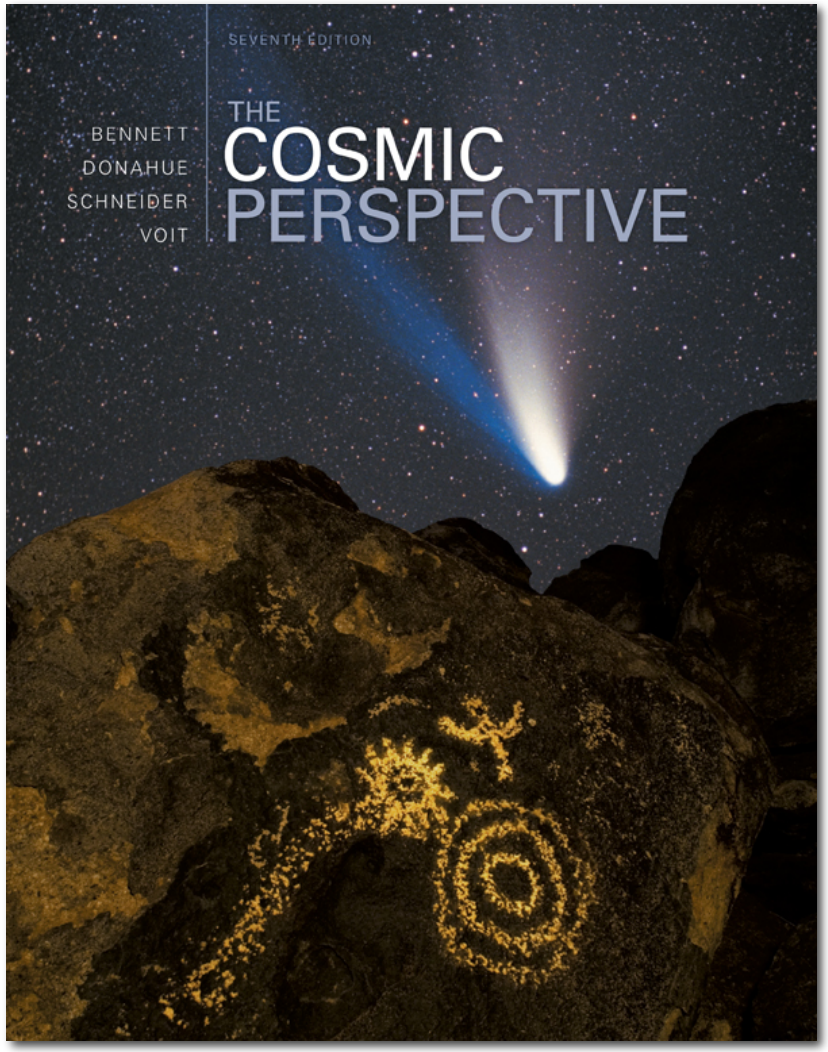
The Cosmic Perspective

Seventh Edition



Galaxy Evolution

When we look at the farthest galaxies in the *Hubble Ultra Deep Field,* we see galaxies that are

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b) about 4.5 billion years old.
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What are possible reasons that galaxies differ in form?

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b) Pre-galactic clouds have different rotation rates.
c) Galaxies collide with one another, creating different types.
d) all of the above.
e) A and B

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What is likely to happen if two galaxies collide?

a) Their stars will crash into each other.
b) Their mutual gravitational pull will greatly distort each galaxy.
c) Starbursts–greatly enhanced star formation–may occur.
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Why should we not be surprised that galaxy collisions were common in the past?

a) Galaxies moved faster in the past and therefore collided more often.
b) Galaxies were larger in the past and therefore collided more often.
c) The universe was much denser in the past, so its galaxies were much closer together, making collisions much more frequent.
d) Because elliptical galaxies are formed by the collision of two spiral galaxies, ellipticals are observed to be more common in the past.

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True or False?: Starburst galaxies have been forming stars at the same furious pace since the universe was about a billion years old.

a) True, starburst galaxies are the most prolific regions of star formation in the universe.
b) False, after too many stars form, a black hole results and a galaxy stops forming stars.
c) False, the bursts of star formation would use up all the gas in a galaxy in a much shorter period of time than the age of the universe.
d) False, starburst galaxies are only found nearby, and are all very young.

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Starburst galaxies have lots of gas and dust that hides their star formation. For this reason,

a) we're not really sure how much star formation is occurring.
b) we use infrared observations to penetrate the dust.
c) we look for x-rays from very hot gas powered by many supernovae.
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a) jets that shoot far into space.
b) active galactic nuclei.
c) strong radio emissions.
d) quasars.
e) all of the above

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a) supernovas
b) gravity
c) colliding stars near the black hole
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True or False?: The black hole at the center of our own galaxy may once have powered an active galactic nucleus.

a) True, active nuclei in other galaxies appear to be powered by accretion into similar sized black holes.
b) True, the Milky Way has a very similar appearance to other galaxies with active nuclei.
c) False, the Milky Way is a spiral galaxy and only elliptical galaxies have active nuclei.
d) False, active nuclei in galaxies are only found in the distant universe.

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Since quasars are mostly found at very great distances,

a) there must have been more of them when the universe was young.
b) we can use their light to study the intergalactic medium between us and them.
c) they must have remained unchanged for at least 10 billion years.
d) all of the above
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