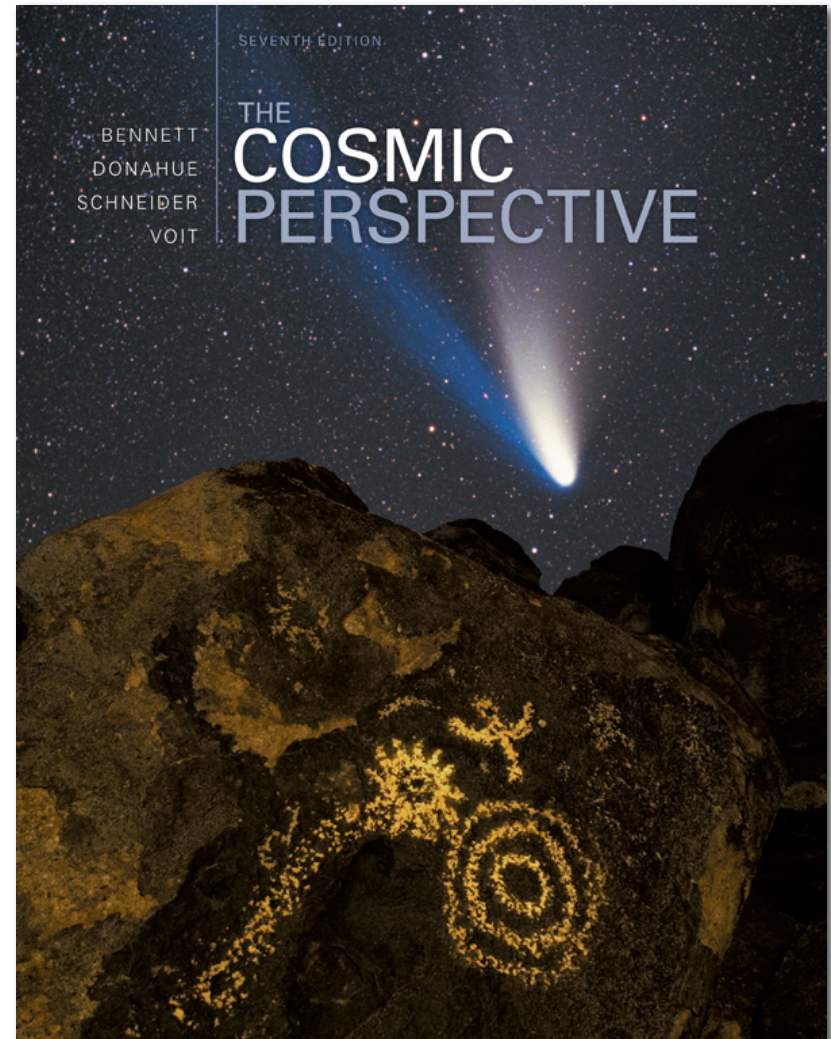


The Cosmic Perspective

Seventh Edition

Our Galaxy



Chapter 19

Suppose you tried to determine where we are in the galaxy by looking in different directions to see how many stars you could see. If you did this, you would pinpoint our location

- a) in the center of the galaxy.
- b) in an arm of the galaxy.
- c) near the edge of the galaxy.

Chapter 19

Suppose you tried to determine where we are in the galaxy by looking in different directions to see how many stars you could see. If you did this, you would pinpoint our location

- a) in the center of the galaxy.**
- b) in an arm of the galaxy.
- c) near the edge of the galaxy.

Why does a simple survey, such as described in the previous slide, give a FALSE answer?

- a) We can't count enough stars to get a good result.
- b) Interstellar dust blocks our view.
- c) Black holes distort the light from distant regions, giving a false result.
- d) Light from far-away stars that have died block our view, giving a false result.

Why does a simple survey, such as described in the previous slide, give a FALSE answer?

- a) We can't count enough stars to get a good result.
- b) Interstellar dust blocks our view.**
- c) Black holes distort the light from distant regions, giving a false result.
- d) Light from far-away stars that have died block our view, giving a false result.

Since dust scatters blue light more than red, stars seen through a lot of interstellar dust would look

- a) bluer than expected for their spectral type.
- b) redder than expected for their spectral type.
- c) the same as when seen without dust.

Chapter 19

Since dust scatters blue light more than red, stars seen through a lot of interstellar dust would look

- a) bluer than expected for their spectral type.
- b) redder than expected for their spectral type.**
- c) the same as when seen without dust.

Why is it difficult to get a good picture of what the Milky Way Galaxy looks like?

- a) We're in the middle of one of its arms and thus have no perspective.
- b) It is very large and the edges are far away and faint.
- c) Dust blocks our view when we look toward the center or in the disk.
- d) We cannot see it from the outside.
- e) all of the above

Why is it difficult to get a good picture of what the Milky Way Galaxy looks like?

- a) We're in the middle of one of its arms and thus have no perspective.
- b) It is very large and the edges are far away and faint.
- c) Dust blocks our view when we look toward the center or in the disk.
- d) We cannot see it from the outside.
- e) all of the above**

How *do* we get a good picture of what our Milky Way galaxy looks like?

- a) by using infrared or microwaves to penetrate the dust
- b) by using radio telescopes to see where clouds of hydrogen gas are
- c) by taking photos from both the top and side of the galaxy to get a good view
- d) all of the above
- e) A and B

How *do* we get a good picture of what our Milky Way galaxy looks like?

- a) by using infrared or microwaves to penetrate the dust
- b) by using radio telescopes to see where clouds of hydrogen gas are
- c) by taking photos from both the top and side of the galaxy to get a good view
- d) all of the above
- e) A and B**

Chapter 19

About how long does light take to reach us from the nearest star besides the Sun? (The Sun takes 8 minutes.)

- a) about an hour
- b) about a week
- c) about a month
- d) about four years
- e) about 1000 years

Chapter 19

About how long does light take to reach us from the nearest star besides the Sun? (The Sun takes 8 minutes.)

- a) about an hour
- b) about a week
- c) about a month
- d) about four years**
- e) about 1000 years

About how long does light take to cross the Milky Way Galaxy?

- a) about a month
- b) about four years
- c) about 1000 years
- d) about 100,000 years
- e) millions of years

About how long does light take to cross the Milky Way Galaxy?

- a) about a month
- b) about four years
- c) about 1000 years
- d) about 100,000 years**
- e) millions of years

What does our galaxy look like?

- a) It has a large disk with spiral arms, and is relatively flat and thin.
- b) It has clouds of gas and dust in the spiral arms.
- c) Older yellow stars are found mostly in the central bulge.
- d) Old stars and globular clusters are located in a spherical halo above and below the disk.
- e) all of the above

What does our galaxy look like?

- a) It has a large disk with spiral arms, and is relatively flat and thin.
- b) It has clouds of gas and dust in the spiral arms.
- c) Older yellow stars are found mostly in the central bulge.
- d) Old stars and globular clusters are located in a spherical halo above and below the disk.
- e) all of the above**

We can estimate the mass of our galaxy by

- a) counting all the stars and multiplying by the average mass of a star.
- b) making an estimate of the number of stars and multiplying by the average mass of a star, then accounting for gas and dust.
- c) observing the speed of rotation using the Doppler shift, knowing the orbital size and speed to calculate mass with Kepler's law.
- d) A and C
- e) B and C

We can estimate the mass of our galaxy by

- a) counting all the stars and multiplying by the average mass of a star.
- b) making an estimate of the number of stars and multiplying by the average mass of a star, then accounting for gas and dust.
- c) observing the speed of rotation using the Doppler shift, knowing the orbital size and speed to calculate mass with Kepler's law.
- d) A and C
- e) B and C**

When you calculate the Milky Way's mass using the two methods of the previous slide, what do you find?

- a) They agree pretty well.
- b) The mass you estimate for all the visible stars is only about $1/10$ the mass you get from observing motions.
- c) The mass you estimate for all the visible stars is about 10 times the mass you get from observing motions.

When you calculate the Milky Way's mass using the two methods of the previous slide, what do you find?

- a) They agree pretty well.
- b) The mass you estimate for all the visible stars is only about 1/10 the mass you get from observing motions.**
- c) The mass you estimate for all the visible stars is about 10 times the mass you get from observing motions.

How do astronomers interpret the results of the previous slide?

- a) Astronomers are bad estimators.
- b) We don't know the masses of stars well.
- c) 90% of the galaxy is hidden from view.
- d) There must be some other kind of matter in the galaxy that we cannot see.
- e) C and D

How do astronomers interpret the results of the previous slide?

- a) Astronomers are bad estimators.
- b) We don't know the masses of stars well.
- c) 90% of the galaxy is hidden from view.
- d) There must be some other kind of matter in the galaxy that we cannot see.
- e) C and D**

Gas is added to the interstellar medium by supernovae and planetary nebulae. What kind of gas would you expect that to be?

- a) hydrogen gas
- b) helium gas
- c) gas that has a mix of heavier elements in it, such as carbon, oxygen, silicon, iron, etc

Gas is added to the interstellar medium by supernovae and planetary nebulae. What kind of gas would you expect that to be?

- a) hydrogen gas
- b) helium gas
- c) gas that has a mix of heavier elements in it, such as carbon, oxygen, silicon, iron, etc**

Chapter 19

Stars we see in the halo of our galaxy formed even before the Milky Way collapsed into a disk. Since we see them today, they must be

- a) young.
- b) old.
- c) low mass.
- d) high mass.
- e) B and C

Chapter 19

Stars we see in the halo of our galaxy formed even before the Milky Way collapsed into a disk. Since we see them today, they must be

- a) young.
- b) old.
- c) low mass.
- d) high mass.
- e) B and C**

Why do stars in the halo of the galaxy have almost no heavy elements such as carbon, nitrogen, and oxygen?

- a) Those elements have been used up in halo stars.
- b) Heavy elements are biological, and there is no life out there to make them.
- c) Halo stars formed before those elements were made.
- d) Making C, N, and O requires massive stars, and there are no massive stars in the halo.

Why do stars in the halo of the galaxy have almost no heavy elements such as carbon, nitrogen, and oxygen?

- a) Those elements have been used up in halo stars.
- b) Heavy elements are biological, and there is no life out there to make them.
- c) Halo stars formed before those elements were made.**
- d) Making C, N, and O requires massive stars, and there are no massive stars in the halo.

Halo stars

- a) are deficient in common elements such as carbon, nitrogen, oxygen, and iron.
- b) have orbits that plunge through the plane of the galaxy.
- c) are all more massive than the Sun.
- d) all of the above
- e) A and B

Halo stars

- a) are deficient in common elements such as carbon, nitrogen, oxygen, and iron.
- b) have orbits that plunge through the plane of the galaxy.
- c) are all more massive than the Sun.
- d) all of the above
- e) A and B**

Where do stars form in the galaxy *today*?

- a) No stars are forming in the galaxy today.
- b) molecular clouds
- c) dark dust clouds
- d) glowing ionization nebulae
- e) B, C, and D

Where do stars form in the galaxy *today*?

- a) No stars are forming in the galaxy today.
- b) molecular clouds
- c) dark dust clouds
- d) glowing ionization nebulae
- e) B, C, and D**

How do the elements produced in massive stars get into other stars?

- a) Supernovae blow them out into space.
- b) Red giant winds blow them into space.
- c) The star-gas-star cycle circulates them.
- d) all of the above
- e) A and B

How do the elements produced in massive stars get into other stars?

- a) Supernovae blow them out into space.
- b) Red giant winds blow them into space.
- c) The star-gas-star cycle circulates them.
- d) all of the above**
- e) A and B

Infrared telescopes penetrate dust and show us that stars at the center of the Milky Way are orbiting very fast. Why?

- a) They are in the process of forming.
- b) They are being accelerated by a supernova explosion.
- c) There is probably a massive black hole at our galaxy's center.

Infrared telescopes penetrate dust and show us that stars at the center of the Milky Way are orbiting very fast. Why?

- a) They are in the process of forming.
- b) They are being accelerated by a supernova explosion.
- c) There is probably a massive black hole at our galaxy's center.**

Based on the idea of chemical enrichment, which types of stars contain a higher proportion of heavy elements: stars in globular clusters or stars in open clusters?

- a) Stars in globular clusters, because they are younger and therefore formed from more enriched material.
- b) Stars in globular clusters, because they are older and therefore formed from more enriched material.
- c) Stars in open clusters, because they are younger and therefore formed from more enriched material.
- d) Stars in open clusters, because they are older and therefore formed from more enriched material.

Chapter 19

Based on the idea of chemical enrichment, which types of stars contain a higher proportion of heavy elements: stars in globular clusters or stars in open clusters?

- a) Stars in globular clusters, because they are younger and therefore formed from more enriched material.
- b) Stars in globular clusters, because they are older and therefore formed from more enriched material.
- c) Stars in open clusters, because they are younger and therefore formed from more enriched material.**
- d) Stars in open clusters, because they are older and therefore formed from more enriched material.

What causes the blue and red colors in a photograph of a typical nebula?

- a) The ionizing photons from a hot star cause hydrogen gas to glow red and helium to glow blue.
- b) Dust grains scatter blue light and let red light pass through, similar to the blue sky and red sunsets in our atmosphere.
- c) The blue color is due to the scattering of light by interstellar dust grains and the red color arises from hydrogen emissions.
- d) The blue light comes from young, hot stars and the red light from older, cooler stars.
- e) The blue color comes from gas moving toward us and the red color from gas moving away from us.

What causes the blue and red colors in a photograph of a typical nebula?

- a) The ionizing photons from a hot star cause hydrogen gas to glow red and helium to glow blue.
- b) Dust grains scatter blue light and let red light pass through, similar to the blue sky and red sunsets in our atmosphere.
- c) The blue color is due to the scattering of light by interstellar dust grains and the red color arises from hydrogen emissions.**
- d) The blue light comes from young, hot stars and the red light from older, cooler stars.
- e) The blue color comes from gas moving toward us and the red color from gas moving away from us.

True or False?: Many spectacular ionization nebulae are seen throughout the Milky Way's halo.

- a) True, they are the sites of new star formation.
- b) True, but they are concentrated in the spiral arms.
- c) False, there are no young, hot stars to cause ionization nebulae in the halo.
- d) False, there are very few stars in the halo.
- e) False, there is very little mass in the halo.

True or False?: Many spectacular ionization nebulae are seen throughout the Milky Way's halo.

- a) True, they are the sites of new star formation.
- b) True, but they are concentrated in the spiral arms.
- c) False, there are no young, hot stars to cause ionization nebulae in the halo.**
- d) False, there are very few stars in the halo.
- e) False, there is very little mass in the halo.

True or False?: The Sun's velocity around the Milky Way tells us that most of our galaxy's dark matter lies within the Sun's orbit.

- a) True, the Sun's motion in the galaxy shows that we are near the edge of the Milky Way disk and therefore exterior to most of the mass of the galaxy.
- b) True, the Milky Way's rotation curve stops increasing well before the orbit of the Sun, indicating that the majority of the Milky Way's mass lies within the Sun's orbit.
- c) False, the Milky Way's rotation curve remains flat well beyond the orbit of the Sun, indicating that the majority of the Milky Way's mass lies beyond the Sun's orbit.
- d) False, the Milky Way's rotation curve looks similar to the rotation curve of planets in our solar system where most of the mass lies near the center.

True or False?: The Sun's velocity around the Milky Way tells us that most of our galaxy's dark matter lies within the Sun's orbit.

- a) True, the Sun's motion in the galaxy shows that we are near the edge of the Milky Way disk and therefore exterior to most of the mass of the galaxy.
- b) True, the Milky Way's rotation curve stops increasing well before the orbit of the Sun, indicating that the majority of the Milky Way's mass lies within the Sun's orbit.
- c) False, the Milky Way's rotation curve remains flat well beyond the orbit of the Sun, indicating that the majority of the Milky Way's mass lies beyond the Sun's orbit.**
- d) False, the Milky Way's rotation curve looks similar to the rotation curve of planets in our solar system where most of the mass lies near the center.