Deep-sky objects

by Bob Riddle

Beyond the region of our solar system is the rest of the Milky Way galaxy, and of course the rest of the universe. To the amateur astronomer or casual observer, the phrase *deep-sky objects* is a reference to those dim celestial objects that are beyond our solar system and either a part of the Milky Way or outside of our home galaxy. These include star clusters, galaxies, and nebulae, and while some may be seen with unaided eyes, many deep-sky objects require binoculars or telescopes to see.

To the unaided eye, these faint objects resemble fuzzy smudges of light and are somewhat similar in appearance to a comet. In 1774, French astronomer Charles Messier published a catalog of objects that he had observed. Messier was a comet hunter, and as he scanned the skies for comets he encountered fuzzy patches of light that resembled comets. He noted their location and numbered each one as M1, M2, and so on. Today this list is popularly known as the Messier list, and includes 110 objects spread across the Northern Hemisphere skies. An interesting goal for many amateur astronomers is to see all of the Messier objects during an all-night session known as a Messier marathon. This is typically done during March and April on nights when there is no Moon to brighten the sky.

Going deep

This month, some of the brighter deep-sky objects may be seen in the early morning over the eastern horizon near the two brightest planets, Venus and Jupiter (see Figure 1). These include two open star clusters, M21 and M25, two globular star clusters, M22 (Sagittarius Cluster) and M28, and two nebulae, M8 (Lagoon Nebula) and M20 (Trifid Nebula).

In the evening winter skies, look for the Orion Nebula below the left and lowermost of the three stars forming the belt of Orion. While looking toward Orion's Belt, look to the right and up for two open star clusters in Taurus, the bull.

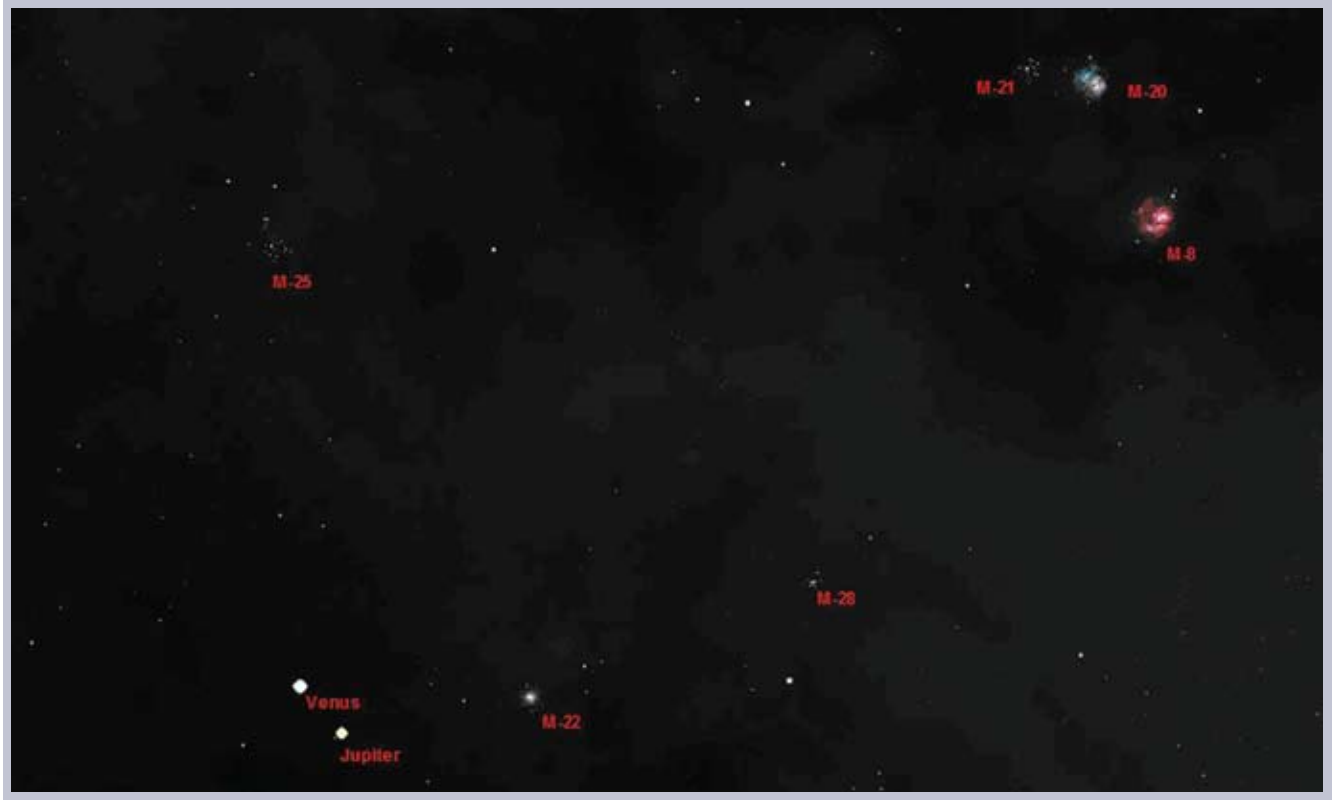
Star clusters

Stars that are gravitationally bound to other stars occur in a variety of groupings. The basic arrangement is a multiple-star system such as a binary system, or binary stars. Larger collections of stars are known as *open star clusters* or as *globular star clusters*. An open star cluster, such as the Pleiades (M45) or the Hyades, both within Taurus, contains tens to hundreds of stars that are usually spread out and held together with less mutual gravitational attraction than the more closely knit stars of a globular star cluster. Typically, an open star cluster has relatively young, hot, bluish stars and is located within spiral arms of the galaxy along the galactic plane. The *galactic plane* is the plane along which the galactic equator lies. Globular star clusters contain tens of thousands to millions of stars older than those in an open cluster, and are more closely bound together by gravity into spherical shapes. Globular star clusters are typically located in elliptical orbits around the galactic center.

Nebulae

While nebulae are not necessarily collections of stars, they are often the birthplaces of stars, and may contain recently formed, hot, young, bluish stars. The Pleiades, M45, is an example of stars still surrounded by the nebulosity from which these stars formed (see Figure 2). The word *nebula* means cloud or mist. These are areas of space composed of dust, hydrogen gas, and plasma from which stars and presumably planets form. Nebulae form in different ways:

FIGURE 1 February 2 at 6:00 a.m



some from the collapse of interstellar gases, some as a result of supernova explosions of large massive stars, and some form smaller, less-massive stars that expand and then collapse quickly, leaving behind an expanding bubble of gases we know as planetary nebula.

An eclipse month

February is the first of the eclipse pairs for 2008. On February 7, at new Moon, the Sun will be partially blocked by the Moon in an annular solar eclipse that will be visible from Antarctica. Two weeks later, on February 20, the full Moon will pass through the Earth's shadow for a total lunar eclipse that will be visible in its entirety from western Europe, all of South America, and the eastern half of the United States. The total phase of the eclipse will occur before moonrise the further west one is viewing. See Resources for a link to eclipse event times for the different time zones across North America.

Uranus rings

We have known for 30 years that there were rings around Uranus, but due to a long orbital period of 84 Earth years, we only get to see the planet with its rings edge-on every 42 years. (This is similar to what happens with our view of Saturn over a 15-year period. The Earth is tilted, as is Saturn. As a result, we see the top side of the rings [they are edge-on], and then we see the bottom side of the rings. At the edge-on point, the rings of Saturn appear as a dark line going across its equator. The rings of Uranus are not thick enough or dense enough to be seen from Earth.) This will be the first series of ring-plane crossings since the rings around Uranus were discovered. A ring-plane crossing occurrence is a combination of the planet's orbits around the Sun and the timing for the equinox on Uranus. Viewing an outer planet's rings during a ring-plane crossing makes it possible for astronomers to observe the rings from the nonilluminated side. During this time, the darker inner rings brighten while the normally bright outer rings darken.

The Uranian ring system was edge-on toward the Sun on its equinox, December 7, and observatories worldwide were aiming their telescopes toward Uranus.

FIGURE 2 The Pleiades (M45)

NASA/ESA/AURA/CALTECH

Due to our planet's axial tilt and orbit, there will be three opportunities for viewing the rings edge-on. The first two were during 2007 and the third and last one in this series will be in February 2008. Unfortunately, this last ring-plane crossing will occur when the Sun is between the Earth and Uranus, so viewing the event will be more limited than the previous two.

Visible planets

Mercury will move into inferior conjunction early in the month, but by the end of the month it will reappear as a morning "star" over the eastern horizon near the planet Venus.

Venus will quickly move east toward the Sun and on the morning of the first will be within one-half degree (the apparent width of a full Moon) of Jupiter.

Mars will rise several hours before sunset and will be visible most of the night, setting before sunrise. The nearby star will be El Nath in the constellation Auriga, one of the stars marking the tip of one of Taurus's horns.

Jupiter will rise about two hours before the Sun and will be visible over the eastern horizon.

Saturn will rise before sunset and will be visible all night.

Celestial events

2/1 Moon near Antares
2/4 Moon near Jupiter and Venus
2/6 Mercury at inferior conjunction
2/7 New Moon
Annular solar eclipse
2/10 Neptune in conjunction
2/14 First quarter Moon
STS-123 launch
2/15 Moon near Mars
2/20 Uranus ring-plane crossing
Full Moon
Total lunar eclipse
Moon near Saturn
2/22 *Cassini* Titan flyby
2/24 Saturn at opposition
2/29 Last quarter Moon

Questions for students

1. While observing the lunar eclipse, determine from which direction the Moon enters the Earth's shadow. (*The Moon orbits the Earth toward the east, so the full Moon will enter the Earth's shadow from the west moving toward the east. This is in addition to the apparent east to west motion of the Moon due to Earth's rotation.*)
2. The Pleiades (M45) are said to be a reflection nebula. What is a reflection nebula? (*A reflection nebula is where the dust reflects and scatters light from the stars within the nebula, causing the dust to glow.*)
3. Many of the star clusters are located along the band of dust and gas we call the Milky Way. Have students research the Milky Way to learn the various names and stories associated with it in different parts of the world. (*Examples: central Asia, the Straw Way; Baltic countries, Bird's Path; Japan, River to Heaven.*)

Resources

Annular solar eclipse—*http://sunearth.gsfc.nasa.gov/eclipse/SEplot/SEplot2001/SE2008Feb07A.GIF*

Hubble Space Telescope views Uranus's rings—*http://hubblesite.org/newscenter/archive/releases/2007/32/results/100*

SEDS Messier database—*www.seds.org/messier*

SFA star charts—*www.midnightkite.com/starcharts.html*

Tips for a Messier marathon—*www.astronomical.org/astbook/messier1.htm*

Total lunar eclipse—*http://sunearth.gsfc.nasa.gov/eclipse/LEmono/TLE2008Feb21/TLE2008Feb21.html*

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