Flipped constellations

BY BOB RIDDLE

Many people may not realize that the term *constellation* refers to a particular region of the starry sky around the Earth and not just to a pattern of stars found in that region. These regions are, however, identified by the recognizable pattern of stars that are often named after figures from Greek mythology. Other patterns, known as *asterisms*, can also be found within a single constellation, such as the Big Dipper. Other asterisms, such as the Summer Triangle, may be made up of stars from a different constellation. The Summer Triangle, for example, is made up of Altair in Aquila the Eagle constellation, Deneb in Cygnus the Swan, and Vega in Lyra the Harp.

One thing that both types of patterns have in common is that they typically are made up of the

FIGURE 1: The Winter Hexagon asterism

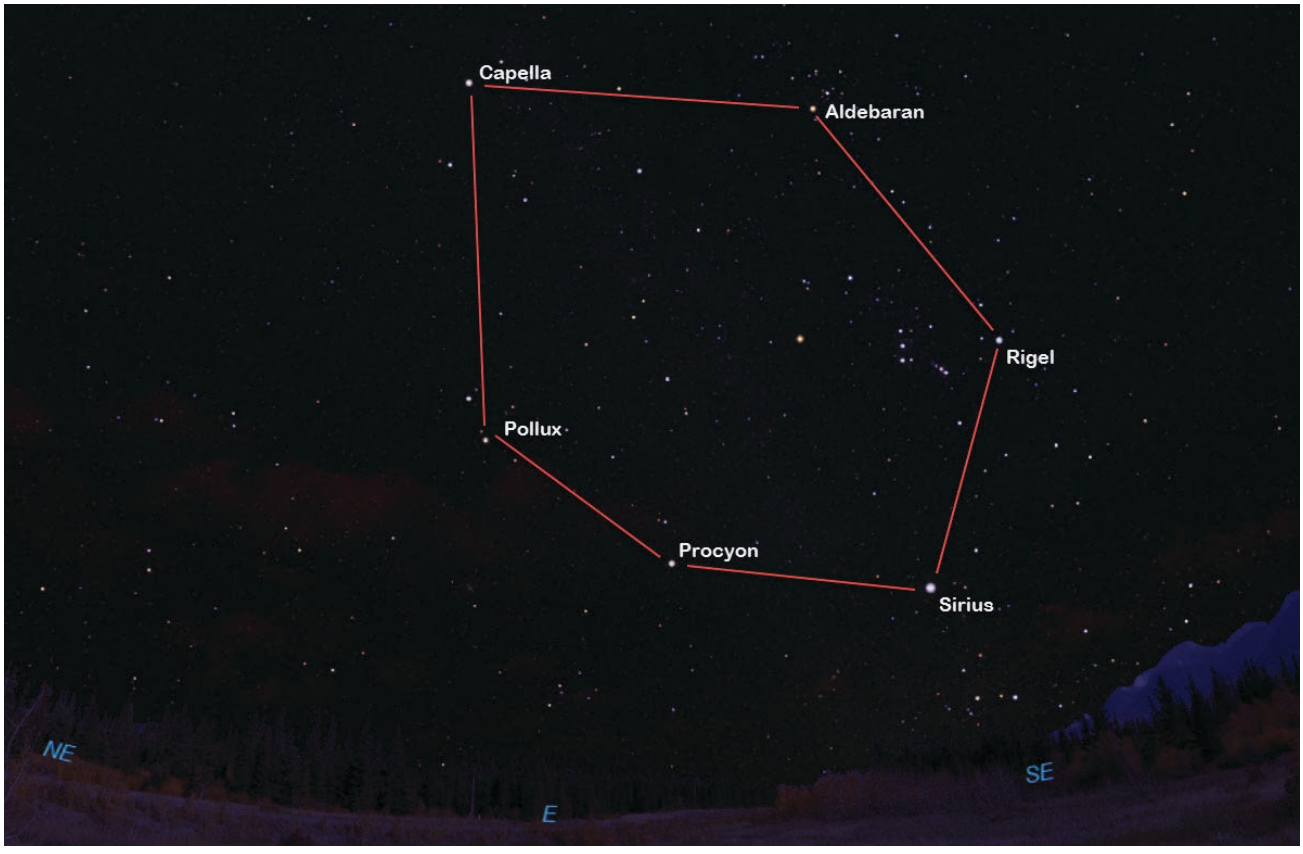


FIGURE 2: Members of the Winter Hexagon

Constellation	Star
Orion	Rigel
Taurus	Aldebaran
Auriga	Capella
Gemini	Pollux
Canis Minor	Procyon
Canis Major	Sirius

brightest stars in our sky. Consequently, when attempting to locate a constellation in the night sky using a smartphone app (see Resources), sky map, or other means, you should focus on locating the brightest stars in the sky instead of trying to visualize a horse, lion, or other imagined shape.

Wintertime in the northern hemisphere is a good time to learn about constellations because some are visible during the early evening hours. During the winter evenings, go outside to a shadowy area where most of the light sources are blocked. Wait a few minutes to allow your eyes to adapt to the darkness. Face toward the southern horizon and look about halfway up to see the center of a group of six constellations, each of which provides a bright star to make up the asterism known as The Winter Hexagon (see Figures 1 and 2).

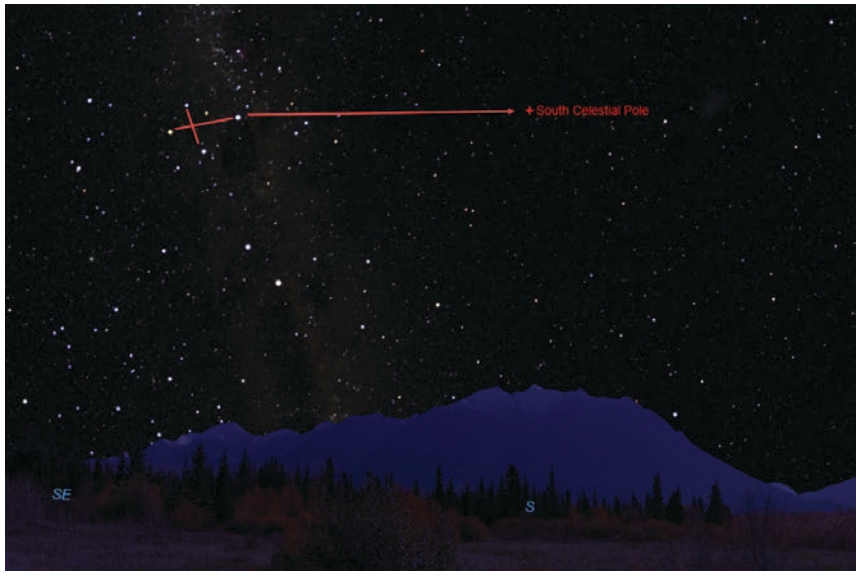
When learning and observing constellations, it's a good idea to use a star map, such as Evening Sky Map from the Skymaps website (see Resources). Allow time for students to become familiar with the January star map, in terms of the dates and times of the map that best represent the sky and the relative locations of bright stars with the horizon and the center of the map. Encourage students to use the map at home to see how the map matches the night sky and to locate the Winter Hexagon and other bright stars.

Switching perspectives

Ask students what the evening skies of January would look like from their home using the same degrees of latitude, but set to south latitude rather than north latitude. Download the southern hemisphere version of the January star map so they can compare the two maps. Students should be able to point out the changes in position

FIGURE 3: A local horizon

FIGURE 4: Locating the South Celestial Pole with the Southern Cross



of the stars above the horizon.

The stars over the southern horizon are higher on the southern hemisphere star map, whereas stars over the northern horizon are lower or no longer visible. We see Orion, for example, facing us with his feet toward the horizon. Near his left foot is the dim star Lambda Eridani, which is at the northern end of Eridanus the River, a long constellation that meanders south of the equator. At the mouth of the celestial river is the bright star Achernar. As northern latitude decreases toward the equator, Orion gets higher in the sky. At the equator, Orion's belt is directly overhead. (Download the January star map for the equator to see Orion directly overhead.) When continuing south, Orion's stars start to get lower over the northern horizon. When stopping at the mid-southern latitude of 43° South, Orion is now seen as upside down over the northern horizon.

The southern hemisphere star map reveals that the night skies south of the equator show some of the constellations visible from north of the equator. But they are oriented differently relative to the horizon; many constellations are upside down from the perspective of the northern hemisphere. Until European explorers sailed to southern latitudes, constellations in the southern hemisphere were unknown or at least unnamed by Europeans. The names (e.g., Telescope, Microscope, Sextant) for these constellations reflected the time period instead of names from Greek or Roman mythologies.

Students can use the southern hemisphere constellations website (see Resources) to learn more about the stars and constellations of that part of the celestial sphere. From the southern latitudes of Argentina, for example, there is no North Star, simply because Polaris is below the northern horizon from any latitude south of the equator. There is instead what is known as the SCP, or South Celestial Pole, which may be found by using the stars of Crux, known as the Southern Cross. The SCP is approximately 26° South from Acrux, the bottom star in the cross shape, but there is no visible star there (see Figure 4). During January, the Southern Cross will rise around midnight and follow an apparent circular path around the SCP, known as *circumpolar motion*, which refers to any star that always follows an apparent circular path around the celestial pole. To locate the SCP, observe the sky every couple of hours or, more practically, set up a camera either for a long-time exposure to get "star trails," or to make

January

1 Waxing crescent Moon near Venus
Moon at descending node

2 Waxing crescent Moon near Mars
Quadrantid shower peak

4 Earth at perihelion

5 First quarter Moon

8 Waxing gibbous Moon near the Hyades

9 Mercury near Saturn
Waxing gibbous Moon near Aldebaran

10 Moon at perigee: 363,200 km (225,682 mi.)

11 Moon at northernmost declination: 19° N

12 Full Moon
Venus at east elongation: 47° E

15 Waning gibbous Moon near Regulus
Moon at ascending node

17 *Cassini* distant flyby of Titan

19 Waning gibbous Moon near Jupiter
Mercury at west elongation: 24° W
Last quarter Moon

21 Moon at apogee: 404,900 km (251,593 mi.)

24 Waning crescent Moon near Saturn

25 Moon at southernmost declination: 19° S

26 Waning crescent Moon near Mercury

27 New Moon

29 Moon at descending node

31 Jupiter near Spica
Moon near Venus and Mars

a time-lapse video.

To see star trails, aim the camera toward the North Star and set it for a long exposure for several minutes. The resulting image should show streaks of light curving around the North Star. Another way to see star trails requires the use of software to stack or merge all of the images taken during a time lapse into one image (See "Circumpolar Motion" in Resources). ●

RESOURCES

Cassini Saturn mission—*http://saturn.jpl.nasa.gov*
Dates of Earth's seasons—*http://aa.usno.navy.mil/data/docs/EarthSeasons.php*
Quadrantids meteor shower—*http://meteorshowersonline.com/quadrantids.html*
Circumpolar Motion—*www.bobs-spaces.net/2015/06/04/circumpolar-motion*
Skymaps—*www.skymaps.com/downloads.html*
South America—*http://1drv.ms/f/s!AhTmMEOSAmy6g4gHEC8ISjJ4p4C4EA*
Southern Hemisphere Constellations—*www.windows2universe.org/the_universe/Constellations/south_constellations.html*
Universe Discovery Guide: January—*http://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=537*

Free smartphone apps

Mobile sky map—*http://sites.google.com/site/pyopyostudioapp* (Android, Apple , and a virtual reality version)
Ready, Jet, Go—*www.pbskids.org/apps/ready-jet-go-space-explorer.html* (Android, Apple, and some tablets)
Sky Map—*http://play.google.com/store/apps/details?id=com.google.android.stardroid&hl=en* (Android Only)

Visible planets

Mercury will rise about 1–2 hours before sunrise and will be visible over the eastern horizon.

Venus will be visible over the western horizon at sunset and will set about four hours after sunset.

Mars will be visible over the western horizon at sunset and will set about five hours after sunset.

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

Saturn will rise 3–4 hours before sunrise and will be visible over the eastern horizon.

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For students

1. Where is the horizon? *It is sometimes described as "where the sky meets the ground," a good visual for those living in or familiar with the geography and "long distance" views of the Great Plains. Actually, the horizon is measured as 90° from the zenith, or straight overhead, regardless of the compass direction faced or what is along the horizon.*
2. What is meant by "your local horizon"? *This is a horizon whose distance from the zenith varies based on human-made or natural objects along the horizon* [see Figure 3].
3. Apparent sky motions: In the southern hemisphere, stars rise and set in which direction? Which direction is circumpolar motion in the southern hemisphere? *The Earth always rotates from west to east, so despite being south of the equator, stars will still rise in the east and set in the west. Circumpolar motion in the southern hemisphere is around the South Celestial Pole and is in the opposite direction from the northern hemisphere. It is an apparent clockwise motion in the southern hemisphere.*
4. Download the January Universe Discovery Guide [see Resources] for some engaging activities about Betelgeuse, the red giant star in Orion, also known as "Beetle Juice."