

JH ASTRONOMY AND ASTROPHYSICS: AS 3015

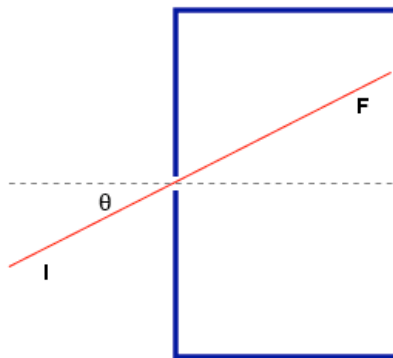
Nebulae: Tutorial Questions 1

1. A star of radius R has uniform brightness B . Fill in the missing steps in the derivation given in the lectures to show that the flux F at distance r is given by,

$$F = \pi B \left(\frac{R}{r} \right)^2$$

consistent with the inverse square law.

2. A pinhole camera consists of a small circular hole of diameter d , a distance L from the film (measured normal to the film).



Show that the flux F at the film plane depends upon the brightness field $I_\nu(\theta, \phi)$ according to,

$$F_\nu = \frac{\pi \cos^4 \theta}{4f^2} I_\nu(\theta, \phi)$$

where $f = L / d$.

3. By differentiating the Planck function $B_\nu(T)$ with respect to ν , show that the peak occurs at, $h\nu_{max} = 2.82 kT$ (this ends up requiring solution of an equation of the form $x=3(1-e^{-x})$ - do this with trial and error using a calculator). Derive the Rayleigh-Jeans and Wien limiting forms of the Planck function.