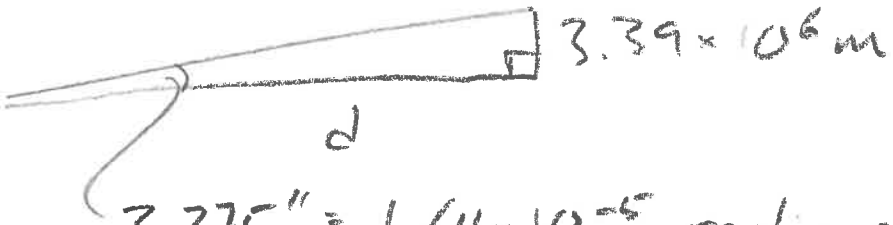
ASTR469
HW #1

1a) $0.1125' \times \frac{60''}{1'} = 6.75''$

b)



$3.375'' = 1.64 \times 10^{-5}$ radians

$\tan\theta \cong \theta = \frac{3.39 \times 10^6 m}{d} = 1.64 \times 10^{-5}$

$\Rightarrow d = 2.07 \times 10^{11}$ m

c) $\Omega \cong \pi\theta^2 = \pi \cdot (1.64 \times 10^{-5})^2 = 8.45 \times 10^{-10}$ sr

d) $\Omega \cong \pi \cdot \left(3.375'' \cdot \frac{1\ deg}{3600''}\right)^2 = 2.76 \times 10^{-6}\ deg^2$

e) $\Omega = 2\pi(1-\cos\theta) = 2\pi\left(1-\cos\frac{3.375}{3600}\right)$

$= 2.76 \times 10^{-6}\ deg^2$

f) Very accurate! $\frac{\Delta\Omega}{\Omega} = \frac{2\pi(1-\cos\theta) - \pi\theta^2}{2\pi(1-\cos\theta)}$

$= -1.41 \times 10^{-20}$

2) $\frac{F}{F_{ref}} = 10^{0.4(m_{ref} - m)} = 10^{0.4(28 - 1.46)}$

$= 6.08 \times 10^{}$

3) We know that $L = 4\pi d^2 F$, so

$$\frac{F_{old}}{F_{new}} = \left(\frac{d_{new}}{d_{old}}\right)^2 = \left(\frac{3 \times 3.09 \times 10^{16}\,m}{1.50 \times 10^{11}\,m}\right)^2$$

$$= 3.82 \times 10^{11}$$

$$= 10^{0.4(m_{new} - m_{old})}$$

$$m_{new} - -27 = 2.5 \log_{10} 3.82 \times 10^{11}$$

$$\Rightarrow m_{new} = 1.95$$

4) $I_\nu = 10^{24}\ W\ Hz^{-1}\ m^{-2}\ sr^{-1}$

$$F_\nu = \int I_\nu \, d\Omega \simeq I_\nu \cdot \Omega$$

$$= 10^{23}\ W\ Hz^{-1}\ m^{-2}$$

$$L_\nu = 4\pi d^2 \cdot F_\nu = 4\pi \cdot (2 \cdot 10^6 \cdot 3.09 \cdot 10^{16})^2 \cdot 10^{23}$$

$$= 4.80 \times 10^{69}\ W\ Hz^{-1}$$