the radius AS = BS so that AB = $b = D\,\theta$ where θ is in radians.

$$D = \frac{b}{\theta} \qquad (2.1)$$

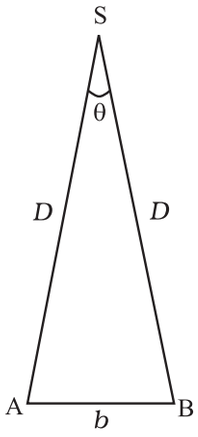

Fig. 2.2 Parallax method.

Having determined D, we can employ a similar method to determine the size or angular diameter of the planet. If d is the diameter of the planet and α the angular size of the planet (the angle subtended by d at the earth), we have

$$\alpha = d/D \qquad (2.2)$$

The angle α can be measured from the same location on the earth. It is the angle between the two directions when two diametrically opposite points of the planet are viewed through the telescope. Since D is known, the diameter d of the planet can be determined using Eq. (2.2).

Def. of angular diameter 'α' of a planet

Example 2.1 Calculate the angle of (a) 1^0 (degree) (b) 1′ (minute of arc or arcmin) and (c) 1″(second of arc or arc second) in radians. Use $360^0 = 2\pi$ rad, $1^0 = 60'$ and $1' = 60''$

Answer (a) We have $360^0 = 2\pi$ rad

$1^0 = (\pi/180)$ rad $= 1.745\times10^{-2}$ rad

(b) $1^0 = 60' = 1.745\times10^{-2}$ rad

$1' = 2.908\times10^{-4}$ rad $\simeq 2.91\times10^{-4}$ rad

(c) $1' = 60'' = 2.908\times10^{-4}$ rad

$1'' = 4.847\times10^{-4}$ rad $\simeq 4.85\times10^{-6}$ rad ◀

Example 2.2 A man wishes to estimate the distance of a nearby tower from him. He stands at a point A in front of the tower C and spots a very distant object O in line with AC. He then walks perpendicular to AC up to B, a distance of 100 m, and looks at O and C again. Since O is very distant, the direction BO is practically the same as AO; but he finds the line of sight of C shifted from the original line of sight by an angle $\theta = 40^0$ (θ is known as 'parallax') estimate the distance of the tower C from his original position A.

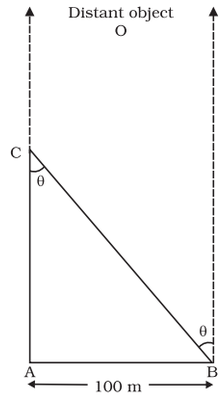

Fig. 2.3

Answer We have, parallax angle $\theta = 40^0$

From Fig. 2.3, AB = AC tan θ

AC = AB/tanθ = 100 m/tan 40^0

= 100 m/0.8391 = 119 m ◀

Example 2.3 The moon is observed from two diametrically opposite points A and B on Earth. The angle θ subtended at the moon by the two directions of observation is 1° 54′. Given the diameter of the Earth to be about 1.276×10^7 m, compute the distance of the moon from the Earth.

Determination of distance of moon using parallax method

Answer We have $\theta = 1°\,54' = 114'$

$$= (114\times60)'' \times \left(4.85\times10^{-6}\right) \text{ rad}$$

$$= 3.32\times10^{-2} \text{ rad},$$

since $1'' = 4.85\times10^{-6}$ *rad*.

Also $b = \text{AB} = 1.276\times10^7$ m

Hence from Eq. (2.1), we have the earth-moon distance,

$$D = b/\theta = \frac{1.276\times10^7}{3.32\times10^{-2}}$$

$$= 3.84\times10^8 \text{ m} \quad ◀$$

Example 2.4 The Sun's angular diameter is measured to be 1920″. The distance D of the Sun from the Earth is 1.496×10^{11} m. What is the diameter of the Sun ?

Determination of diameter of Sun from its angular diameter 'α'

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