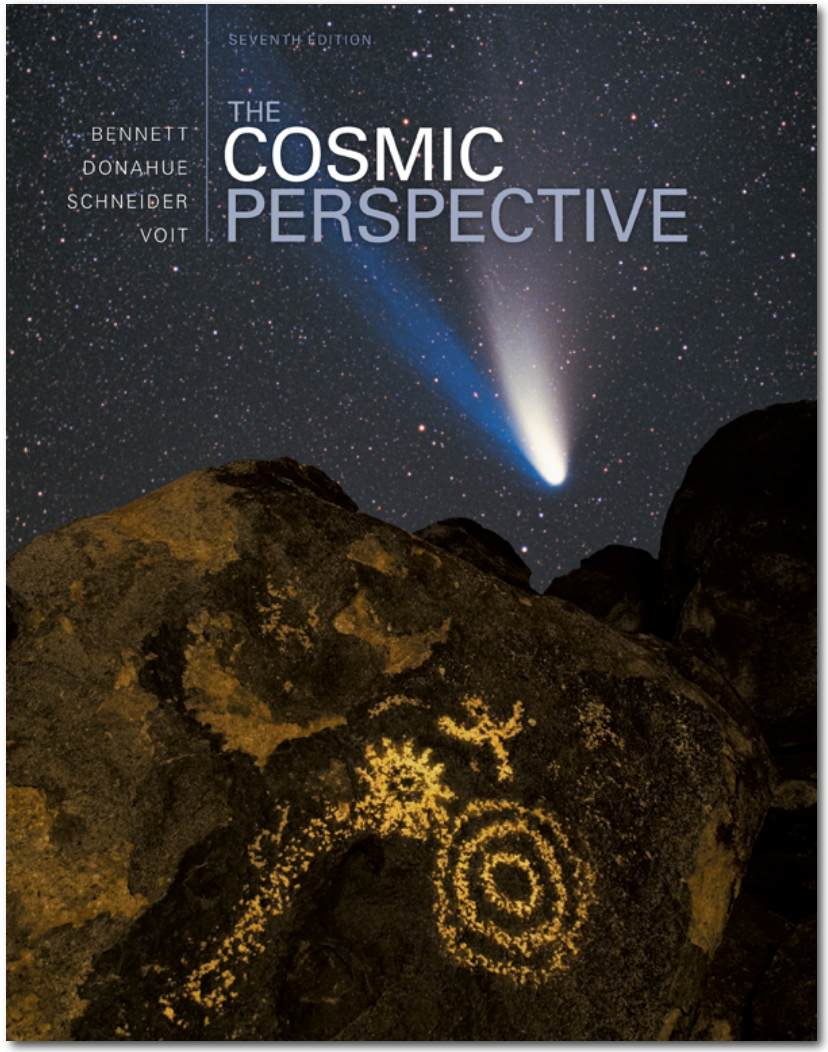
Chapter 23 Review Clickers

The Cosmic Perspective

Seventh Edition



Dark Matter, Dark Energy, and the Fate of the Universe

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a) visible light.
b) radio waves.
c) microwaves.
d) all of the above.
e) A and C

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d) motions were back and forth–not really rotation at all.
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How have astronomers interpreted the unexpectedly fast rotation of galaxies?

a) Scientific measurements must be wrong.
b) Galaxies may be breaking up.
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Why are the absorption lines of elliptical galaxies wide?

a) They are moving away from us.
b) They are rotating.
c) Some stars in them are going away from us, some toward us, so we get red *and* blueshifts, which make lines wider.
d) The stars in elliptical galaxies have wider absorption lines than the stars in spirals.

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Why do we think there is a lot of dark matter in clusters of galaxies?

a) Individual galaxies are moving so fast that they could not be held together by the gravity of visible matter.
b) We've detected some of it with dark matter telescopes.
c) The X rays seen coming from cluster of galaxies arise in very hot clouds of gas that could only be held in the cluster by very strong gravity.
d) Gravitational lensing lets us measure mass even when we can't see it.
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b) minimal
c) key, since it has gravity and is abundant
d) unknown, because we don't know the distribution of dark matter

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b) clusters of galaxies
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d) voids, walls, sheets, and chains of galaxies
e) uniform arrangements of galaxies over the largest distances

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The structures seen in the universe today

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What measurement commonly made on Earth is similar to the way astronomers measure how fast the universe is expanding?

a) using a stopwatch to judge how fast a runner is running
b) using your car's speedometer to judge its speed
c) police measuring the speed of your car and giving you a ticket
d) seeing how fast an explosion causes matter to move

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b) It is slowing down.
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How do we know that the universe's expansion is speeding up?

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b) We look at objects from different times in the past to see how expansion changes with time
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How could the universe be accelerating, despite the gravitational pull of all the matter in it?

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True or False?: Astronomers now believe that most of a galaxy's mass lies beyond the portions of the galaxy that we can see.

a) True, because the orbital velocity of gas and stars remains fairly constant as we look farther from the galactic center, even beyond where most stars are found.
b) True, because dark matter telescopes show massive halos well beyond where stars are found.
c) True, because the mass-to-light ratio of galaxies is much less than the value for the Sun.
d) True, because the mass-to-light ratio of galaxies is much greater than the value for the Sun.
e) False, once we take into consideration the gas in a galaxy as well as the stars, we can account for all its mass.

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True or False?: A cluster of galaxies is held together by the mutual gravitational attraction of all the stars in the cluster's galaxies.

a) True, in the same way that the mutual gravitational attraction of all the stars in the Milky Way holds it together.
b) True, a large cluster can contain many billions of stars, sufficient to hold the cluster together.
c) False, the amount of mass in a cluster's stars is much lower than the amount needed to hold the cluster together.
d) False, X-ray observations show that the hot gas between the clusters has enough mass to hold clusters together.
e) False, the focusing effect of gravitational lensing prevents individual galaxies from leaving a cluster.

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True or False?: So far, clusters of galaxies are the largest structures that have been detected in the universe.

a) True, some clusters have been found to contain thousands of galaxies.
b) True, the largest clusters stretch halfway across the sky.
c) False, there are several nearby galaxies that have a much larger angular size than distant galaxy clusters.
d) False, clusters are themselves part of even larger superclusters.
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True or False?: The primary evidence for an accelerating universe comes from observations of young stars in the Milky Way.

a) True, observations show that there were many more young, massive stars in the early universe.
b) True, massive star supernovae allow us to measure the expansion rate of the universe.
c) False, in order to measure accelerating expansion, we need to measure the distances of objects billions of light-years away.
d) False, evidence for an accelerating universe comes from observations of the oldest stars in the Milky Way, white dwarfs.
e) False, we have to look at young stars in other galaxies beyond the Milky Way to measure the acceleration of the universe.

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