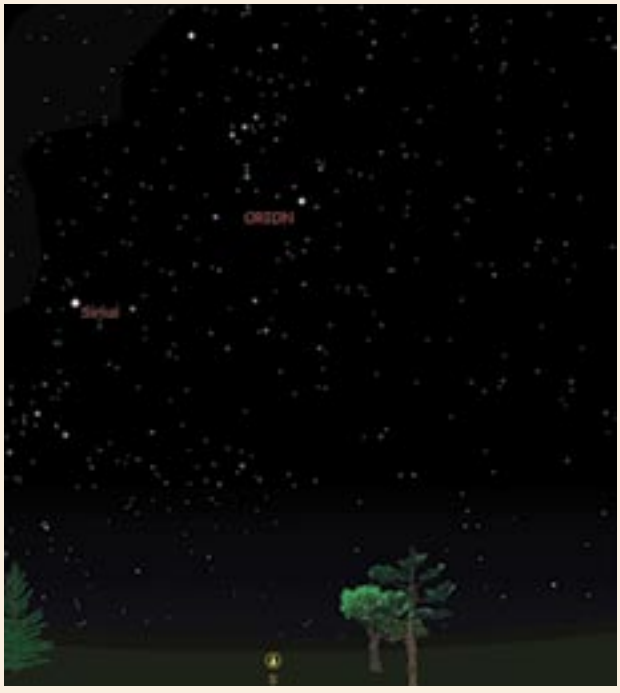
Follow the Drinking Gourd

February is the month we traditionally acknowledge Americans of African origin, and the plight of their ancestors held as slaves during the early years of our country. During the years leading up to and around the American Civil War, slaves very often made their way north to freedom by taking advantage of the Underground Railroad, a system of people and locations that were safe havens or safe routes for the escaping slaves to follow. Much of the travel was done at night and as was common in those days, people used their knowledge of the stars to help determine compass directions. Primarily used were the stars of the two dipper-shaped patterns known as the Big Dipper and the Little Dipper. These easily recognizable star patterns, or *asterisms*, are parts of the constellations Ursa Major, the Great Bear, and Ursa Minor, the Little Bear. The Big Dipper asterism was also known to many as the Drinking Gourd due to its resemblance to a common gourd that, when dried out, was used as a drinking vessel.

FIGURE 1 **February 15, 2006, at 8 p.m., looking south**



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Seasonal motion vs. circumpolar motion

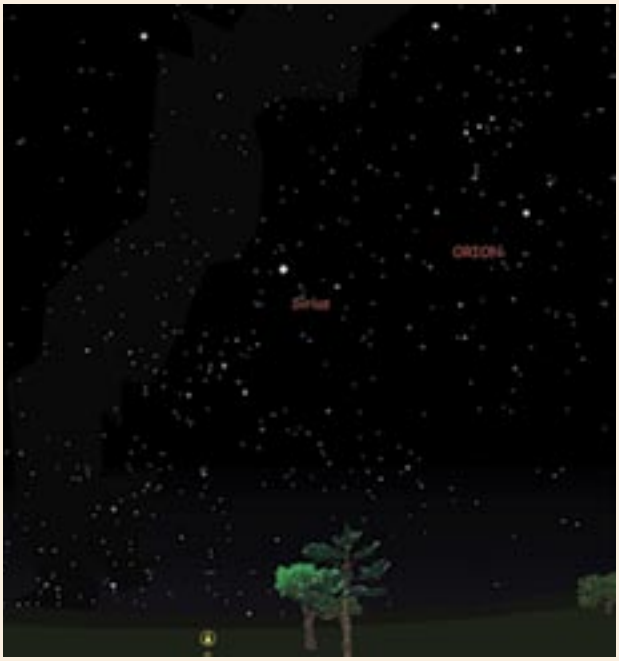
Using a readily available rotating planisphere or the Big Dipper Star Clock pattern (see Resources), students can explore the changing position of these stars due to the rotation and revolution of the Earth. Additionally, students can see how circumpolar stars can also be used as a sky clock for approximating the local time due to the regular rate that the Earth rotates.

Stars that we see at night may be classified into two groups based on their visibility. Stars that rise in the east and set in the west and are highest over the southern horizon (for the Northern Hemisphere) may be referred to as *seasonal stars*. As the Earth revolves around the Sun, these stars and their associated constellation patterns rise earlier each night by approximately four minutes, or by about two hours each month. What we will see as winter stars in the evening this month, for example, will be seen farther toward the west at the same time next month, and so on (Figures 1 and 2). To see these changes, have students go outside around 7:30 p.m., midmonth (February), and observe where the stars of Orion are located. Have students repeat this observation next month at the same time and they will see that Orion is farther west; as they think about the seasonal changes, students will realize that Orion was at the same place it was during February, but 1–2 hours earlier than during March. This can also be modeled using the planisphere (see Resources).

The other group of stars classified by visibility is referred to as *circumpolar stars*. These stars and their associated constellation patterns never rise or set relative to the horizon, but are visible all night long. They follow a circular pattern around a point in the sky known as the celestial pole. In the Northern Hemisphere the north celestial pole is marked by the star we call the North Star, or Polaris. It is the end star in the handle of the Little Dipper, and is very close to being directly over the Earth's North Pole. As the Earth rotates about its axis of rotation, the circumpolar stars appear to follow a circular motion around Polaris, neither rising nor setting.

Circumpolar stars may also be thought of as seasonal stars in that they will have a certain position over the Northern Hemisphere each season. However, since their apparent motion carries them around the pole star throughout the night it is more practical to consider these changing seasonal positions by using a particular time as a reference. With that in mind, during the evening hours, after sunset, for example, the seasonal position of the stars making up the Big Dipper

FIGURE 2 **March 15, 2006, at 8 p.m., looking south**



pattern may be described with reference to hours on a clock. During the winter months the Big Dipper is located at about the three o'clock position; during spring it is high overhead, near the twelve o'clock position; during the summer months the Big Dipper is near the nine o'clock position; and during the autumn the Big Dipper is low over the horizon, near the six o'clock position.

Moon phases

	February
First quarter	2/5
Full Moon	2/12
Last quarter	2/21
New Moon	2/27

Visible planets

Mercury will be at its best evening apparition for the year—visible over the western horizon at sunset.

Venus will rise about 2–3 hours before the Sun and will be visible over the east–southeastern horizon.

Mars will be visible over the southwestern horizon after sunset.

Tracking the planets

Throughout the school year, data will be provided through this column for students to track the annual motion of the planets by plotting their position on either graph paper or a star chart using celestial coordinates. (See Resources for a free star chart source.)

Planet	2/5	2/19	2/26
Mercury			
Right ascension	$21^h42^m48^s$	$23^h11^m38^s$	$23^h39^m01^s$
Declination	–15°40′56″	–5°01′55″	–0°16′38″
Distance	1.34026	1.07602	0.88269
Venus			
Right ascension	$19^h06^m18^s$	$19^h24^m37^s$	$19^h42^m21^s$
Declination	–15°33′06″	–16°11′03″	–16°18′41″
Distance	0.33475	0.42160	0.47100
Mars			
Right ascension	$3^h23^m58^s$	$3^h51^m51^s$	$4^h06^m52^s$
Declination	20°28′14″	22°01′29″	22°43′40″
Distance	1.10160	1.24076	1.31083
Jupiter			
Right ascension	$15^h02^m20^s$	$15^h05^m55^s$	$15^h06^m51^s$
Declination	–15°59′03″	–16°11′27″	–16°13′59″
Distance	5.37173	5.14537	5.03533
Saturn			
Right ascension	$8^h39^m47^s$	$8^h35^m25^s$	$8^h33^m29^s$
Declination	19°06′53″	19°24′11″	19°31′38″
Distance	8.13525	8.20118	8.25550
Uranus			
Right ascension	$22^h44^m48^s$	$22^h47^m43^s$	$22^h49^m12^s$
Declination	–8°45′08″	–8°27′25″	–8°18′18″
Distance	20.97915	21.05096	21.06664
Neptune			
Right ascension	$21^h18^m59^s$	$21^h21^m05^s$	$21^h22^m06^s$
Declination	–15°49′28″	–15°39′56″	–15°35′16″
Distance	31.04310	31.02172	30.99015
Pluto			
Right ascension	$17^h43^m35^s$	$17^h44^m57^s$	$17^h45^m30^s$
Declination	–15°54′15″	–15°53′19″	–15°52′37″
Distance	1.68732	31.49414	31.38734

Jupiter will rise around midnight and will be visible over the southeastern horizon at sunrise.
Saturn will rise before sunset and will be visible over the southeastern horizon after sunset.

Resources

Winter, J. 1992. *Follow the drinking gourd.* New York: Dragonfly Books.
Follow the drinking gourd (mp3 or wav file)—*www.nasaexplores.com/extras/constellations/follow_the_drinking_gourd_07-03-03.html*
Online star clock—*www.lhs.berkeley.edu/starclock*
Planisphere—*www.lhs.berkeley.edu/starclock/skywheel.html*
SFA star charts—*observe.phy.sfasu.edu*
Star clock—*www.lhs.berkeley.edu/starclock/starclockprintout.html*

Questions for students

1. Toward which direction does the Earth rotate? (*The Earth rotates from west to east, or toward the east.*)

2. When facing toward the north horizon, in the Northern Hemisphere, do circumpolar stars appear to move clockwise or counterclockwise? (*Circumpolar stars appear to move in a counterclockwise direction in the Northern Hemisphere.*)

3. When facing toward the south horizon, in the Northern Hemisphere, do seasonal stars appear to move clockwise or counterclockwise as a result of either rotation or revolution? (*Seasonal stars appear to move westward, or clockwise, as the Earth rotates, and also as the Earth revolves around the Sun.*)

4. If a constellation is seen over the southern horizon during February will it be farther west or east at the same time of day one month later? (*At the same time of day, one month later, the constellation will be farther west.*)

5. Use the planisphere to see which seasonal constellation will be over the southern horizon during the evening on your birthday. (*Answers will vary.*)