The New Milky Way Galaxy

by Bob Riddle

When students are asked about the Milky Way Galaxy and where our solar system is located, most will describe it as a spiral-shaped galaxy with the Sun located on one of the spiral arms. While this is essentially correct, data obtained with the Spitzer Telescope has provided new insight into the shape of our galaxy and given us a newer model of the Milky Way Galaxy to consider (See January 2008 column).

Galaxies have many shapes and sizes but are classified into three major types by appearance or shape. The Milky Way is an example of a spiral galaxy, however, the Spitzer data suggests that our galaxy is a type of spiral known as a barred-spiral. All spiral galaxies have a roundish central region or bulge surrounded by a diffuse halo of dust, gases, and stars (Figure 1a). In barred spirals the central bulge is more elongated and the spiral arms appear to extend from the ends of the bar. Wrapped around the central bulge or bar are the spiral arms. This region of a spiral galaxy is known as the disk and stars within the flattened disk follow nearly circular orbits around the galactic center. The disk contains stars of all ages and is active in star and planet formation. Stars within the halo and bulge area are older than disk stars and they orbit the center of the galaxy at various angles inclined away from the disk.

Elliptical galaxies look like a spiral galaxy without the spiral arms (see photo at right). Some elliptical galaxies are large enough to be among the most massive known galaxies, while others are small enough (only a few billion stars) to be described as dwarf elliptical galaxies. Many dwarf elliptical galaxies are found orbiting larger spiral galaxies. Approximately one-fourth of the galaxies within our local group of galaxies are dwarf elliptical galaxies. Because there is no disk or spiral arms, star formation in elliptical galaxies is non-existent or very limited compared to the spiral galaxies. Elliptical galaxies may have formed as the result of the merging of two spiral galaxies, and often appear yellow or red in color due to the lack of hot blue stars found in the disk area of spiral galaxies.

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Elliptical galaxy

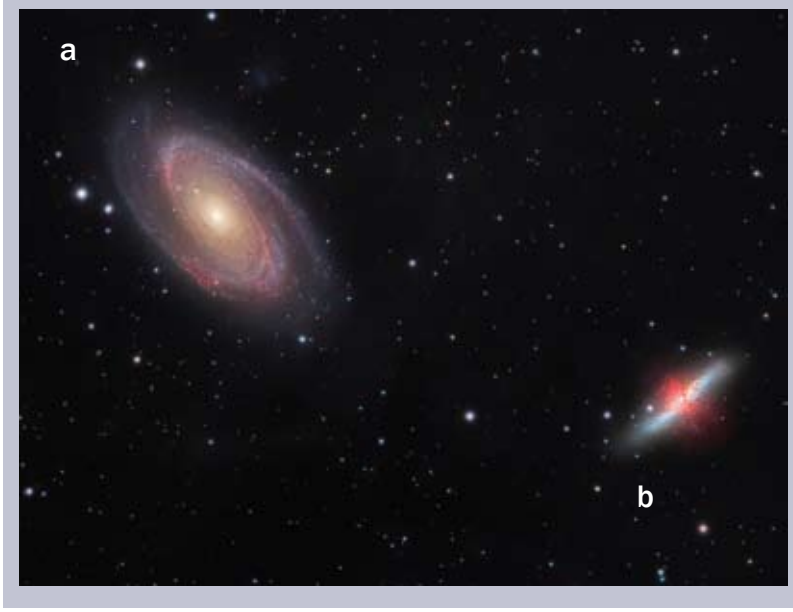
Intermediate between spiral and elliptical galaxies are lenticular galaxies, or those with a bulge and halo but no spiral arms. These are, however, not the third type of galaxy, but are thought to be perhaps a transition between spiral and elliptical galaxies. Galaxies that do not fit into either of the other two types are called irregular galaxies (Figure 1b). These, like their counterparts, come in a variety of sizes. Unlike spirals and elliptical galaxies, irregular galaxies are grouped into two general types—irregular with some shape or structure, and irregular with no discernible structure. Irregular galaxies are thought to be the result of gravitational interactions between spiral galaxies. Until recently, the Large and Small

Magellanic Clouds (Clouds of Magellan), visible from the southern hemisphere, were thought to be examples of irregular galaxies. Further studies have revealed some structure to them, including a barred central bulge.

The local group

Our galaxy is not alone in its part of the universe. In fact, we are part of what is known as the Local Group of Galaxies, a collection of 3–4 dozen galaxies of all three types, and in a range of sizes. In turn, our local group of galaxies is a member of a much larger local group of galaxy groups or clusters belonging to the Virgo Super Cluster. The two largest members of the local group are the Milky Way Galaxy and the larger Andromeda Galaxy. Both of which have several smaller companion galaxies gravitationally bound to them. The two Magellanic Clouds are companion galaxies to Milky Way and these are two of the only three objects visible to the naked eye that are not within the Milky Way Galaxy. The Andromeda Galaxy is the third object, and at a distance of about 2.5 million light years is the most distant object visible to the naked eye. The Andromeda Galaxy is visible over the western horizon during February after sunset.

FIGURE 1 Spiral Galaxy M-81 and Irregular Galaxy M-82



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Spitzer Space Telescope

The Spitzer Space Telescope, named after Lyman Spitzer, an American astrophysicist, was launched in 2003 and originally was known as the Space Infrared Telescope Facility. Using a 0.85 meter telescope and three science instruments, the orbiting observatory is used to observe the universe in infrared wavelengths. With an infrared telescope, much more of the universe becomes visible than in the optical wavelengths our eyes are sensitive to. With the Spitzer telescope, astronomers are able to use infrared to view objects otherwise hidden beyond obscuring clouds of dusts and gases, and objects emitting radiation only as heat energy.

Visible planets

Mercury is visible over the eastern horizon before sunrise for most of the month.

Venus is very visible over the western horizon at sunset setting several hours later.

Mars starts becoming more visible over the eastern horizon before sunrise.

Jupiter outshines Mercury and Mars as it rises in between the other two this month.

Saturn rises after sunset and is located over the southwest horizon at sunrise.

February

2 First Quarter Moon
3 Uranus at Aphelion
Moon near the Pleiades
7 Moon at Perigee 361,487 km
Cassini Titan Flyby
9 Penumbral Lunar Eclipse
10 Moon near Saturn
12 STS-119 Launches to ISS
Neptune in Conjunction with Sun
13 Mercury at Greatest Western Elongation
15 Happy Birthday Galileo
16 Last Quarter Moon
17 Moon near Antares
18 Dawn Mars Flyby
19 Moon at Apogee 405,132 km
21 Venus at Perihelion
22 Moon near Mercury
23 Moon near Jupiter and Mars
25 New Moon
27 Moon near Venus

Internet resources

Astronomy picture of the day—*http://apod.nasa.gov/apod*
Cassini Mission—*http://saturn.jpl.nasa.gov*
Cool Cosmos—*http://coolcosmos.ipac.caltech.edu/cosmic_classroom/ir_tutorial*
Dawn Mission—*http://dawn.jpl.nasa.gov*
Elliptical Galaxy—*http://antwrp.gsfc.nasa.gov/apod/ap070630.html*
International Year of Astronomy—*www.astronomy2009.org*
M81 and M82—*http://antwrp.gsfc.nasa.gov/apod/ap080325.html*
Milky Way Galaxy Picture—*http://sscws1.ipac.caltech.edu/Imagegallery/image.php?image_name=ssc2008-10b*
Penumbral Lunar Eclipse—*http://eclipse.gsfc.nasa.gov/LEplot/LEplot2001/LE2009Feb09N.GIF*
SFA star Chart—*http://midnightkite.com/starcharts.html*
Spitzer Space Telescope—*www.spitzer.caltech.edu*

Questions for students

1. When you look at a galaxy or any distant celestial object are you seeing them as they appear now?
   No, you are seeing celestial objects as they once were. For example, light from the Sun takes about 8 minutes to reach the Earth; light from the Andromeda Galaxy tales about 2.5 million years.
2. What does the blue colors we see in the spiral arms of galaxies indicate?
   The blue colors come from the young hot stars forming within the spiral arms.
3. Suggested topics for student research.
   What is infrared; why is it important to astronomer, and what can we see when we use infrared? Have students visit the Cool Cosmos web site to watch the video More Than Your Eyes Can See, and do their research about infrared.

Bob Riddle *(briddle@kcmsd.net)* is the planetarium director for the Kansas City, Missouri, school district. Visit his astronomy website at *www.currentsky.com.*