

Summer skies

by Bob Riddle

This summer the planet parade shifts to the morning skies as most of the visible planets are arranged over the southeastern to southwestern horizons before the Sun rises. And only one planet, Saturn, graces the evening skies. All, with the exception of Mercury and Venus, will stay essentially in the same part of the sky throughout our summer months. Mercury and Venus, as the fastest-orbiting planets, will show a noticeable change in position during the coming three-month period.

Mercury will start the summer as a morning planet, moving out away from the Sun toward the west and western elongation on June 13. At this elongation, Mercury will be approximately 23° from the Sun, but this will not be a particularly favorable apparition due to the angle at which it rises. Mercury, however, does make an interesting loop around the stars of the Hyades, the open cluster of stars marking the face of Taurus the Bull, as it moves through elongation. If this “loop” is observed, you will notice that each day at the same time the Hyades will be slightly higher above the horizon, rising earlier each day. At the same time, Mercury will be moving east, away from the Hyades after elongation and getting lower each day. Mercury will move behind the Sun and reach superior conjunction by the middle of July, and will reappear as an evening planet on the east side of the Sun during August.

Venus will be hard to miss, as it outshines everything but the Moon and the International Space Station (ISS) in the predawn skies. At the beginning of June, Venus will shine brightly among the dim stars of Pisces. Located just to the east (left) is the much dimmer planet Mars. Venus, like Mercury, will reach western elongation during June, and will then start moving east back toward the Sun. The slower-moving Mars will quickly be left behind. The path that Venus will follow over the next few months closely mirrors that taken by Mercury. By the end of June, and into early July, Venus will be moving between the stars of the two open clusters of Taurus, the Pleiades and the Hyades. A nice binocular treat awaits us on August 31 as Venus passes very close to the smaller-appearing open



International Space Station on August 20, 2001

NASA

star cluster known as the Beehive, in Cancer the Crab.

The other morning planets, Mars and Jupiter, will remain visible throughout our summer months, but only during the very early hours. Mars will be steadily moving eastward and slowly gaining in brightness as it traverses the stars of Taurus the Bull, passing by the same two open star clusters, Venus and Mercury, passed earlier during the summer. Toward the end of July, Mars will be passing by the reddish giant star Aldebaran in Taurus, providing an opportunity to compare the colors. By the end of August, Mars will be passing across the feet of the Gemini Twins and the much smaller and compact open star cluster known as M35. This should make a striking visual when viewed through binoculars on August 28 or 29.

The largest planet, Jupiter, will rise at around 1:00 a.m. local time at the beginning of June and by the end of August, Jupiter will rise around sunset local time. On June 15, Jupiter will begin retrograde motion and will be moving slowly westward across the dim stars of Aquarius. On July 13, Jupiter will be within about one-half degree from the planet Neptune. Although Neptune will be too dim to be visible with binoculars, it may be seen with small telescopes as a pale, bluish-green dot. On August 14, Jupiter will reach opposition and will be visible all night.

A ringed-world tour

Saturn will remain as an evening planet, visible over the western horizon throughout the summer months. However, as the months pass and the viewing angle toward Saturn slowly changes, this ringed planet will set earlier each

evening. During June, Saturn will set around midnight local time. By August, Saturn will be setting close to the time of sunset and will be more difficult to view. This year is not the most exciting year for viewing Saturn's spectacular ring system. In fact, this year is similar to one of the years during which Galileo observed the planet with the newly invented telescope, and what we see is essentially what Galileo saw and found confusing. What caused the confusion was that when Galileo first observed the rings, he described them as lobes, or ears, on either side of the planet's disk. Later, he observed that the lobes were no longer seen. Galileo happened to view Saturn during the time when the ring system becomes edge-on toward the Earth. This is a regular 15-year cycle during which we alternate seeing the top and bottom of the rings. At approximately the midway point, we barely see the rings, as they appear edge-on (see Figures 1 and 2).

This summer will also be a busy month for the *Cassini* spacecraft, as it will continue its exploration of the Saturnian system of 61 known moons and rings. During each of the three summer months, *Cassini* will have two close flybys of the moon Titan, with each flyby having the spacecraft coming within 600 miles of Titan's cloud tops. *Cassini* will cross the ring-system plane 12 times during this time period as it travels in an orbit that takes the spacecraft in a polar trajectory traveling north past the ring plane and then looping south. While *Cassini* is doing this, it will also have flybys of several other moons, including Dione, Prometheus, Pandora, Tethys, Janus, Atlas, Pallene, and Telesto. Visit the *Cassini* mission

website (see Resources) for a more detailed schedule of *Cassini's* encounters.

Seeing the International Space Station

Now that the ISS has all of the solar panels installed, it will reflect sunlight to the extent that it will outshine everything at night except the Moon—even brilliant Venus. To get an idea of how bright the ISS will appear, look at Venus one morning this summer. Then picture an object brighter than that, but appearing smaller, moving from west to east across the sky in a matter of minutes. For how and where to observe the ISS, use the NASA website created just for this purpose (see "ISS Sightings" link in Resources). It is a simple matter of selecting your viewing location and having the website generate a list of dates and times and other viewing information for when the ISS can be seen from that location.

Visible planets

Mercury will be a morning planet during June, will move to the other side of the Sun, and will be visible as an evening planet during August.

Venus will stay visible as a morning planet over the eastern horizon, rising ahead of the Sun.

Mars will rise a few hours before the Sun and will be visible over the southeastern horizon before the Sun rises.

Jupiter will be visible over the southern to southwestern horizon before sunrise.

Saturn will be visible over the southwestern horizon at sunset.

FIGURE 1 Saturn's rings edge-on, August 2009

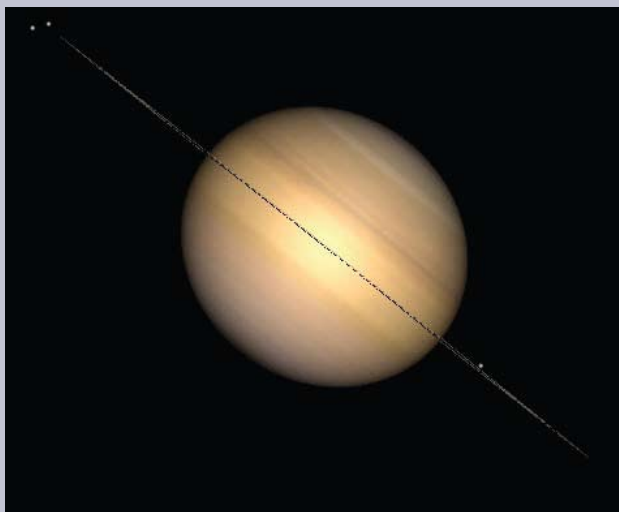


FIGURE 2 Tops of Saturn's rings, 2016



June

- 5 Venus at western elongation (46°)
- 6 *Cassini* flyby of Titan
- 7 Full Moon
- 10 Moon at apogee (405,786 km)
- 13 Mercury at western elongation (23.5°)
- Moon near Jupiter
- Venus at aphelion
- Last quarter Moon
- 19 Moon near Mars and Venus
- 21 June solstice
- Moon near Mercury
- 22 New Moon
- Cassini* flyby of Titan
- 23 Moon at perigee (358,018 km)
- Pluto at opposition
- 29 First quarter Moon

July

- 4 Earth at aphelion (1.017 AU)
- 7 Full Moon
- Penumbral lunar eclipse
- Moon at apogee (406,233 km)
- 8 *Cassini* flyby of Titan
- 10 Moon near Jupiter
- 14 Mercury at superior conjunction
- 15 Last quarter Moon
- 18 Moon near Mars
- 19 Moon near Venus
- 21 Moon at perigee (357,465 km)
- 22 New Moon
- Total solar eclipse
- 24 *Cassini* flyby of Titan
- 25 Moon near Saturn
- 28 First quarter Moon

August

- 4 Moon at apogee (406,027 km)
- 6 Penumbral lunar eclipse
- Full Moon
- Moon near Jupiter
- 9 *Cassini* flyby of Titan
- 12 Perseid meteor shower
- 13 Last quarter
- 14 Jupiter at opposition
- 16 Moon near Mars
- 17 Neptune at opposition
- Moon near Venus
- 19 Moon at perigee (359,642 km)
- 20 New Moon
- 22 Moon near Mercury and Saturn

Questions for students

1. During July at new Moon, we will experience one of this century's longest solar eclipses. Why do we not have an eclipse at every new Moon? (*The Moon's orbital path is inclined by nearly 6° to the Earth's orbit, so not every new Moon is aligned with the Earth and Sun.*)
2. Two weeks after the solar eclipse, at full Moon, there will be a lunar eclipse. As the Moon moves into the Earth's shadow, which direction is the Moon moving? (*The Moon will have two motions during the lunar eclipse, one real and the other apparent. As the Earth rotates toward the east, the eclipsed Moon will be moving toward the west. At the same time, the Moon will be moving eastward as it orbits the Earth.*)
3. What would an observer standing on the surface of our Moon facing Earth see during a total lunar eclipse? During a total solar eclipse? (*From the side of the Moon facing the Earth, an observer would see the Earth completely block the Sun from view during a lunar eclipse. During a solar eclipse, the observer would see a dark spot, the Moon's shadow, moving across the Earth.*)

- 24 Mercury at eastern elongation (26.4°)
- 25 *Cassini* flyby of Titan
- 27 First quarter Moon
- Cassini* flyby of Telesto
- 31 Moon at apogee (405,269 km)

Resources

- Cassini Mission—<http://saturn.jpl.nasa.gov>
- International Year of Astronomy—www.astronomy2009.org
- ISS sightings—www.jsc.nasa.gov/sightings
- Lunar eclipse—<http://eclipse.gsfc.nasa.gov/LEplot/LEplot2001/LE2009Jul07N.pdf>
- Lunar eclipse—<http://eclipse.gsfc.nasa.gov/LEplot/LEplot2001/LE2009Aug06N.pdf>
- Perseid meteor shower—<http://meteorshowersonline.com/perseids.html>
- SFA star chart—<http://midnightkite.com/starcharts.html>
- Solar eclipse—<http://sunearth.gsfc.nasa.gov/eclipse/SEplot/SEplot2001/SE2009Jul22T.GIF>

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