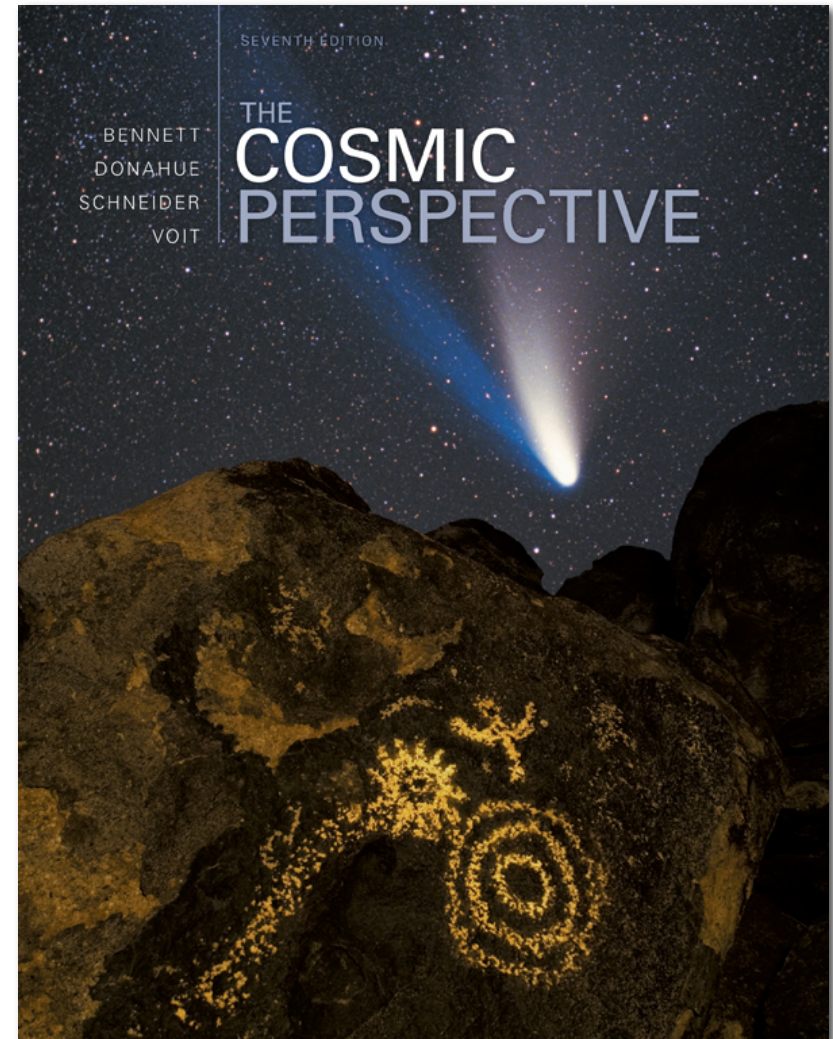


The Cosmic Perspective

Seventh Edition

The Bizarre Stellar Graveyard



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- a) a red giant.
- b) a planetary nebula.
- c) a white dwarf.
- d) a supernova.
- e) A, B, and C

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A white dwarf

- a) is the core of the star from which it formed, and contains most of the mass.
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- d) is so dense that one teaspoonful would weigh about as much as an elephant.
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If a white dwarf in a binary has a companion close enough that some material begins to spill onto it, it can

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- c) have new nuclear reactions and experience a nova.
- d) become much larger.
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What happens if a white dwarf has a nearby binary companion that tries to expand as it evolves?

- a) Hydrogen may be pulled into an accretion disk around the white dwarf, then onto it.
- b) The hydrogen may begin to fuse and create a nova, as bright as 100,000 Suns.
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If the mass transferred to a white dwarf exceeds the 1.4 solar mass limit, what happens?

- a) Carbon can begin to fuse rapidly on the white dwarf's surface.
- b) The star can emit 100 *billion* times as much light as the Sun for several days.
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A neutron star

- a) contains most of the mass of the star from which it formed.
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If the beam from a spinning neutron star hit Earth,

- a) we would all die.
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- a) gas may be pulled into an accretion disk around the pulsar, then onto it.
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If significantly more mass than a neutron star was concentrated in the same spot,

- a) it would collapse even smaller than a neutron star.
- b) it would keep collapsing and nothing could stop it.
- c) gravity would get stronger and stronger as it collapsed further.
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Gravity in a black hole is so strong that

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If the Sun were suddenly squeezed small enough to become a black hole,

- a) Earth would get sucked in.
- b) Earth would continue in orbit pretty much as before.
- c) Earth would get very cold.
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- b) Time is distorted.
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Black holes can't be seen. Can they be detected?

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- b) They can be detected if they are in a binary system.
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When the *Compton Gamma Ray Observatory* was launched in 1991, it showed that gamma ray bursts were coming uniformly from all over the sky. What does this tell us about the source of the gamma ray bursts?

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What would happen to Earth's orbit if our Sun suddenly became a black hole?

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True or False?: The radii of white dwarfs in close binary systems gradually increase as they accrete matter.

- a) True, their radii will slightly increase due to the extra material.
- b) True, their radii will continue to increase up to the white dwarf mass limit.
- c) False, the radius of a white dwarf star is constant.
- d) False, the matter will be ejected in novae and their radii will remain unchanged.
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True or False?: Before pulsars were discovered, no one knew for sure whether neutron stars existed.

- a) True, pulsars were the first evidence for the existence of objects more compact than a white dwarf.
- b) True, neutron stars had been observed before at optical wavelengths but it was only after they were found to pulsate at radio wavelengths that astronomers realized their nature.
- c) False, the existence of neutron stars was predicted by theory and it was widely accepted that they were common in the universe.
- d) False, the existence of neutron stars is still debated and is a major reason why neutrino telescopes are being built.

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True or False?: If a black hole ten times more massive than our Sun were lurking just beyond Pluto's orbit, we'd have no way of knowing it was there.

- a) True. Black holes do not emit light so they cannot be detected.
- b) True. Such a low mass black hole would have no influence on the solar system.
- c) False. Such a black hole would measurably affect the orbits of the planets.
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True or False?: We can detect black holes with X-ray telescopes because matter falling into a black hole emits X-rays after it smashes into the event horizon.

- a) True, the energy of matter smashing into the event horizon is very high and creates strong X-ray emission.
- b) False, after matter smashes into the event horizon, its radiation cannot escape.
- c) False, black holes do not have surfaces for material to smash into. The X-ray emission comes from gas as it falls toward the event horizon and heats up.
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