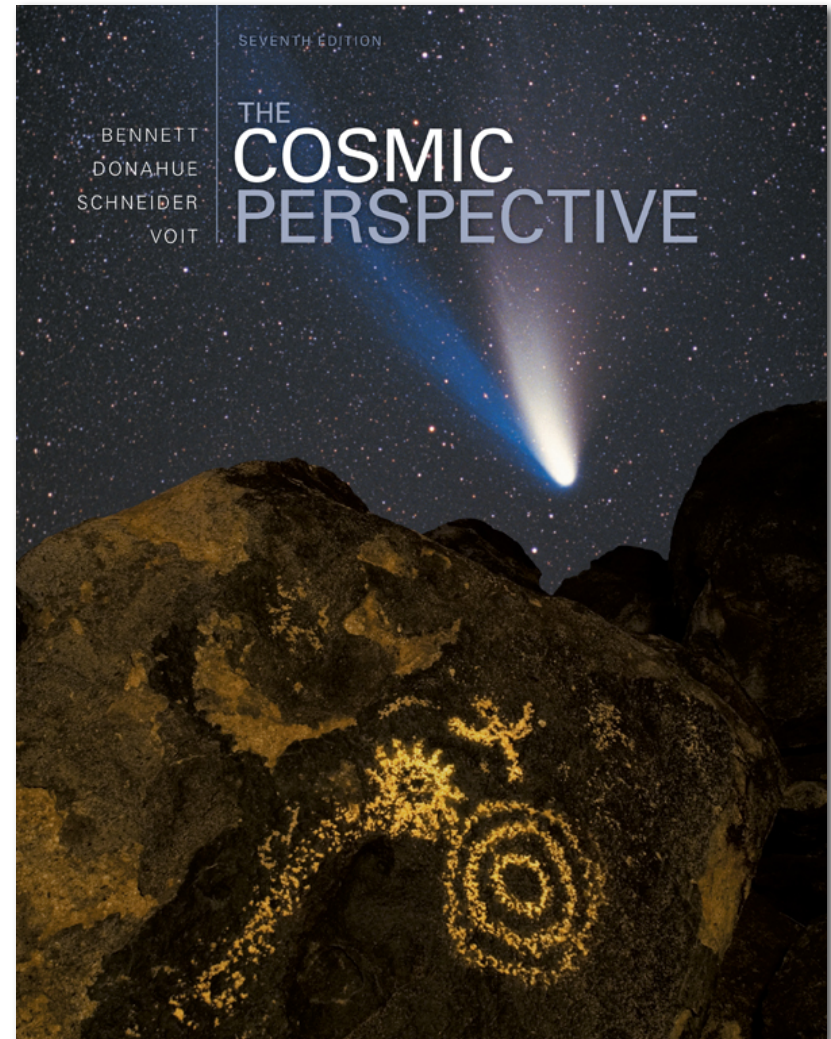


## The Cosmic Perspective

Seventh Edition

### Asteroids, Comets, and Dwarf Planets: Their Nature, Orbits, and Impacts



## 12.1 Asteroids and Meteorites

- What are asteroids like?
- Why is there an asteroid belt?
- How are meteorites related to asteroids?

How big is the largest asteroid?

- a) about 100 km in diameter
- b) about 300 km in diameter
- c) about 1000 km in diameter
- d) about 3000 km in diameter
- e) about 10,000 km in diameter

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- b) about 300 km in diameter
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What is the average distance between asteroids in the asteroid belt?

- a) about 100 km
- b) about 1000 km
- c) about 10,000 km
- d) about 100,000 km
- e) about 1,000,000 km

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## Why didn't the material in the asteroid belt form a planet?

- a) There was not enough material there to gravitationally accrete into a planet.
- b) The asteroids were too far apart to run into each other frequently enough to form a planet.
- c) A planet formed early in the solar system and was broken apart by a giant impact.
- d) Orbital resonances with Jupiter disrupted the orbits of the asteroids and prevented them from forming a planet.
- e) Tidal forces from Jupiter prevented the asteroids from accreting into a planet.

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## What are the *Trojan asteroids*?

- a) They are particularly large asteroids in the main asteroid belt.
- b) They are asteroids in the 1:1 resonance with Jupiter in Jupiter's orbit.
- c) They are asteroids whose orbits cross the orbits of Earth and Mars.
- d) They are asteroids in any resonance with Jupiter.
- e) They are hollow asteroids.

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## Why are most meteorites found in Antarctica?

- a) Meteorites are dark and easy to spot against the ice in Antarctica.
- b) Meteorites melt coming through the atmosphere and usually only survive if quickly refrozen by the cold temperatures of Antarctica.
- c) Because of the slower rotational speed of Earth near the poles, meteorites are more likely to survive atmospheric entry near the poles.
- d) The orbits of meteoroids and the tilt Earth's axis make them more likely to impact near the poles.
- e) Penguins confuse meteorites with their eggs and rescue them, making them easy to collect from Antarctica.

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What are the most common type of meteorite?

- a) carbon-rich primitive meteorites
- b) stony primitive meteorites
- c) metal-rich processed meteorites
- d) rocky processed meteorites
- e) meteorites from the Moon and Mars

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## 12.2 Comets

- What are comets like?
- Where do comets come from?

## What is the orientation of a comet's plasma tail?

- a) The plasma tail extends from the nucleus in the opposite direction of the comet's motion.
- b) The plasma tail extends from the nucleus in the opposite direction of the Sun.
- c) The plasma tail extends from the nucleus both away from the Sun and away from the orbital motion of the comet.
- d) The plasma tail extends from the nucleus toward the Sun.
- e) The plasma tail "wags" between various different orientations behind the direction of the comet's motion.



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## What produces meteor showers?

- a) Meteor showers are caused by the passage of Earth through the debris left by a comet in its orbit.
- b) Meteor showers are caused by the passage of Earth through the dust tail of a comet.
- c) Meteor showers are caused by the passage of Earth through a debris cloud from an asteroid collision.
- d) Meteor showers are produced by a large meteoroid breaking up as it enters the atmosphere.

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Comet nuclei are often described as

- a) "icy asteroids."
- b) "icy impactors."
- c) "dirty snowballs."
- d) "giant snowballs."
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## 12.3 Pluto: Lone Dog No More

- How big can a comet be?
- What are the largest objects of the Kuiper belt like?

## Where do the Kuiper belt comets come from?

- a) They formed in the asteroid belt and were scattered out by Jupiter.
- b) They formed in the Kuiper belt.
- c) They formed among the jovian planets and were scattered out by Jupiter.
- d) They formed among the jovian planets and were pushed out by the solar wind.
- e) They formed around another star and were captured by the Sun when it passed near that star.

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How is Pluto different than the other objects in the Kuiper belt?

- a) Its orbit is unlike the orbits of other Kuiper belt objects.
- b) It has moons, unlike other Kuiper belt objects.
- c) It is larger than all the other Kuiper belt objects.
- d) It is the only Kuiper belt object in resonance with Neptune.
- e) none of the above

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How many moons have been discovered around Pluto?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

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## What is a *dwarf planet*?

- a) A dwarf planet is any object orbiting the Sun that is not one of the 9 planets.
- b) A dwarf planet is any object orbiting the Sun that is not one of the 8 planets.
- c) A dwarf planet is any object orbiting the Sun that is large enough to be round but not one of the 8 planets.
- d) A dwarf planet is any object orbiting the Sun that is large enough to be round but not one of the 4 jovian planets.
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What is the largest dwarf planet discovered to date?

- a) Pluto
- b) Triton
- c) Ceres
- d) Eris
- e) Sedna

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## 12.4 Cosmic Collisions: Small Bodies Versus the Planets

- Have we ever witnessed a major impact?
- Did an impact kill the dinosaurs?
- Is the impact threat a real danger or media hype?
- How do the jovian planets affect impact rates and life on Earth?

## What is comet SL9?

- a) It is the largest comet in the Oort cloud.
- b) It is the comet that was studied by the Deep Impact spacecraft, which sent an impactor into its nucleus.
- c) It is a comet that was seen crashing into Jupiter.
- d) It is the comet that hit Earth 65 million years ago leading to a mass extinction.

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Which of the following is not evidence for a large impact on Earth 65 million years ago?

- a) enhanced levels of elements common in meteorites in 65 million year old sediment layers
- b) soot in sediment layers indicating global fires
- c) traces of a crater scar underground
- d) solidified rock droplets in the sediment layers
- e) globally distributed meteorites with a radiometric age of 65 million years

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How large was the object that caused the Tunguska event?

- a) about 40 meters across
- b) about 100 meters across
- c) about 400 meters across
- d) about 1 km across
- e) about 4 km across

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How often does an impactor large enough to cause a tsunamis and widespread devastation strike Earth?

- a) about once in 1000 years
- b) about once in a million years
- c) about once in a hundred million years
- d) about once in a billion years



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How would the impact history on Earth have been different if Jupiter did not exist?

- a) There would be no significant difference.
- b) There would be more impacts from comets and asteroids.
- c) There would be fewer impacts from comets and asteroids.
- d) There would be more impacts from comets and fewer from asteroids.
- e) There would be more impacts from asteroids and fewer from comets.

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