Star Images

Two stars are separated by 10 arc sec. What is the separation of the star images in the focal plane of a telescope/camera with a focal length of 1000 mm?

Solution

\[
\text{Angular Separation} = \theta = 10 \text{ arc sec}
\]

\[
\theta_{1/2} = 5 \text{ arc sec} = 0.00139 \text{ deg}
\]

\[
h' = f \tan \theta_{1/2} \quad f = 1000 \text{ mm}
\]

\[
h' = 0.024 \text{ mm}
\]

\[
\text{Separation} = 2L' = 0.048 \text{ mm} = 48 \mu \text{m}
\]

Or use small angle approximations:

\[
\theta = 10 \text{ arc sec} = 0.00278 \text{ deg} = 0.000048 \text{ rad}
\]

\[
\text{Separation} \approx f \theta = 0.048 \text{ mm} = 48 \mu \text{m}
\]

To use the approximation \( \text{Separation} \approx f \theta \), the angle \( \theta \) must be in radians.