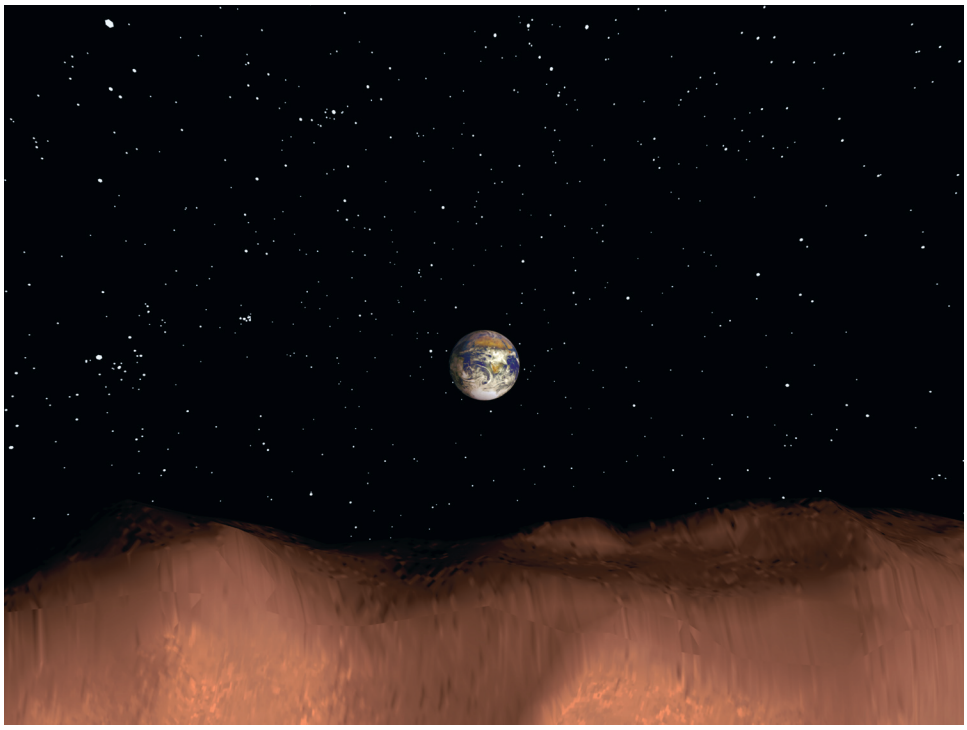
September in the skies



Computer generated view of earth as seen from the asteroid Toutatis

This school year begins with no planets visible in the evenings, and it will remain this way until November when Mercury returns to the evening skies. For a period of several days, starting on September 8, you can follow the waning crescent Moon in the early morning as it passes Saturn, Venus, the bright star Regulus, and Mercury. On the morning of September 10, the separation between Mercury and Regulus will be less than the diameter of a full Moon. If you look through binoculars or a telescope, Mercury and Venus will appear to be the shape of our waning Moon. All three will display their respective phases for the same reason—the arrangement of the Earth, the Sun, and the planet or moon. Interestingly, it was a similar observation of the phase changes Venus goes through that gave Galileo reason to question the *geocentric*, or Earth-centered, model of the universe.

While it may not be convenient to see planets at the beginning of the school year, there are certainly plenty of other celestial thrills to make up for it. For example, on September 29, the strangely shaped asteroid Toutatis (Earth Crossing Asteroid 4179) will tumble past the Earth, coming within about 1,609,344 kilometers of our planet. This is a dumbbell-shaped asteroid that is about 2.4 kilometers wide and 4.8 kilometers long and has a four-year orbital period around the Sun. As the name suggests, it also crosses the orbital path of the Earth. As an Earth crossing asteroid, Toutatis is considered to be one of several asteroids listed as a "PHA," or a *Potentially Hazardous Asteroid*.

Solar system exploration

Not to be eclipsed by celestial events, there are a lot of activities taking place this month related to the exploration of our solar system. The *Genesis* spacecraft is now on its way home. On September 8, a package will be dropped into our atmosphere that contains solar wind material ejected from the Sun that was captured during a 680-day period while the spacecraft was in orbit at the Lagrange Point 1. The "L1" point is a location between the Earth and the Sun where the gravitational attraction between the two is balanced. The plan is to catch the package in midair over Utah using a helicopter equipped with a special hook. The mission's purpose was to "collect samples of the solar wind, material flowing outward from the Sun, and return these samples to Earth. Scientists will be able to compare the compositions of these samples with known compositions of the planets and help in the effort to understand how our solar system and its planets formed" (*www.genesismission.org/index.html*).

Moon phases

September	
Last quarter	9/6
New Moon	9/14
First quarter	9/21
Full Moon	9/28

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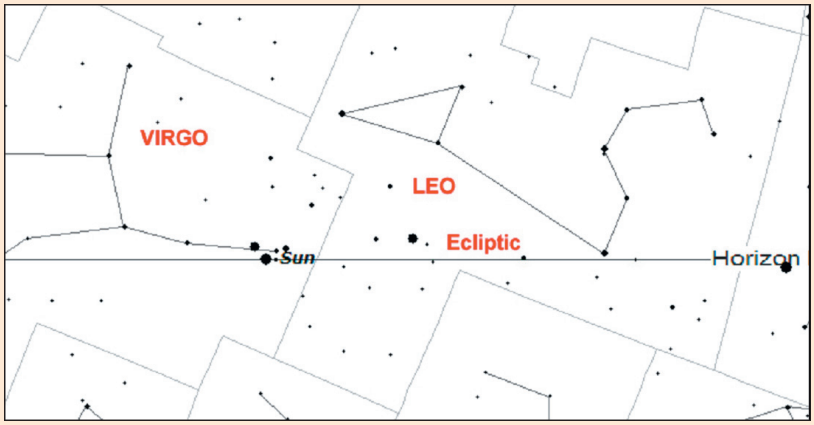
Tracking the Sun



Throughout the school year, information and data will be provided through this column so students may indirectly follow the Earth along its orbital path, the *ecliptic*, around the Sun. Because, from our perspective, the Sun appears to be moving, students will actually be graphing the Sun's apparent motion caused by the Earth's real orbital and rotational motions. This graph-ready data will include the celestial coordinate position, the 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 each month, students may follow and plot the Sun's location along the ecliptic after downloading free SFA star charts (see Resources). Students can measure the Sun's altitude and its angle above the horizon at midday. This month students can join in Project SunShIP (Sun Shadow Investigation Project) a global collaboration to calculate the polar circumference of the Earth. The website includes project worksheets and instructions (see Resources).

September

During September, the Sun's apparent motion along the ecliptic takes it from the constellation Leo to Virgo.

On these dates at midday EDT

Date, time of midday Sun	Distance (in AU)	Altitude	Apparent size	Right ascension	Declination
Sept. 20th, 1:13 P.M.	1.0040 A.U.	51° 50'	32'	11h 53m	0° 0'

Celestial events

9/6 Last quarter Moon
9/8 *Genesis* sample return
9/9 Mercury at greatest western elongation
9/14 New Moon
9/15 Mars/Sun conjunction
9/20 Mars solstice—Northern Hemisphere summer begins
9/21 First quarter Moon
9/22 Jupiter/Sun conjunction
9/22 September equinox
9/22 SunShIP Project
9/28 Full Moon
9/29 Asteroid Toutatis/Earth flyby

Internet resources

September equinox—*www.equinox-and-solstice.com/html/autumnal_equinox.html*
NASA near Earth objects—*neo.jpl.nasa.gov/index.html*
Earth crossing asteroids—*www.eecs.wsu.edu/~hudson/Research/Asteroids/index.htm*
SFA star charts—*www.cox-internet.com/ast305/SFAStarCharts.html*
Cassini/Huygens Mission to Saturn—*saturn.jpl.nasa.gov/index.cfm*
Project SunShIP, Sun Shadow Investigation Project—*sunship.currentsky.com*
Genesis Mission—*www.genesismission.org/index.html*