Summer skies

In its path around the Sun, the Earth follows an elliptically shaped orbit. On July 5, 2004, the Earth reaches *aphelion*, its maximum distance from the Sun, and is approximately 1.0166933 AU from the Sun. An AU (Astronomical Unit) is equal to the average distance between the Earth and Sun, approximately 149,597,870 km (92,955,807 miles). About six months later, on January 2, 2005, this distance will shrink to approximately 0.9832968 AU when Earth reaches *perihelion*, its minimum distance from the Sun.

Celestial events

Blue Moon—During July the Moon will reach full phase twice, first on July 2 and again on July 31. The second full Moon of a month is commonly referred to as the "blue moon." The use of the term has debatable origins, but infrequent or rare events are said to happen "once in a blue moon."

The *Perseids meteor shower* will reach its peak, maximum meteors per hour, after midnight on August 11 and before sunrise the following morning. Moonlight will not interfere with this year's viewing during the nights of maximum meteor activity (July 17–August 24). As with all meteor showers, the number of meteors per hour increases during the days before the peak date, and then tapers off following the peak date. The source of the meteors in this shower is the Swift-Tuttle comet, a periodic comet discovered in 1862 with an orbital period around the Sun of approximately 120 years. This year there may be a higher number of meteors per hour than normal, as the Earth will pass close to the debris trail left behind from the comet's 1862 passage.

A meteor shower gets its name from the constellation in the sky from which the meteors appear to radiate—the Perseids meteors radiate from the constellation Perseus. To view the meteors, face northeast a couple of hours before sunrise and look about 45 degrees from the horizon. During its peak, the shower may reach a zenith hourly rate (zrh) of 100, which means that more than 100 meteors per hour may be visible under dark sky conditions. The Perseids appear faster than meteors in other showers because they are entering the Earth's atmosphere head-on. In other words, your location on Earth is rotating into the oncoming field of meteors.

On the morning of the peak, August 12, Perseids observers will also see the very thin waning crescent Moon to the left of the brightly shining Venus, and lower, closer to the horizon, the planet Saturn near the feet of the Gemini Twins.

A tail of two comets

During the first few hours following sunset during June, two comets, faint but still displaying a tail, may be seen under dark sky conditions. Look for Comet LINEAR (C/2002 T7) to be low over the western horizon until around the middle of June, and Comet NEAT (C/2001 Q4) higher and farther northwest near the bowl stars of the Big Dipper.

Visible planets—July and August

Evening planet viewing during the summer will be limited to the inner planet Mercury and the largest planet Jupiter during most of July and the first part of August. Jupiter will be over the southwestern horizon during this period near the stars marking the hindquarters of Leo the Lion, and will set 1–2 hours after the Sun. By mid-July Mercury becomes visible, albeit low over the western horizon, rising higher and setting later each evening as it moves out from behind the Sun and superior conjunction. Mercury and Jupiter will still be over the western horizon during the first week of August but are quickly lost to the Sun's glare.

During the last week of July the second largest planet, Saturn, starts becoming visible low over the eastern horizon about an hour before sunrise. Saturn will gradually become more visible rising earlier and farther west, ahead of the Sun, in the months to come. The other inner planet, Venus, has dominated the pre-dawn skies all summer, shining very brightly over the southeast horizon a few hours before sunrise. However, by the end of August Venus will be rising later, and thus will not be as high over the horizon at sunrise. During July and August, Venus will draw closer to Saturn and will pass within less than 2 degrees from Saturn on August 31.

Internet resources

Saturn Observation Campaign (information about an educational outreach program that is part of the Cassini Mission to Saturn)—*soc.jpl.nasa.gov/index.cfm*

Cassini/Huygens Mission to Saturn (multinational mission to explore Saturn, its ring system, and many of its moons.)—*saturn.jpl.nasa.gov/index.cfm*

Perseid Meteor Shower History—*comets.amsmeteors.org/meteors/showers/perseidhistory.html*

Sun Shadow Investigation Project (invites students to particpate in a data-sharing project)—*sunship.currentsky.com*

Once in a Blue Moon (defines this infrequent occurrence)—*www.obliquity.com/astro/bluemoon.html*

Critical thinking for students

Many students (and adults) have the mistaken idea that it is hotter in the summer because we are closer to the Sun. Survey your students to see what they think is the month of our closest approach to the Sun. Do not give them the answer, but ask them to do some research. Discuss the findings and relate the temperature/season in each hemisphere to the angle of the Sun's rays and not the distance between us and the Sun.

1. What is aphelion? When does it occur? What season is that in our hemisphere? What season is it in the Southern Hemisphere? (You could have students dissect the word to determine its meaning and orgin {Gr. *apo* from + *heilos* sun)
2. What is the opposite of aphelion? When does it occur? What season are we having then?
3. The average distance between the Earth and the Sun is called one Astronomical Unit or AU. How many kilometers is that? How many miles is that?
4. The Earth is 1.0166933 AU from the Sun at aphelion. How many kilometers is that?
5. The Earth is 0.9832968 AU from the Sun at perihelion. How many kilometers is that?
6. What is the difference in the distances at perihelion and aphelion?
7. If it is not distance that causes our seasonal temperature ranges, what is it? Draw a diagram to illustrate this.

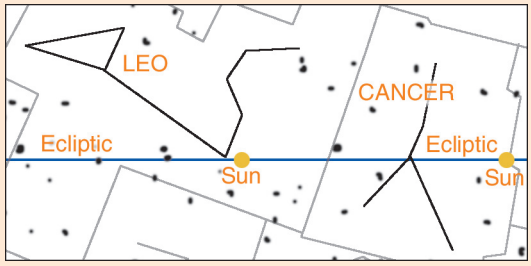
Blue Moon

You often hear people refer to rare events as happening "once in a blue moon." July has a blue moon. What is a blue moon and how is it connected to the usage of the phrase?

Perseid meteor shower

1. What is a meteor?
2. What is implied by the term "meteor shower"?
3. How are meteor showers named?
4. August has the Perseids meteor shower. Why is it named this? Be specific.

Tracking the Sun



Throughout the school year, information and data will be provided through this column so that students can indirectly follow the Earth along the ecliptic, its orbital path around the Sun. From our perspective, it is the Sun that is "moving," so students will actually be graphing the Sun's apparent motion caused by the Earth's real orbital and rotational motions. In this column, we will provide graph-ready data that will include the celestial coordinate position of the Sun and midday altitude of the mid-month Sun, its distance from the Earth, and the Sun's apparent size.

In addition to graphing the data provided, students may follow and plot the Sun's location along the ecliptic each month using the free SFA Star Charts available at *www.cox-internet.com/ast305/SFAStarCharts.html.* Or, with the use of a shadow stick, students could measure the Sun's altitude, its angle above the horizon, at midday. In the September column, I will explain how students can join in with a global collaboration to calculate the polar circumference of the Earth.

July and August 2004

During July, the Sun's apparent motion along the ecliptic takes it from the Gemini Twins to Cancer the Crab, as it crosses the boundary into Cancer on July 20. By August 20, the Sun will have crossed into the boundaries of Leo the Lion.

On these dates at midday EDT

Date	Time	Distance (in AU)	Altitude	Apparent size	Right ascension	Declination
7/20	13:13	1.0161779	71° 36'	31'	8h 1.6m	20° 30'
8/20	13:11	1.0118207	63° 15'	32'	10h 0.5m	12° 11'