

Introduction to Physical Science

Microscopes and Telescopes
Presented by Robert Wagner

The Microscope

- While the eye had a great ability to see large and small - there are limits.
- Optical instruments allow us to see beyond what our eyes could normally see.
- Microscopes developed in the early 1600s
 - Simplest version has an objective lens and an eyepiece

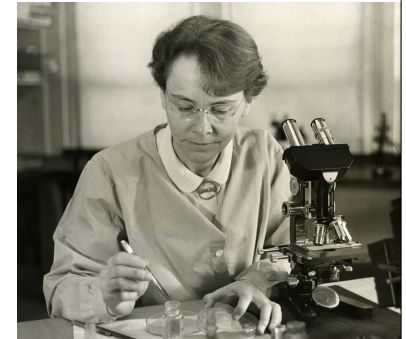


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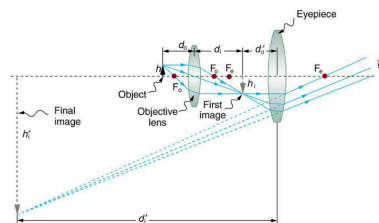


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Telescopes

- Each lens in a microscope magnifies the image
- Total magnification
 - If and
 -

Telescopes

- A basic telescope will also have an objective and an eyepiece
- Using a convex and a concave lens will give an upright image (spyglass)
- Using two convex lenses will give an inverted image (telescope)

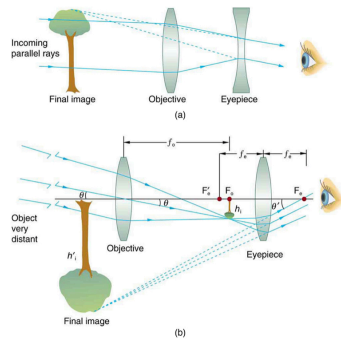


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Telescope Magnification

-
- Maximum magnification:
 - Long focal length objective and short focal length eyepiece
 - Magnification is a relatively unimportant factor in astronomical telescopes

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Reflecting Telescopes

- A mirror can be used as the objective for a telescope as well.
- Mirrors can be made much larger than lenses and have other advantages as well in modern optical telescopes
- Telescopes can also be constructed that can observe other parts of the electromagnetic spectrum

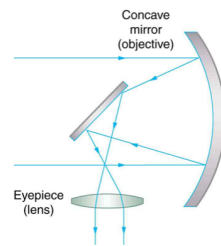


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Aberrations

- Chromatic aberration - Lens can behave like a prism
 - Corrected by using multiple lenses
- Spherical aberration - rays focusing at different distances from the lens/mirror
- Coma - Off-center object image will be distorted

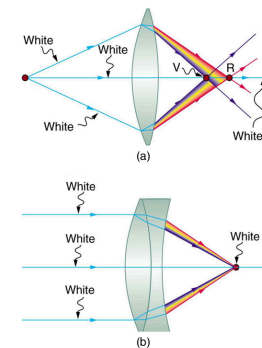


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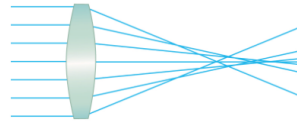


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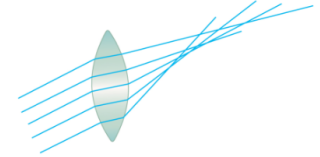


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Summary

- Microscopes and telescopes both magnify images allowing us to see the worlds of the very large and very small
- The magnification of a telescope or microscope depends on the objective and the eyepiece
- Various aberrations are associated with using lenses/mirror but can be corrected to some extent