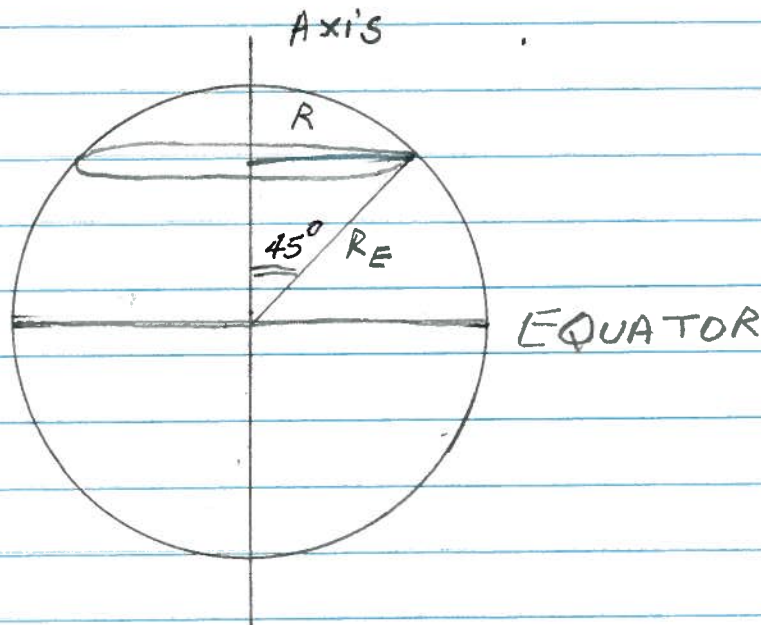


## TWO FREE RIDES PLUS SPEED AND SIZE OF MOON.

A The Earth gives us two free rides  
 (i) Due to rotation of Earth about its axis



TIME FOR ROTATION = 24 hrs.

Radius of Earth = 4000 mi = 6400 km

Our latitude  $45^\circ$

Radius of  $\odot R = R \sin 45$

$$\text{Speed due to rotation} = \frac{2\pi R}{24} \text{ mph}$$

$$= \frac{2\pi \times 4000 \times \sin 45}{24} \approx 700 \text{ mph} \\ \approx 1120 \text{ km/hr}$$

(ii) Due to revolution of Earth around the Sun

Radius of Earth's orbit = 93,000,000 mi

Time for Revolution = 1 yr =  $(365.25 \times 24)$  hrs.

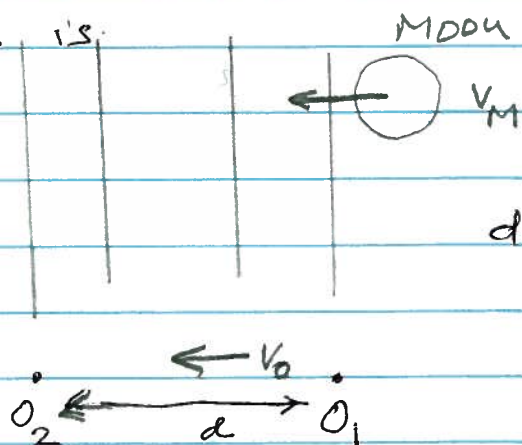
$$\text{Speed due to revolution} = \frac{2\pi \times 93 \times 10^6}{365.25 \times 24}$$

$$\approx 67,000 \text{ mph}$$

### B SPEED AND SIZE OF MOON:

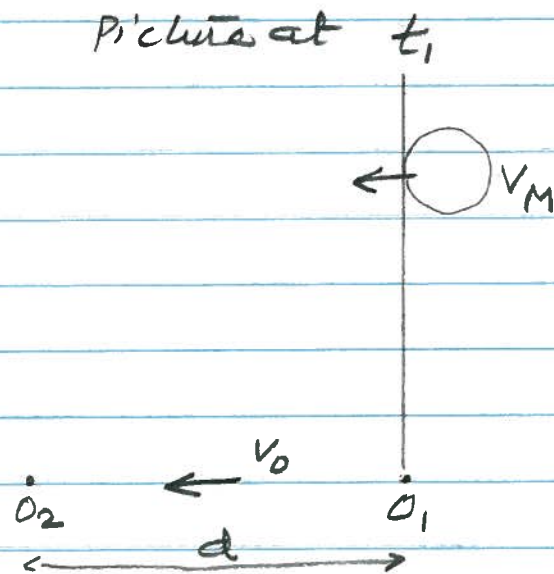
To access speed of moon we need two observers to go out at mid-night on a full moon night and observe a star such that the moon intercepts the light from the star. Star is very far so light from it is a parallel beam. Both observers on same latitude so both have same velocity  $v_0$  due to Earth's rotation.

The picture is:

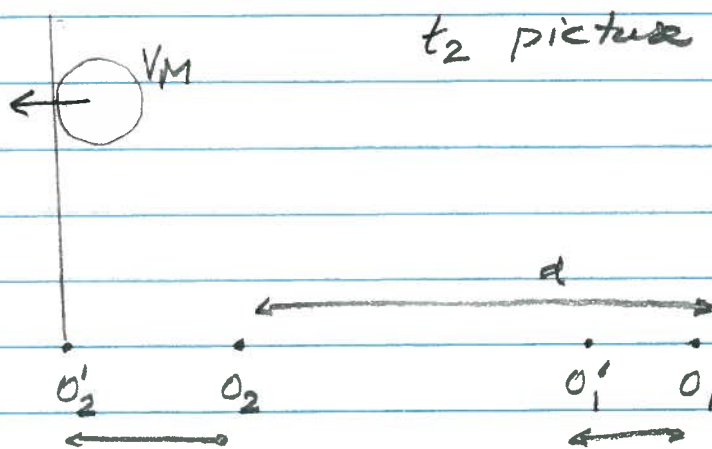


$d$  = distance between  $O_1$  and  $O_2$

At time  $t_1$ , moon intercepts light from star as seen by  $O_1$



At time  $t_2$  moon intercepts light as seen by  $O_2$ .



$O_2'O_2 = O_1'O_1 =$  distance travelled by observer due to motion of Earth

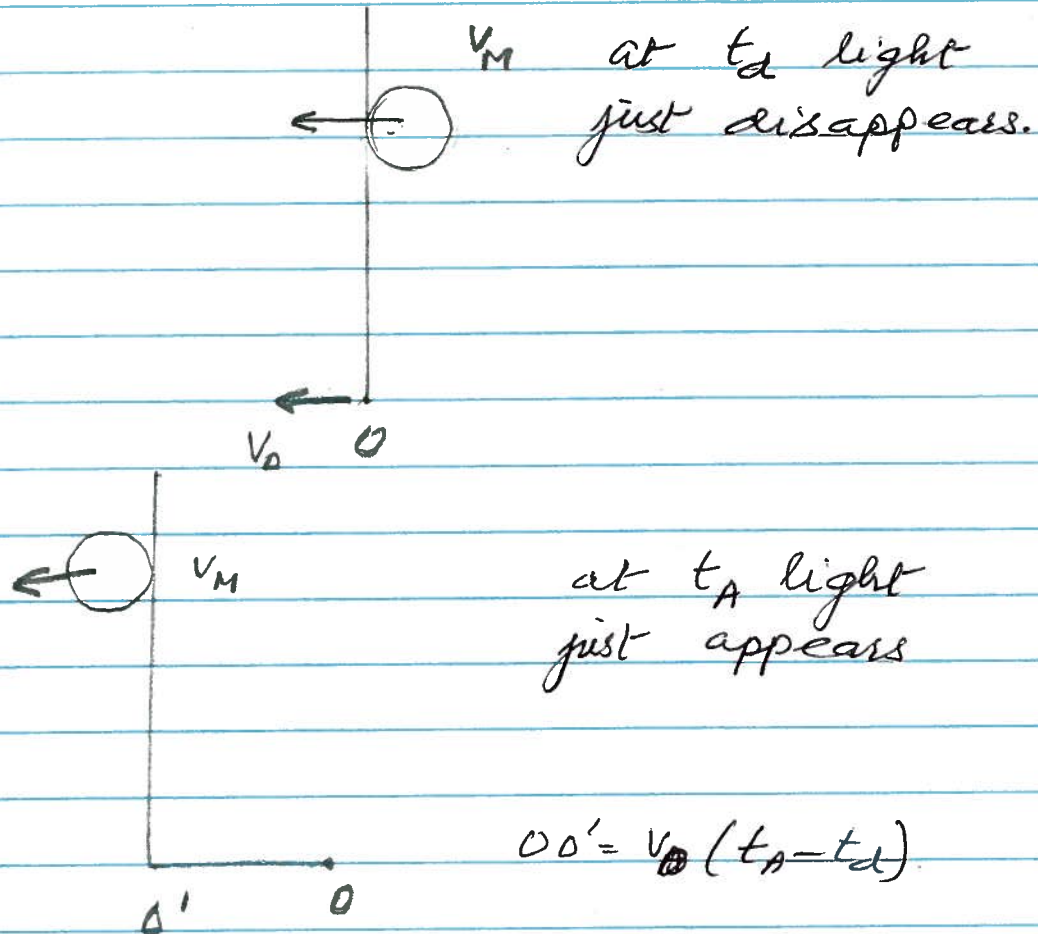
Hence

$$V_M(t_2 - t_1) = d + v_0(t_2 - t_1)$$

speed of moon  $V_M = \frac{d}{t_2 - t_1} + v_0$

Once we know  $V_M$  a single observer can "measure" diameter of moon

Again, concentrate on light from a star being intercepted by moon.



Distance Moved by moon =  $d_M + v_E (t_A - t_d)$   
 where  $d_M =$  diameter of moon

$$v_M (t_A - t_d) = d_M + v_E (t_A - t_d)$$

$$d_M = (v_M - v_E) (t_A - t_d)$$

which will allow us to measure