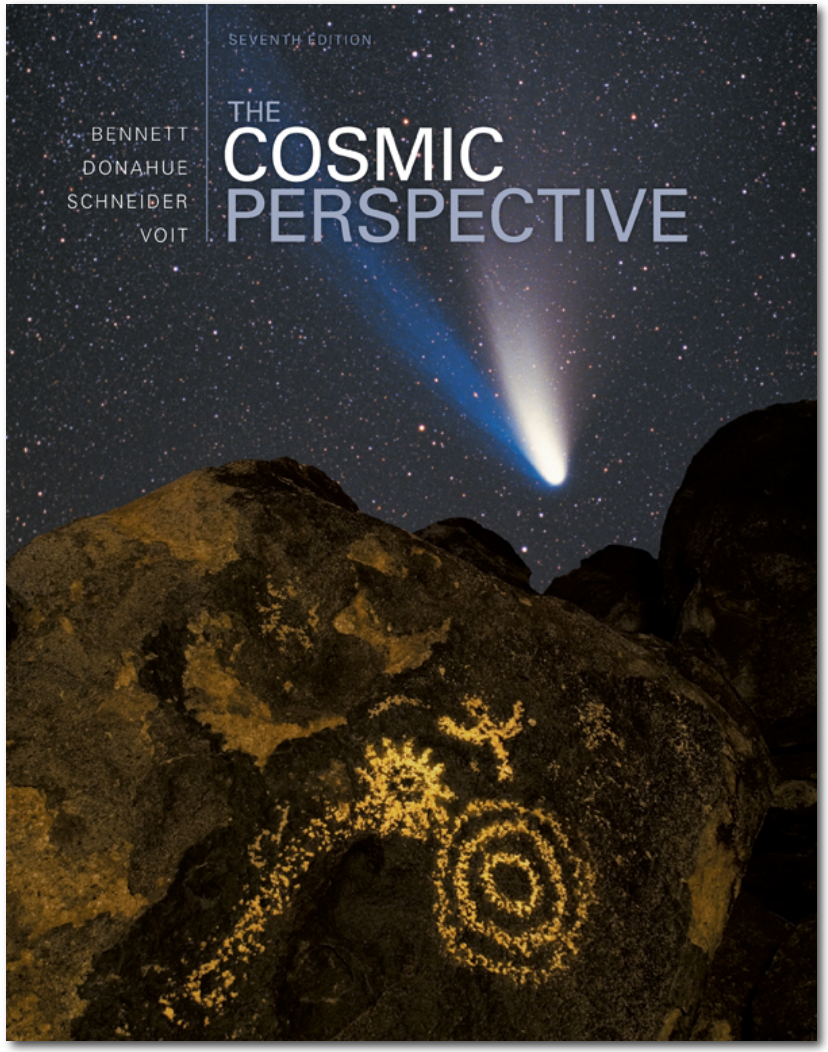
The Cosmic Perspective

Seventh Edition



Telescopes: Portals of Discovery

6.1 Eyes and Cameras: Everyday Light Sensors

- How do eyes and cameras work?

How do the cornea and lens affect light entering the eye?

a) They reflect light of certain wavelengths, allowing only those that form an image to enter.
b) They change size to allow an appropriate amount of light to enter.
c) Light travels slightly slower moving through them, causing the direction of the incoming light to change and focus on the retina.
d) They have no affect on the light except to transmit it through to the retina.
e) The cornea transmits the light to the lens which detects the incoming light.

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Why can cameras see objects too faint to be seen by the eye?

a) They have larger detectors.
b) They can record light for a longer period of time.
c) Their detectors are more sensitive to light than the eye.
d) They have more pixels than the eye.
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The electronic detector of a digital camera performs the same role as what part of the eye?

a) the cornea
b) the lens
c) the pupil
d) the retina
e) The eye does not have any part analogous to the detector of a camera.

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6.2 Telescopes: Giant Eyes

- What are the two most important properties of a telescope?
- What are the two basic designs of telescopes?
- What do astronomers do with telescopes?

What is the diffraction limit?

a) It is the theoretical limit on the angular resolution of a telescope that depends on the wavelength of light and the size of the aperture.

b) It is the theoretical limit on the faintness of an object that a telescope can detect that depends on the size of the aperture and the type of detector.

c) It is the theoretical limit to the angular resolution of a telescope that depends on the size of the aperture and the type of detector.

d) It is the theoretical limit on the faintness of an object that a telescope can detect that depends on the size of the aperture and the wavelength of light.

e) It is the shortest wavelength of light that can be observed by a telescope and depends on the size of the aperture.

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Which of the following is not a problem for refracting telescopes?

a) Different wavelengths of light are focused at slightly different locations.
b) The primary lens can only be supported at the edges making deformation of large lenses difficult to avoid.
c) The quality of the glass lens in transparency and in the shape of both surfaces must be high.
d) The secondary mirror blocks some of the light passing through the primary lens.

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Improving the spectral resolution of a spectrograph comes at the expense of

a) increased exposure time.
b) decreased angular resolution.
c) larger telescope aperture.
d) A and B
e) none of the above

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What is a light curve?

a) a plot showing the amount of light at different wavelengths
b) the shape of a telescope's primary lens or mirror
c) a plot showing how an object's intensity varies with time
d) the path that light takes as it goes through a telescope lens and reflects off the mirrors.
e) a curve that is very shallow

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6.3 Telescopes and the Atmosphere

- How does Earth's atmosphere affect ground-based observations?
- Why do we put telescopes into space?

What is light pollution?

a) It is the contamination of a spectrum by unwanted wavelengths.
b) It is city light scattering off the atmosphere and into a telescope.
c) It is light from a second object in the telescope's field of view that washes out or interferes with the image of the object being studied.
d) It is degradation of a telescopic image by the presence of smog and other pollutants in the atmosphere.
e) It is pollution that rises to the top of the atmosphere because it is not as heavy as the other forms of pollution.

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How does atmospheric turbulence affect telescopic observations?

a) It increases the amount of time needed to obtain a clear image.
b) It reduces the angular resolution of the image.
c) It reduces the spectral resolution that can be obtained.
d) It increases the chromatic aberration of an image.

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Which of the following is not an advantage of space telescopes?

a) They are closer to the astronomical objects they are observing.
b) They are unaffected by atmospheric turbulence, which affects angular resolution.
c) They are able to detect light that is blocked by the atmosphere.
d) None of the above (all are advantages)

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6.4 Telescopes and Technology

- How do we observe invisible light?
- How can multiple telescopes work together?

What part(s) of the spectrum can only be observed from space?

a) radio
b) Infrared
c) X-ray
d) gamma-ray
e) C and D

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a) visible
b) ultraviolet
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How does adaptive optics improve the performance of a telescope?

a) It rapidly adjusts the shape of the telescopes mirror to compensate for the effects of turbulence.
b) It adjusts the position of a diffraction grating to match the wavelength of observation to atmospheric conditions.
c) It adjusts the position of the secondary mirror to automatically change the focus in response to turbulence.
d) It adjusts the size of the telescope aperture to compensate for the effects of turbulence.

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What is interferometry?

a) It is the measurement of the different amounts of light at different wavelengths.
b) It is the analysis of interference patterns of light from different telescopes to enable combining the light into one image.
c) It is the measurement of atmospheric interference with light entering a telescope to reduce the effects of turbulence.
d) It is the measurement of x-rays with grazing incidence angle mirrors.
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How does interferometry improve the capabilities of a telescope?

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b) It improves the angular resolution.
c) It improves the ability to detect far-away objects.
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