

Week 2 Discussion

2020年4月7日 星期二 下午4:22

Q. Size measurement of galaxy:

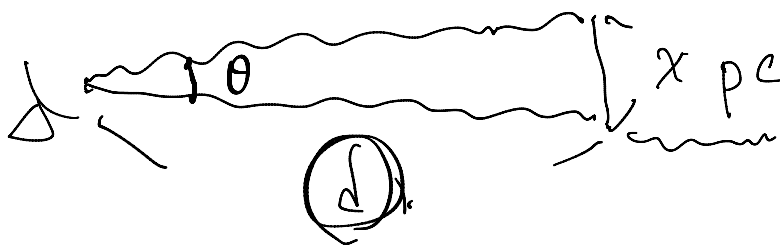
$$R \text{ at } \mu(B) = 25 \text{ mag/arcsec}^2$$

A galaxy at $d = 10 \text{ Mpc}$. $\rightarrow 1 \text{ Mpc}$

Given. Sun: $M_V = 4.83$
 $B-V = 0.65$ } Table (.4)

how many "Suns" in a pc^2
to produce $\mu(B) = 25 \text{ mag/arcsec}^2$?

(i) Convert arcsec to pc.



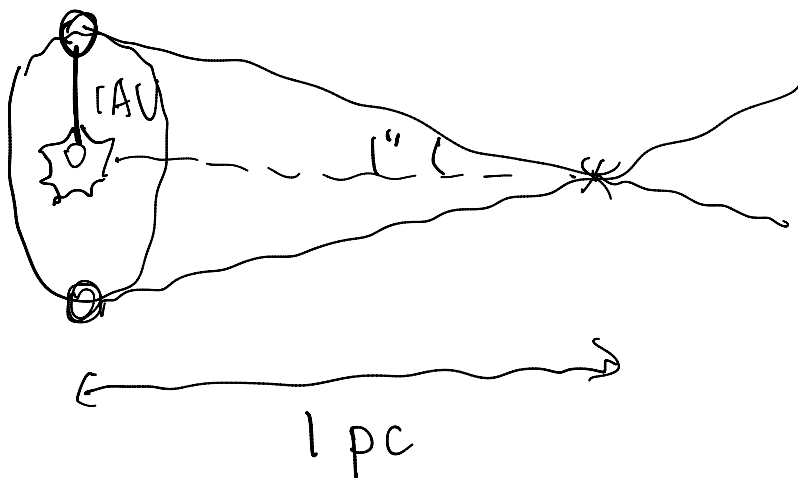
$$d = 10 \text{ Mpc} = 10^7 \text{ pc}$$

$$\theta = 1'' = \left(\frac{1}{3600}\right)^\circ = \frac{1}{3600} \times \frac{\pi}{180} = \frac{1}{206265}$$

$$x = d\theta = 10^7 \times \frac{1}{206265} = 48.5 \text{ (pc)}$$

$$\chi = d\theta = \frac{10''}{10^6} \times \left(\frac{1}{206265} \right) = \frac{48.5 \text{ (pc)}}{10^7 \text{ AU}}$$

$$1 \text{ pc} = 206265 \text{ AU}$$



$$4.85 \text{ pc}$$

$$1'' \leftrightarrow 4.85 \text{ pc}$$

$$1 \text{ arcsec}^2 \leftrightarrow (4.85)^2 \text{ pc}^2 = 2352 \text{ pc}^2$$

(ii) 25 mag putting N "Suns"
 $\rightarrow$ B-band.

$$M_V = 4.83, \quad B-V = 0.65 \rightarrow \text{Sun.}$$

$$M_B = M_V + (B-V) = 5.48 \text{ mag}$$

Distance modulus:

$$m - M = 5 \log(d) - 5$$

M_0
 $\rightarrow$ " " "

$$\underline{m - M} = 5 \log (d) - 5$$

$$= 5 \log \left(\frac{10^7}{10^6} \right) - 5 = \frac{30}{25}$$

$$\begin{aligned} & \Rightarrow \text{"} \\ & 30 + M \\ & \text{"} \\ & 35.48 \\ & \underline{30.48} \end{aligned}$$

(iii) Compare M between N "Suns" and 1 Sun.

$$\underline{m_{tot} - M_{\odot}} = -2.5 \log \left(\frac{F_{tot}}{F_{sun}} \right) = N \cdot F_{sun}$$

$$= -2.5 \log(N)$$

$$= \frac{25 - 35.48}{30.48} \approx -10.48 \Rightarrow N$$

$$N = 10^{\frac{10.48}{2.5}} = 15560 \rightarrow \underline{\underline{156}}$$

To produce $M(B) = 25 \text{ mag/arcsec}^2$

$\equiv \underline{15560 \text{ Suns (in B band)}}$

in 2352 pc^2

$$\Rightarrow \frac{15560}{2} \text{ Suns} = 7780 \text{ Suns} \propto d^2 = 6.6$$

$$\Rightarrow \left(\frac{1556}{2352} \right) \frac{\text{Suns}}{\text{pc}^2} = \underline{\underline{6.6}}$$

surface brightness

invariant with distance.

$$\frac{156}{23.52} = \underline{\underline{6.6 \frac{\text{Suns}}{\text{pc}^2}}}$$