

Planet Positions

As the planets orbit the Sun, they move around the celestial sphere, staying close to the plane of the ecliptic. As seen from the Earth, the angle between the Sun and a planet -- called the **elongation** -- constantly changes. We can identify a few special **configurations** of the planets -- those positions where the elongation is particularly noteworthy.

The **inferior planets** -- those which orbit closer to the Sun than Earth does -- have configurations as shown:

At both **superior conjunction** (SC) and **inferior conjunction** (IC), the planet is in line with the Earth and Sun and has an elongation of 0° .

At **greatest elongation**, the planet reaches its maximum separation from the Sun, a value dependent on the size of the planet's orbit. At **greatest eastern elongation** (GEE), the planet lies east of the Sun and trails it across the sky, while at **greatest western elongation** (GWE), the planet lies west of the Sun, leading it across the sky.

Best viewing for inferior planets is generally at greatest elongation, when the planet is as far from the Sun as it can get and thus in the darkest sky possible.

The **superior planets** -- those orbiting outside of Earth's orbit -- have configurations as shown:

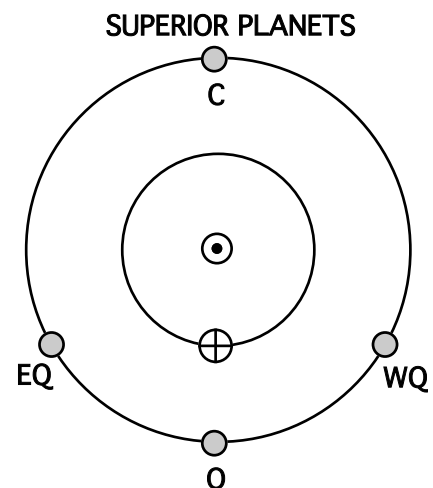
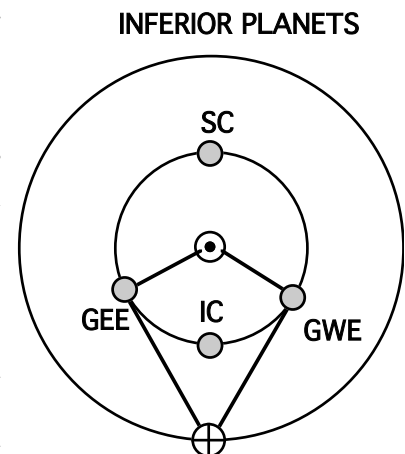
A planet at **conjunction** (C) is lined up with the Sun and has an elongation of 0° , while a planet at **opposition** (O) lies in the opposite direction from the Sun, at an elongation of 180° .

Planets at **quadrature** have elongations of 90° . At **eastern quadrature** (EQ), the planet is 90° east of the Sun, while at **western quadrature** (WQ) it is 90° west of the Sun.

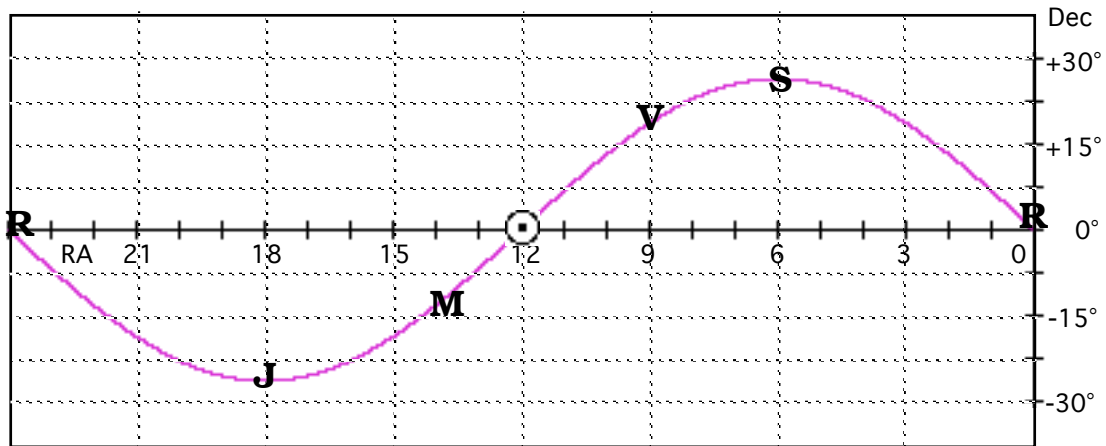
Best viewing for superior planets occurs around opposition, when the planet is fully illuminated and above the horizon all night long.

The interval between successive similar configurations, such as opposition to opposition, is called the synodic period (S). This can be calculated from the sidereal period of the planet (P) as shown:

$$1/S = |1 - 1/P| \quad \text{where S and P are both in years}$$



As for locating planets in the sky, they will lie somewhere along the ecliptic, depending on their elongations and the Sun's position (which depends on the season). The following diagram shows the position of the Sun at the autumnal equinox and also locates the bright planets at the configurations shown: Mercury (M) at greatest eastern elongation ($\approx 28^\circ$), Venus (V) at greatest western elongation ($\approx 48^\circ$), Mars (R) at opposition, Jupiter (J) at eastern quadrature, and Saturn (S) at western quadrature.



Thus, at any given time of the year, planets may be found high or low on the ecliptic. Mercury and Venus tend to follow the Sun closely, never straying too far into the darkness of the night sky. The other planets can appear anywhere along the ecliptic, drifting gradually eastward with respect to the stars, except around opposition when their retrograde motion carries them westward for a while.