Summer skies

by Bob Riddle

One of the drawbacks to summer, in my opinion, is the decreased number of night hours combined with when they occur—between late at night and early in the morning. Because of when planets are most visible (around sunset or sunrise), it takes a little extra effort to observe the sky during the summer months. However, despite the hours, bugs, humidity, and more than likely some degree of light pollution, there will be many opportunities this summer for your students to get outside and do some summer astronomy. For example, they can follow the Moon as it orbits the Sun with the Earth, making its monthly passage across our skies. Using the dates on the calendar or from other print or online resources, students can use the Moon's position as a guide to finding the visible planets near the Moon's path.

Possibly one of the more exciting celestial objects to observe is the International Space Station (ISS) as it crosses over your part of the world. With about one acre of solar panels, the ISS reflects considerable sunlight, making it the brightest object in the night sky other than our Moon. It appears as a fast-moving bright spot of light that will suddenly appear at a specified location, and will similarly disappear at the time and location given on the ISS sightings website. To find when and where to look for the ISS, use the NASA website listed in the Resources. Many cities are listed under their respective state, and each listing includes the date, time, direction of travel, height above the horizon, and duration of visibility for the station, as well as for the space shuttle if it is in orbit. For more information about viewing the ISS, refer to my Summer 2010 column (see Resources).

There are also viewing opportunities with the Moon that could take students beyond the solar system as the thin waxing or waning crescent Moon passes by what are typically known as deep-sky objects. These are celestial objects outside of our solar system or our galaxy that include other galaxies, nebula, and various star clusters typically seen through the eyepieces of telescopes or large binoculars, or as images in books or online. From the backyard or neighborhood park where many of our students do their night-sky observing, there are still deep-sky objects that are visible with the naked eye or with the type of binoculars that many of us have, usually a 7 x 35 pair. To view relatively dim objects like these, view when the Moon is a thin crescent. Interestingly, with the exception of a few galaxies, what we see in the night sky with just our eyes is all within the confines of our galaxy. Use the information in Figure 1 to locate some deep-sky objects this summer.

Bigger is better, however...

When using binoculars, it is helpful to know some specifics about them. Binoculars differ in both magnification and the size of the lenses; these optical parameters are usually represented by two numbers that are printed on binoculars covers (e.g., 7 x 35). Using the 7 x 35 binoculars as an example, the first number, 7, is how many times the lenses will magnify an object, or how many times closer the object will appear. The second number, 35, is the diameter in millimeters of the primary lens. The second number, and the more important of the two, is the diameter of the primary lens (the large lens in front). The larger the diameter of the primary lens, the more light can be focused on the eyepiece. On the one hand, this means a brighter-looking object. On the other hand, as the size increases, so does the weight of the binoculars, making it difficult to hold them steady while viewing distant objects.

Magnification, or "power," is determined by dividing the focal length by the diameter of the eyepiece lens. The focal length is the distance between the two lenses (from the primary lens to the eyepiece). This is probably more relevant to telescopes. Another very useful piece of information about binoculars is the approximate field of view, or how much of the sky is seen when looking through them. This is typically around 9° for a 7 x 35 binocular, 7° for 7 x 50, and 5° for 10 x 50. See Figure 2 for a comparison of the fields of view for some binoculars. The graphic is set for July 25 before sunrise and shows the Pleiades, or M45, an open star cluster within about 3° of the waxing crescent Moon. Knowing the field of view makes it easier to use the field of view to measure your way across the sky. For example, on June 5, the waxing crescent Moon is 5° from M44, another open star cluster. Using a pair of 7 x 35 binoculars, you could position the field of view so that the Moon is near one side; the star cluster would also be visible, but a little more than halfway across the field of view from the Moon.

Inside outer space

Outer space can be studied indoors during the summer months using the internet or library resources. For example, students could strengthen their global awareness while learning about locations where two solar eclipses and one lunar eclipse will be visible. Most eclipse events now include live video streamed on the internet from eclipse-viewing locations. There will be several launches to Earth orbit and one to Jupiter that will be shown on the internet, as well. These include our country's last shuttle flight, the launch of a Chinese space station component, and launches by private space companies.

Vesta fiesta

This July, the *Dawn* spacecraft will begin exploring new worlds on Vesta, the first of its two planned destinations. Vesta, which is located in the main asteroid belt between Mars and Jupiter, is a rocky asteroid approximately 329 miles (530 km) in diameter and the third largest asteroid. *Dawn* will enter into orbit around Vesta during mid-July and begin the science phase of its mission during August. Join the mission to celebrate the arrival at Vesta by hosting or attending a Vesta Fiesta event with your club, society, school group, or museum. Visit the mission website (see Resources) for more information about ways to connect with *Dawn* mission scientists, opportunities for networking with a local observatory, materials for recruiting fiesta-goers, and great activities for the party itself.

Juno mission to Jupiter

We are heading back to Jupiter this summer with the planned launch of the *Juno* spacecraft in August. The *Juno*

FIGURE 1 Data table

Date	Moon phase	Object	Distance
June 5	Waxing crescent	M44: Open star cluster	5°
June 28	Waxing crescent	M45: Open star cluster	2°
July 25	Waxing crescent	M45: Open star cluster	2°
July 27	Waxing crescent	M1: Nebula	2°
July 27	Waxing crescent	M35: Open star cluster	9°
July 28	Waxing crescent	M35: Open star cluster	3°
August 22	Waxing crescent	M45: Open star cluster	5°
August 24	Waxing crescent	M35: Open star cluster	3°

FIGURE 2 Comparison of fields of view

spacecraft will take approximately five years to reach Jupiter and is scheduled to arrive during July of 2016. As a mission to the outer solar system, the *Juno* spacecraft is unique in that the spacecraft and instruments will be powered by solar panels rather than the usual power system involving radioisotope decay. At the distance Jupiter lies from the Sun, it receives 25 times less sunlight than we do on Earth, so the solar panels will need to be larger than those used on spacecraft nearer to the Sun. Each of the three solar panels is about 18 m (60 ft.) long, and the orbit around Jupiter is designed so that the solar panels will always be oriented toward the Sun.

Following arrival, the spacecraft will enter into an orbital path that includes at least 32 orbits around and through the Jupiter system lasting one Earth year. During the mission period, scientific instruments onboard will be used to observe and record information about Jupiter's magnetic field and auroras. Other instruments will probe the planet's interior to study the core and the composition of the atmosphere.

June

1	New Moon
	Partial solar eclipse
	Launch of Chinese space station module
3	Neptune begins retrograde motion
6	Launch of *Dragon C-3*
8	First quarter Moon
10	Moon near Saturn
12	Mercury at superior conjunction
14	Saturn ends retrograde motion
15	Full Moon
	Total lunar eclipse
19	Dwarf planet Ceres at opposition
20	*Cassini* flyby of Titan
21	June solstice (1:17 p.m. EDT)
	Launch of *Progress M-11M* to ISS
23	Last quarter Moon
26	Moon near Jupiter
28	Dwarf planet Pluto at opposition
	Moon near Mars
	Launch of *STS-135* to ISS

July

1	New Moon
	Partial solar eclipse
3	Saturn at east quadrature
4	Earth at aphelion (152,102,140 km or 91,405,032 miles)
8	First quarter Moon
10	Uranus begins retrograde motion
12	First complete orbit for Uranus since discovery
15	Full Moon
	Launch of Orbcomm satellite on *Dragon C-2*
16	*Dawn* arrives at asteroid Vesta
18	Happy birthday, John Glenn
20	Mercury at eastern elongation
22	Last quarter Moon
23	Moon near Jupiter
27	Moon very close to Mars
30	New Moon

Questions for students

1. What is meant by the term visible planet? *(A visible planet, in practical terms, is any planet that is above the horizon and may be seen with the naked eye.)*
2. The deep-sky objects listed in the table all have the letter M followed by a number. What is this about? *(These objects are collectively known as Messier objects and are part of a list compiled by French astronomer Charles Messier, who kept track of objects that appeared to be comets, but were not. See Resources to learn more about Messier and the objects.)*
3. Jupiter receives 1/25 the amount of light Earth does from the Sun. How is this determined? *(The decrease in radiation [in this case sunlight] as distance increases is determined by using the inverse square law. Jupiter is approximately 5 times farther from the Sun than Earth. Write this as a fraction, 5/1, inverse the numbers, 1/5, and then square it to get 1/25. Alternatively, Earth is 5 times closer to the Sun than Jupiter, so we receive 25 times more sunlight than Jupiter.)*

August

3	Moon near Saturn
5	Launch of Juno mission to Jupiter
6	First quarter Moon
12	Perseids meteor shower
13	Full Moon
20	Moon near Jupiter
21	Last quarter Moon
22	Neptune at opposition
25	Moon near Mars
28	New Moon
30	Launch of *Progress M-012M* to ISS
31	Moon near Saturn

Visible planets

Mercury will become visible as an evening planet during the last week of July and will remain over the western horizon through most of August.

Venus will be visible as a morning planet during the first half of June and then will be on the opposite side of the Sun and not visible until early this autumn.

Mars will be visible as a morning planet high over the eastern horizon this summer.

Jupiter will rise around midnight and will be visible over the southern horizon at sunrise.

Saturn will be visible as an evening planet over the western horizon at sunset this summer. ■

Resources

Cassini at Saturn—http://saturn.jpl.nasa.gov

Charles Messier—http://seds.org/messier/xtra/history/biograph.html

Dawn Mission—http://dawn.jpl.nasa.gov

Dragon C-3 launch—www.spacex.com/dragon.php

ISS sightings—http://spaceflight.nasa.gov/realdata/sightings

Juno Mission—www.nasa.gov/mission_pages/juno

Messier objects—http://seds.org/messier

Moon phases and other observing information—http://currentsky.com

Partial solar eclipse (July 1)—http://eclipse.gsfc.nasa.gov/SEplot/SEplot2001/SE2011Jul01P.GIF

Partial solar eclipse (June 1)—http://eclipse.gsfc.nasa.gov/SEplot/SEplot2001/SE2011Jun01P.GIF

Perseids meteor shower—http://meteorshowersonline.com/perseids

Riddle, B. 2010. Bird watching. Science Scope 33 (9): 86–88.

Total lunar eclipse—http://sunearth.gsfc.nasa.gov/eclipse/LEplot/LEplot2001/LE2011Jun15T.pdf

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