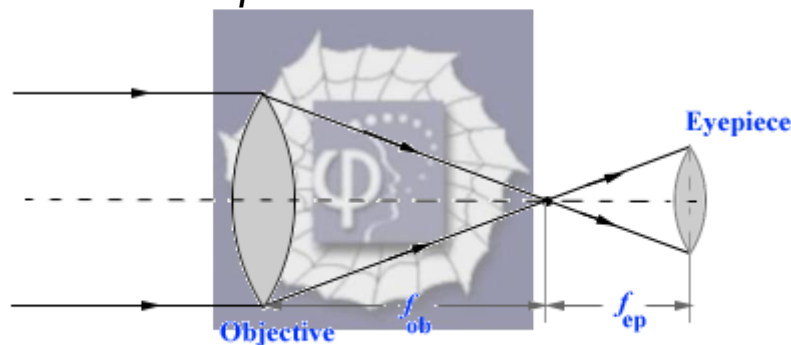


625.

Problem 44.35 (RHK)

The angular magnification of an astronomical telescope in normal adjustment is 36, and the diameter of the objective lens is 72 mm. We have to find the minimum diameter of the eyepiece required to collect all the light entering the objective from a distant point source on the axis of the instrument.



Solution:

For all the light that enters the objective of the telescope to enter the eyepiece, the sizes of the objective lens and the eyepiece lens should be such as will be determined by the geometry of the diagram shown above.

We recall that the magnification of a telescope is determined by the focal lengths of the objective lens, f_{ob} , and of the eyepiece lens, f_{ep} . It is

$$m_{tel} = \frac{f_{ob}}{f_{ep}}.$$

The angular magnification of the telescope given in the problem is 36.

$$\therefore \frac{f_{ob}}{f_{ep}} = 36.$$

Let D_{ob} and D_{ep} be the diameters of the objective lens and the eyepiece lens, respectively. From geometry, we have

$$\frac{D_{ep}}{D_{ob}} = \frac{f_{ep}}{f_{ob}},$$

or

$$D_{ep} = \frac{f_{ep}}{f_{ob}} \times D_{ob} = \frac{1}{36} \times 72 \text{ mm} = 2 \text{ mm}.$$

