Planets on the move

While most of us will enjoy a summer break during the next three months, the planets will continue along their orbital paths. From our perspective here on Earth, Mercury and Venus will move behind the Sun while Jupiter and Saturn move out in front. Although the motion of these two outer planets won't be apparent for a few weeks, the motion of the much faster-moving inner planets can be detected in a matter of days.

From our earthly perspective, Venus and Mercury are located on the left or eastern side of the Sun at the start of summer—this position is somewhere between superior conjunction (directly behind the Sun) and greatest elongation (maximum distance from the side of the Sun). From our viewpoint the inner planets will appear to trail the Sun from horizon to horizon each day, rising after sunrise and setting after sunset.

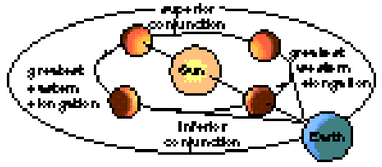
A planet's visibility over the western horizon at sunset and over the eastern horizon at sunrise depends on several factors, including latitude of the observing site, time of year, and position of the planet with respect to the ecliptic (the apparent path of the Sun in the sky).

The inner planets

Due to the orbital paths of Venus and Mercury as well as the relative positions of the Earth and the Sun, these two planets undergo changes in phase, size, and brightness that can easily be viewed through binoculars and telescopes. In fact, it was these changes of phase that prompted Galileo to reconsider the geocentric model of our solar system.

Inner planets are farthest away from Earth when they are at superior conjunction. When they move out from behind the Sun, they are still extremely distant; therefore, their viewing size is very small. In this position, the inner planets appear in a gibbous phase—greater than half-phase, but less than full. (We do not see the full phases of the inner planets because they occur when they are behind the Sun.)

Keep in mind that while the planets are in motion, the Sun also appears to move as a result of Earth's orbital motion. The Earth moves approximately one degree per day around the Sun, so the Sun's apparent motion is also about one degree per day. Inner planets circle the Sun faster than Earth does, so their orbital motion is faster than the apparent motion of the Sun. And, like the outer planets, inner planets also have both prograde (apparent forward, or eastward) and retrograde (apparent backward, or westward) motions to their orbits. However, prograde and retrograde motions, for an inner planet, are relative to the "moving" Sun, not a fixed background of stars, as with the outer planets. This means that the speed of the inner planets relative to the Sun changes as the planets orbit the Sun.



Superior conjunction has the inner planets on the other side of the Sun, but "even" with the Sun. Due to a faster orbital speed, the inner planets gradually move ahead of the Sun eastward in prograde motion until reaching greatest eastern elongation. From our view at sunset, the inner planets set later each evening. Through binoculars or telescopes the inner planets' viewing sizes increase because they're moving closer to the Earth as their gibbous phase wanes.

At about eastern elongation there is a momentary pause as the inner planets, relative to the Sun's apparent motion, become stationary, then begin retrograde motion westward back toward the Sun. The Sun, meanwhile, continues "moving" eastward. From eastern elongation to inferior conjunction, the Sun and the inner planets, in effect, close in on each other. They appear to move closer together at a faster rate than when they separated after superior conjunction. From our view at sunset, the inner planets set closer and closer to the time of sunset. Through binoculars or telescopes the inner planets increase in viewing size as the crescent phase wanes.

From inferior conjunction to about greatest western elongation (on the right side of the Sun), the inner planets and the Sun pull away from each other at a combined rate of the Sun's apparent motion and the orbital speed of the inner planets. From our view looking toward the sunrise horizon, the inner planets appear to rise a little earlier than the Sun each day. When viewed through binoculars or a telescope, the inner planets appear as large, thin crescents that gradually wax toward quarter phase.

The last leg of the inner planets' orbit is from western elongation to superior conjunction. From our view toward the sunrise horizon, the inner planets rise closer and closer to the time of sunrise. Through binoculars or telescopes the inner planets' viewing sizes decrease while their phases wax from quarter to gibbous.

The innermost and swiftest planet, Mercury, will be visible in two positions this summer as it moves from one side of the Sun to the other. During all but the first few days of June, when it will still be behind the Sun, Mercury will be visible after sunset over the west-northwest horizon. Mercury reaches greatest eastern elongation on June 28 and then will quickly move into inferior conjunction during July. Mercury reaches the other side of the Sun, its greatest western elongation, on August 14, when it will be visible as a morning planet rising ahead of the Sun.

Venus is over the western horizon at sunset from May through about the last week of July. During this period Venus moves to greatest eastern elongation on June 11, and to its greatest brilliancy about one month later, on July 14. Shortly after reaching its brightest position Venus moves to inferior conjunction on August 20.

The outer planets

Mars rises after sunset and will be visible over the western horizon. Watch for the brightness of Mars to steadily decrease as the faster-moving Earth pulls ahead. The retrograde motion of Mars comes to an end in early June, as Mars resumes its eastward motion across Libra.

Jupiter slowly moves from superior conjunction during April into visibility over the eastern horizon by June. However, due to its low rising angle relative to the horizon, Jupiter will not be easy to view until August.

Saturn also slowly moves from an April conjunction with the Sun into the predawn skies. And like Jupiter, Saturn will not be visible until August.

Web resources

- Create Your Own planet—www.createyourownplanet.com
- The Solar System—seds.lpl.arizona.edu/nineplanets/nineplanets.htm
- The Planets—cse.ssl.berkeley.edu/sol/solarsys/sol
- Solar System Dynamics—ssd.jpl.nasa.gov