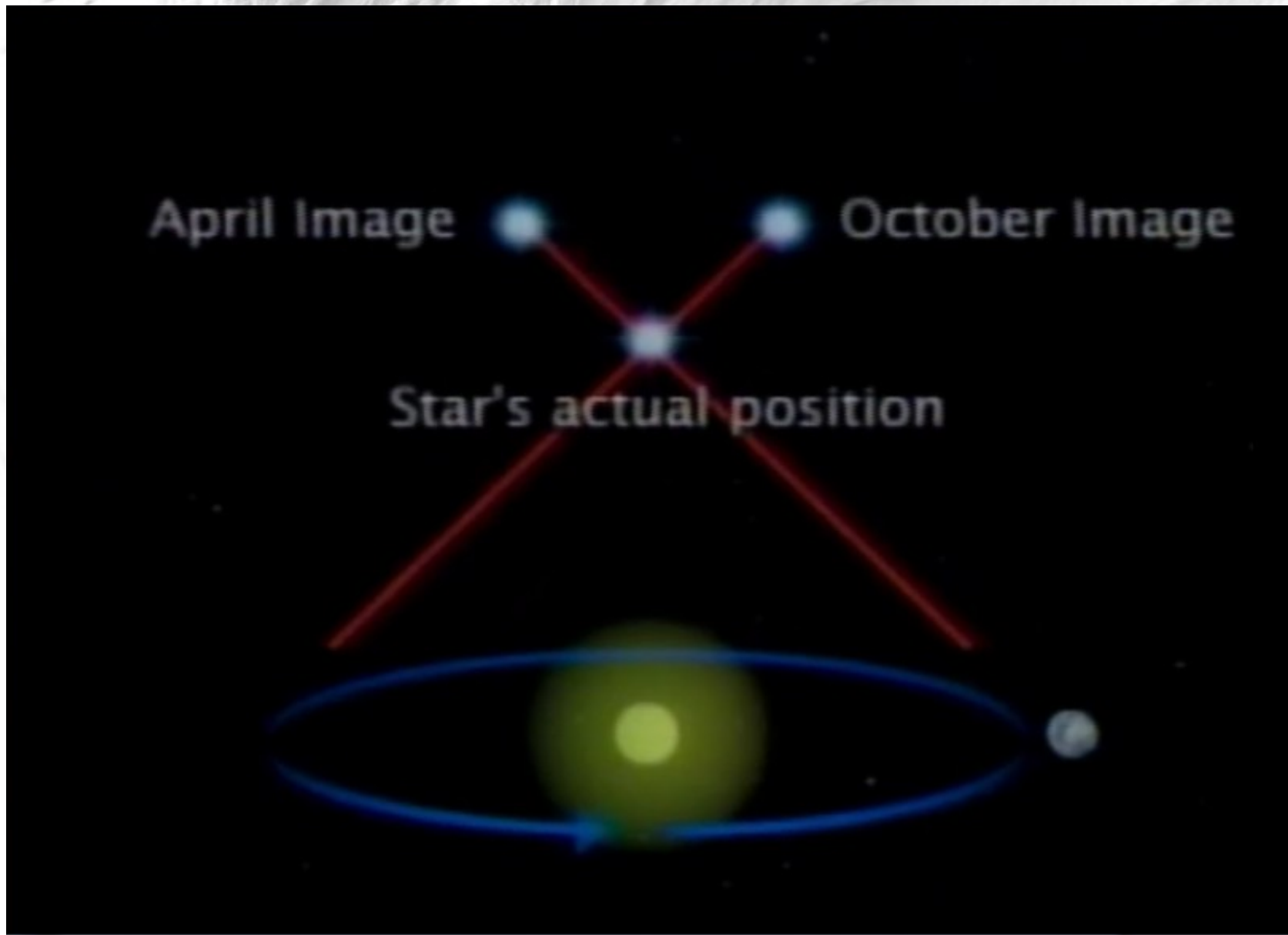
(use google)

Proxima Centauri, has a parallax of 0.7687 arcsec.

(This angle is approximately that subtended by an object 2 centimeters in diameter located 5.3 kilometers away)

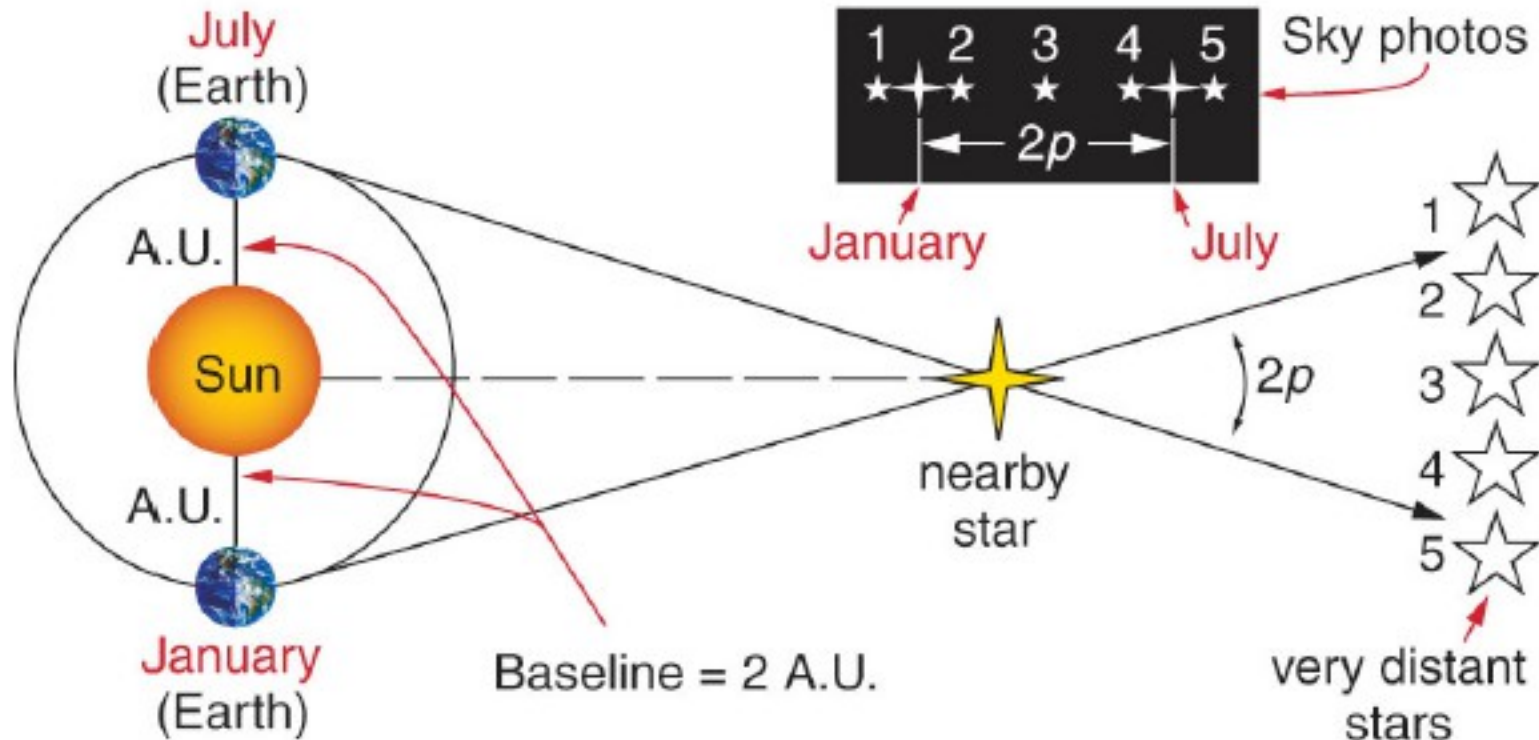
FIND THE DISTANCE

1 l.y = 6 trillion miles or 10 trillion km



Parallax is an apparent displacement or difference in the apparent position of an object viewed along two different lines of sight

Stellar distances: use “trigonometric parallax”
(triangulation) for nearby stars



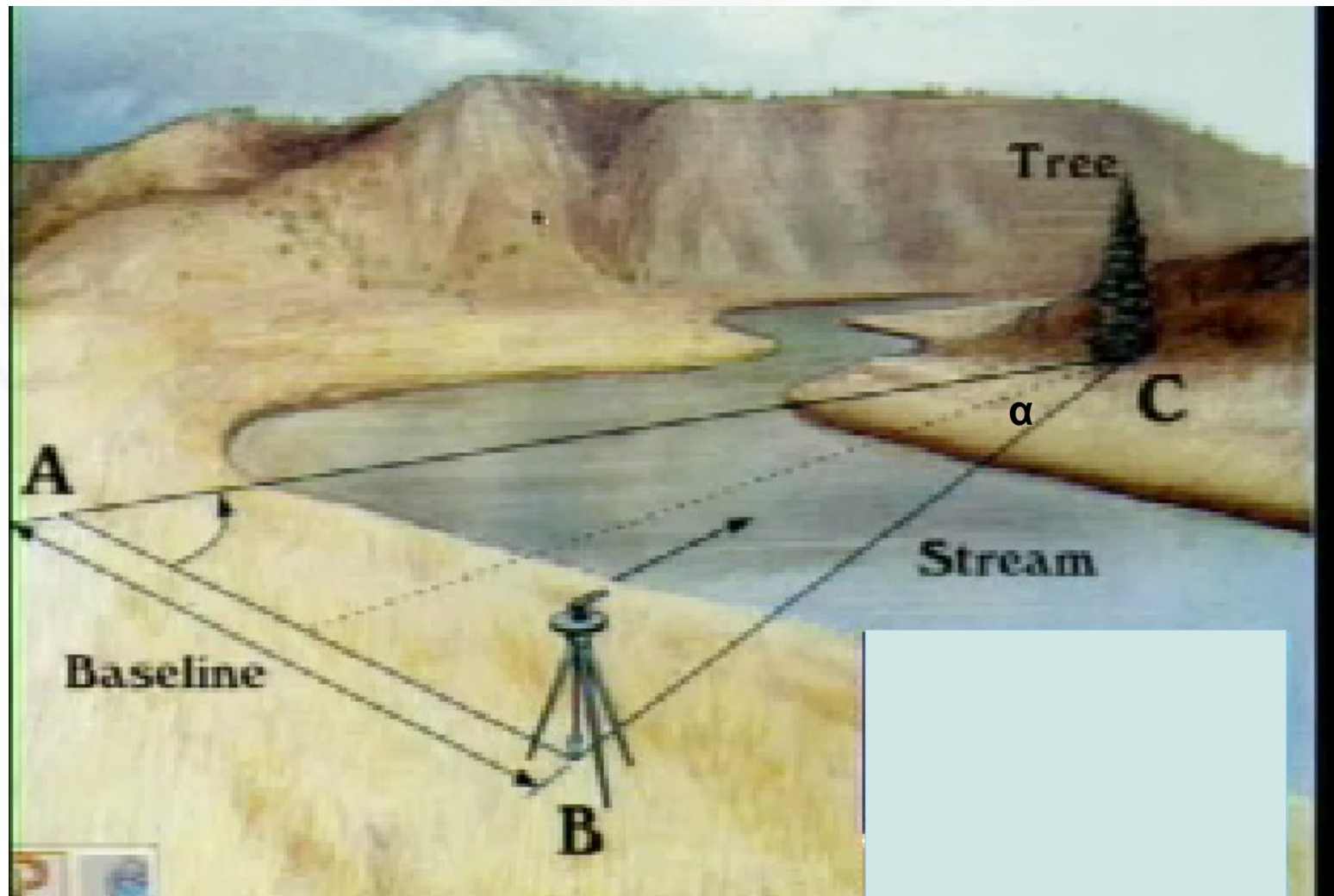
© 2007 Thomson Higher Education

Parallax = angle subtended by 1 A.U., the distance from Earth to Sun (half the diameter of the Earth’s orbit)

$$p = 1/d \quad p \text{ in arcseconds, } 1 \text{ AU, } d \text{ in parsecs} \quad 1 \text{ parsec} = 3.25 \text{ l.y.}$$

$$1 \text{ arcsecond} = 1/3600 \text{ of } 1 \text{ degree} \quad 1 \text{ l.y.} = 10^{16} \text{ m about}$$

Do the experiment with your finger to represent a star. Close 1 eye at a time.



$$\text{Tan}(\alpha) = (AB/2) / (\text{distance shore-tree})$$