

## Introductory Astronomy

**Homework 28: Galaxies** Not to be handed in. Homework solutions are posted already.

- A typical nearest neighbor distance between galaxies is of order:
  - 1 Mpc.
  - 1 kpc.
  - 1 pc.
  - 1 cm.
  - 4220 Mpc.
- Hubble galaxy types are conveniently displayed by a:
  - Hubble spoon diagram.
  - Hertzsprung-Russell (HR) diagram.
  - Hubble tuning fork diagram.
  - Hertzsprung-Hubble spoon diagram.
  - Hertzsprung-Russell knife diagram.
- “Let’s play *Jeopardy!* For \$100, the answer is: They are the subtypes of the Hubble type barred spiral.”  
What are \_\_\_\_\_, Alex?
  - Sa, Sb, and Sc
  - SBa, SBb, and SBc
  - E0, E1, E2, E3, E4, E5, E6, and E7
  - SO and SBO
  - Irr I and Irr II
- “Let’s play *Jeopardy!* For \$100, the answer is: Galaxies of this Hubble type range in size from about  $10^5 M_{\odot}$  (small dwarfs) to  $10^{13} M_{\odot}$  (large giants), consist mainly of Population II and old Population I stars, and have relatively little dust and gas.”  
What is \_\_\_\_\_, Alex?
  - irregular
  - lenticular
  - spiral
  - barred spiral
  - elliptical.
- Lenticular (SO and SBO) galaxies have:
  - spiral arms, but no disks.
  - disks, but no spiral arms.
  - bulges, but no disks.
  - no bulges, disks, spiral arms, or halos.
  - no size whatsoever.
- Spiral galaxies are divided into ordinary spirals (or just spirals without qualification) and:
  - bulgeless spirals.
  - haloed spirals.
  - disked spirals.
  - barred spirals.
  - unbarred spirals.
- The spiral arms rotate in the same sense as the disk stars around the center of the galaxy. The arms, however, rotate more slowly than the stars and gas. The ends of the spiral arms:
  - point in the direction of rotation.
  - point opposite the direction of rotation: i.e., the arms are trailing.
  - point exactly radially.
  - curl back and point toward the galaxy center.
  - are knotted together.
- To see a spiral or lenticular galaxy parallel to the disk is to see it \_\_\_\_\_ and to see it perpendicular to the disk is to see it \_\_\_\_\_.
  - edge-on; face-on
  - face-on; edge-on
  - edge-on; obliquely
  - face-on; obliquely
  - obliquely; opaquely
- One can usually tell the subtype of a spiral or barred spiral seen **EDGE-ON** because a subtype indication is provided by:
  - the tightness of the winding of the spiral arms.
  - the darkness of the disk dust lane.

- c) the relative size of the halo.      d) the relative size of the bulge.      e) the galaxy brightness on the sky.
10. A well known example of an irregular galaxy (of subtype Irr I) is the:
- a) Whirlpool Galaxy (M51).      b) Sombrero Galaxy (M104).      c) Large Magellanic Cloud (LMC).      d) Milk Way (i.e., the Galaxy).      e) Andromeda Galaxy (M31).
11. The compression of gas and dust in the spiral density wave spiral arms leads directly to these observationally obvious spiral arm features:
- a) star formation, hot young, blue stars (i.e., OB stars), and H II regions.      b) white dwarfs, neutron stars, and black holes.      c) brown dwarfs and planets.      d) Venus and Mars.      e) the Moon and Mercury.
12. “Let’s play *Jeopardy!* For \$100, the answer is: These objects are themselves grouped into larger structures: clusters (poor and rich), superclusters, filaments, sheets and, in a zero or near-zero population sense, voids.”
- What are \_\_\_\_\_, Alex?
- a) spiral arms      b) galaxies      c) H II regions      d) black holes      e) bulges
13. Some galaxies in the local group may be undiscovered because:
- a) they are too large.      b) they are hidden by the Galaxy dusty disk.      c) located in the southern hemisphere of the celestial sphere.      d) emit only **RED** light.      e) emit only **GREEN** light.
14. The nearest rich cluster contains over 2000 galaxies, covers about  $10^\circ \times 12^\circ$  on the sky in the constellation Virgo, is about 15 Mpc away, and has a diameter of about 3 Mpc. It is an irregular cluster. It is called the:
- a) Local Group.      b) solar system.      c) Coma cluster.      d) Virgo cluster.      e) Norma cluster.
15. These structures, which are roughly spherical, are of order 30 Mpc to 120 Mpc in diameter. They are rather empty, but may contain hydrogen gas and strings of dim galaxies. They are called:
- a) voids.      b) vaults.      c) vandals.      d) vents.      e) vultures.
16. “Let’s play *Jeopardy!* For \$100, the answer is: The large-scale structure of galaxy groupings is often described by this adjective.”
- What is \_\_\_\_\_, Alex?
- a) snowy      b) solid      c) sudsy      d) creamy      e) joky
17. In formation of elliptical galaxies most of the star formation must have occurred and exhausted the gas before the gas could collapse to a disk **OR** a disk formed, but the disk and gas:
- a) collapsed to form a supermassive black hole.      b) were eliminated by collisions and mergers in galaxy rich environments.      c) vanished into thin air.      d) mutually annihilated.      e) dissolved into helium.
18. The Andromeda galaxy (M31), the Large Magellanic Cloud (LMC), and the Small Magellanic Cloud (SMC) are all:

- a) elliptical galaxies.    b) dwarf elliptical galaxies.    c) irregular galaxies.    d) spiral galaxies.  
e) unaided-eye objects: i.e., they can all be seen by the unaided eye.