

Physics 1061. Stars and Galaxies

Final Exam REVIEW. Supernovae, the Galaxy, Distances, Cosmology Supernovae

1. A surface explosion on a white dwarf, caused by falling matter from the atmosphere of its binary companion, creates what kind of object?
 - (a) hypernova
 - (b) nova
 - (c) gamma ray burstar
 - (d) type I supernova
 - (e) type II supernova
2. The classification of supernovae is based primarily on _____ and to a lesser extent on their light curve.
 - (a) duration
 - (b) color
 - (c) peak brightness
 - (d) minimum brightness
 - (e) spectra
3. Which of these is the likely progenitor of a type Ia supernova?
 - (a) a contact binary, with the neutron star at 2.3 solar masses
 - (b) an evolved red giant which is just starting to make silicon in its core
 - (c) an evolved blue supergiant that is about to experience the helium flash
 - (d) a lone, helium-neon white dwarf
 - (e) a mass-transfer binary, with the white dwarf already at 1.3 solar masses
4. What do type Ia supernovae and novae have in common?
 - (a) The same peak brightness.
 - (b) both originate in the halo.
 - (c) both result in black holes.
 - (d) a certain 'je ne sais quox?'
 - (e) both involve a white dwarf with a companion star.
5. T or F. Type Ib and Ic supernovae involve a white dwarf exploding just like Type Ia.
6. T or F. Fusion of Iron (Fe) in the core of a massive star requires about as much energy as it releases, and therefore cannot prevent the collapse of the core.
7. T or F. A supernova can outshine its entire parent galaxy.

The Milky Way Galaxy

8. How far is the Sun from the center of the Milky Way galaxy?
(a) 9 pc (b) 1.8 kpc (c) 5 kpc (d) 8.5 kpc (e) 25 kpc
9. Shapley noticed that these objects are concentrated in the constellation Sagittarius.
(a) galaxies (b) spiral nebulae (c) globular clusters
(d) molecular clouds (e) blue stars
10. Our Sun is located in _____ of a spiral galaxy.
(a) the center (b) the halo (c) -between the arms (d) a globular cluster
(e) the nuclear bulge
11. The spiral arms of galaxies are delineated by _____.
(a) novae (b) red stars (c) blue stars and dust lanes (d) blue stars only
(e) dust only
12. T or F. The mass of the supermassive black hole at the center of our Milky Way was determined using infrared observations of the orbits of individual stars in the nucleus.
13. Which object defines the center of our galaxy?
(a) Our Sun. (b) The radio source Sag A (c) the direction perpendicular to the Sun's motion
(d) Cygnus X-1 (e) a star cluster in Sagittarius
14. Structurally, the Milky Way consists of a disk, a halo, and a _____.
15. T or F. Globular clusters have orbits much like those of the halo stars in our Galaxy.
16. The disk of the Milky Way (and most other spiral galaxies) has a rotation velocity that stays nearly constant rather than decreasing with distance. This indicates the presence of
(a) globular clusters (b) dark matter (c) enhanced star formation (d) isotropy
(e) Keplerian orbits
17. The orientations of the orbits of the stars in our halo are isotropic, meaning
(a) near the nucleus
(b) pointing inward and outward
(c) tangential
(d) the same in every direction
(e) circular
18. T or F. The orbits in the Galactic disk are non-isotropic.

19. Since Type II supernovae are the explosions of young, massive stars, they should primarily be found in the _____.
- (a) bulge (b) halo (c) Galactic disk (d) nucleus (e) Magellanic clouds
20. What does MACHOs stand for? _____
21. What does WIMPs stand for? _____
22. What part of the Milky Way contains a mixture of Pop. I (young, hi metal content) and Pop. II (old, low metals) stars?
- (a) the spiral arms (b) the disk (c) the central bulge (d) Globular clusters
(e) the halo
23. The strongest evidence for a cloud collapse scenario for the Milky Way's formation is
- (a) the young stars collectively rotate faster than the old stars (b) ellipticals have only old stars
(c) cepheids come in two "flavors" (d) the rising rotation curve (e) the nearby Magellanic clouds
24. If, beyond 8.5 kpc, the rotation curve of our Galaxy was Keplerian (like our solar system's), then the rotation speed, V_{sun} , at the position of the Sun would be
- (a) less than V_{10} at $r=10$ kpc (b) greater than V_{10} at $r=10$ kpc (c) greater than it is now
(d) less than it is now (e) greater than V_6 at $r=6$ kpc
25. The stars orbiting near our Galaxy's black hole are best observed in which wavelengths?
- (a) radio (b) infrared (c) visual (d) ultraviolet (e) gamma rays
26. About how many Galactic Years (revolutions) have there been since our Galaxy formed?
- (a) 10 (b) 40 (c) 500 (d) 8500 (e) 12 billion
27. T or F. A cluster of neutron stars would work equally well as a black hole to explain the dark mass in our Galaxy's nucleus.
28. T or F. The bulge of the Milky Way contains a mixture of old and young stars.
29. T or F. The Milky Way is considered a "Grand Design" spiral.
30. T or F. Stars and gas in disks catch up to spiral density waves.
31. T or F. Spiral density waves suppress star formation in galaxy disks.
32. T or F. Our Milky Way galaxy is a barred spiral.

33. The “winding problem” refers to a model for explaining
- (a) star formation (b) bulge to disk ratio (c) spiral arms (d) supernovae
(e) rotation curves
34. The density of stars in the nucleus of the Milky Way (within about 1 pc) is about _____ times the density near the Sun.
- (a) 0.5 (b) 10 (c) 100 (d) 1000 (e) 1,000,000
35. What is the diameter of the Milky Way galaxy?
36. What was being argued in the Shapley-Curtis debate of 1920? (Hint: spiral nebulae)
37. The spectroscopic parallax technique for determining distances assumes that
- (a) stars of the same spectral type have the same luminosity (b) all stars have the same absolute magnitude (c) the diameter of the Earth’s orbit is 2 AU (d) stars of the same spectral type have the same apparent magnitude (e) all open clusters are 1 pc away
38. Henrietta Leavitt found that, for Cepheid variable stars, the brighter the star,
- (a) the greater its diameter (b) the longer its period (c) the rounder (d) the further its distance (e) the shorter its period
39. Which distance indicator (or standard candle) is most appropriate for calibrating the Hubble law to the greatest distance?
- (a) Trigonometric parallax (b) supergiant Sc galaxies (c) novae light curves (d) cepheids
(e) HII regions
40. When we know the apparent (or relative) magnitude of an object, all we need to calculate its distance is
- (a) its diameter (b) its absolute magnitude (c) its radius (d) its m_v (e) its velocity

Galaxies and Distances

1. Most spiral galaxies have a rotation velocity that stays nearly constant with radius rather than decreasing. This indicates the presence of

- (a) globular clusters (b) dark matter (c) enhanced star formation (d) isotropy
(e) Keplerian orbits
2. For certain variable stars in the Magellanic clouds, it was found (in the early 20th century) that the brighter the star _____
- (a) the greater its diameter (b) the longer its period of oscillation (c) the rounder its shape
(d) the further its distance (e) the shorter its period
3. The _____ variable stars have a period of about 1 day.
- (a) RS CnVan (b) RR Lyrae (c) Delta Scuti (d) Beta lyrae (e) Cepheid
4. Why are Cepheid variable stars so important in cosmology?
- (a) They are abundant in the solar neighborhood.
(b) They can be used to find galaxy distances out to ~ 25 Mpc.
(c) They have an easily identifiable spectrum.
(d) They are the oldest stars known.
(e) They are brighter than RR Lyrae stars.
5. When we know the apparent (or “relative”) magnitude of an object, all that we need to calculate its distance is _____.
- (a) its diameter (b) its absolute magnitude (c) its radius (d) its m_v
(e) its velocity
6. Most of the galaxies ($> 99\%$) are
- (a) moving around randomly.
(b) showing Doppler blueshifts.
(c) moving in circles.
(d) rushing away from us.
(e) approaching us.
7. Galaxy distance and Doppler redshift are correlated for galaxies. What do we call that correlation?
- (a) the Hubble law
(b) Wein’s law
(c) Kirchoff’s law
(d) the period luminosity relation
(e) Einstein’s postulate of special relativity

8. One redshift-independent distance estimator which works for galaxies beyond 30 Mpc is _____.

- (a) Cepheid stars (b) spectroscopic parallax (c) Type Ia supernovae
(d) stellar parallax (e) the Hubble Law

9. (3pts) Order these distance estimators by their height on the “distance ladder”. Here, “1” will be the estimator for the lowest rung (i.e., limited to the shortest distances).

- _____ Hubble’s Law _____ Radar
_____ Stellar Parallax _____ Tully-Fischer
_____ Cepheids _____ Type Ia Supernovae
_____ Spectroscopic Parallax

Cosmology

10. T or F. The motion of galaxies away from us proves that we are at the center of the universe.

11. The beginning of our observable universe is referred to as the _____.

12. Observations of Type Ia supernovae indicate that our universe is _____ in its expansion.

13. Our current best estimate of the age of the universe is

- (a) 10-13 million years (b) 4.5-5 billion years (c) 13-15 billion years
(d) 100-200 billion years (e) infinite.

14. The critical evidence for cosmic acceleration in 1998 came from two teams of astronomers, both observing:

- (a) hypernovae.
(b) gamma ray bursts.
(c) type Ia supernovae.
(d) type II supernovae.
(e) ages of globular clusters.

15. What is the meaning of isotropic?

- (a) the same density everywhere
(b) the same in all directions
(c) the same at all times
(d) the same temperature everywhere
(e) the same in every way throughout space

16. _____ is the concept that the number of galaxies contained in a large region is about the same no matter where that large region is located in the universe.

- (a) Conformity
 - (b) Isotropy
 - (c) Universality
 - (d) Homogeneity
 - (e) Cosmology
17. The idea that the universe looks the same no matter where you are, is called the
- (a) cosmological principle (b) law of gravitation (c) cosmic quota
 - (d) anthropic principle (e) Kansas principle
18. The age of the universe is
- (a) 10 -20 million years (b) 4.5-5 billion years (c) 100-200 billion years
 - (d) 10-20 billion years (e) infinite.
19. The temperature of the Cosmic Microwave Background is now
- (a) 2 K (b) 2.7 K (c) 100 K (d) 5800 K (e) 1,000,000 K
20. T or F. The observable universe is finite while the universe may be infinite.
21. T or F. Astronomers think dark energy has a slowing influence on the expansion of the universe while gravity increases the expansion rate.
22. The Drake Equation is a way to estimate the number of intelligent civilizations in the _____.
- (a) sea (b) solar system (c) local group (d) observable universe
 - (e) Milky Way
23. The object referred to by the textbook as the largest structure known is the Sloan Great Wall, with a length of about _____.
- (a) 3000 Mpc (b) 300 Mpc (c) 14 GLY (d) 100 Mpc (e) 100 kpc
24. What is the meaning of a "closed" universe?
- (a) The universe will expand forever.
 - (b) The universe will someday stop expanding and start to collapse.
 - (c) The universe will stop expanding in an infinite amount of time.
 - (d) The universe is in a steady-state.
 - (e) The universe will disappear into a white hole in time.
25. The cosmic microwave background is important mostly because:

- (a) its detection led to the discovery of dark matter.
 - (b) its detection opened a new form of radiation to observation.
 - (c) it showed that the universe is open.
 - (d) it showed that the universe is closed.
 - (e) it confirmed a major prediction made by the Big Bang theory.
26. The Big Bang has 3 pillars of evidence: primordial abundances, cosmic expansion, and
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- (a) the cosmological principle (b) neutrinos (c) a lingering order
 - (d) the cosmic microwave background (e) the HR Diagram