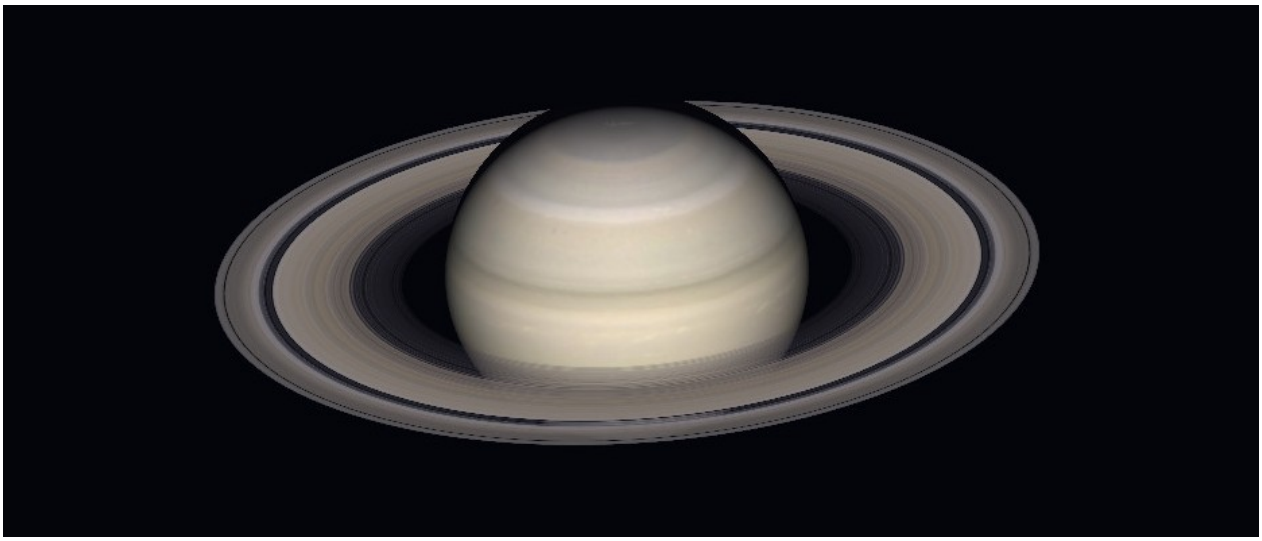
Saturn



Saturn is the sixth planet from the Sun and the second largest planet in the Solar system. It has the largest oblateness (flattening of its spherical shape) in the solar system, probably because of its lighter composition and its high rate of axial rotation (once every 10 hours 39 min). It has a density of .62 kg/litre (compared to 1.0 for water), so if you can find an ocean big enough, Saturn would float in it! Saturn like Jupiter has a similar system of zones and belts, but much less pronounced. Spots do form on the belts of Saturn, but they are much less frequent than on Jupiter. The winds, however, are much stronger blowing at an average of 1,600 kph at the cloud tops.

Saturn is comprised of hydrogen (93%) and helium (5%) with traces of methane, ammonia and water. It is thought to have a liquid metallic hydrogen layer, similar to Jupiter, and perhaps a rocky core. Like Jupiter, Saturn radiates more energy than it receives, generated from its primordial internal heat. Saturn also has a large magnetic field that emits radio waves, and has radiation belts. The magnetic field is thought to interact with the Saturn ring system, creating "spokes". The spokes are possibly created as charged particles (generated by the magnetic field) then swept away by the ring system.

When observing Saturn, the first feature that stands out is its incredible ring system. The rings of Saturn have been known for hundreds of years. Galileo first glimpsed them in 1610, but was puzzled by what he saw to be a planet “with ears”. It wasn't until 1656 when Huygens correctly identified them with a more efficient telescope.

The rings are about 270,000 km in diameter, and vary in thickness from 100 to 300 metres. There are so thin that on the occasions that they appear edge-on to Earth, they seem to disappear from sight. They are actually thousands of tiny ringlets. The question of what material the rings comprise has puzzled astronomers over the years but now with data from probes, astronomers know that they are mostly made up of chunks of ice. These chunks vary in size from as small as peas to the size of trucks. Amongst the ice are fragments of rock and dust.

The rings are numbered from the inner most then moving outwards. They start with the D ring, then move out with C, B, A, F, G and E ring. This ordering of letters has to do with the historical sequence of discovery.

The inner most ring to Saturn is the D ring, it is marked by the fact the inner edge appears to extend right down to the cloud tops of Saturn.

The next ring is the C ring or the Crepe ring. Next comes a small gap, called the Maxwell Gap, which is only 270 km wide. The brightest ring is the B-ring, which is about 35,500 km in radial width, and is the ring where the spokes were first discovered. Giovanni Cassini, in 1675, discovered a dark gap between the B-ring and the A-ring, which is aptly called the Cassini Division, and is one of the more prominent features of the ring, extending some 4500 km is radial width. The gap is thought to exist due to the perturbation effects of one of Saturn's moons called Mimas.

The A-ring, which is about 14,600 km in radial width, is not as bright as the B-ring, and actually contains a number of gaps. The outer edge of the A-ring has a sharp boundary, possibly created by the "shepherd moon" Atlas. The gap outside the A-ring is called the Encke division and is only about 325 km in radial width. Next is the F ring (30-500 km in radial width), which was discovered by Voyager, it is a braided structure with the moons Prometheus and Pandora lying on either side of it. It was this ring that helped astronomers understand how shepherding moons maintain the ring structures, which without them would soon dissipate.

The G ring (8,000 km in radial width) lies between the orbits of Mimas and two co-orbital moons (Janus and Epimetheus), the distance between the G ring and the F ring is about 30,000 km.

The outer most ring, which is visible from Earth is the E ring, it is something like 300,000 km in radial thickness and lies just inside the orbit of Enceladus. If you could take a commercial jetliner from the E ring to the D ring, the journey would take you about 5 days.

Over the past years we have learned much more about Saturn its rings and its moons from the NASA Cassini Mission Cassini/Huygens.

Moons of Saturn

Saturn currently has 60 known moons. This number may change with any new discoveries.

Its largest moon is Titan, the 2nd largest in our solar system. Titan is unique in that it is the only known moon to have an atmosphere, admittedly of an unbreathable nature (at least to humans). There are ten others whose diameters exceed 100 km, then the remainder which range from 94 km down to a mere 4 km diameter.

The moons exceeding 100 km diameter are, in order of largest diameter:

Titan – 5,151 km
Rhea – 1,529 km
Iapetus – 1,469 km
Dione – 1,125 km
Tethys – 1,073 km
Enceladus – 505 km
Mimas – 398 km
Hyperion – 266 km
Phoebe – 213 km
Janus – 181 km
Epimetheus – 117 km

Planet Data

Mass 5.69 x 10^{26} kg (95.2 M_E)

Equatorial Diameter: 120,537 km (9.45 D_E)

Mean density (kg/litre) (water =1): 0.62

Mean distance from Sun: 9.54 AU (1,425,983,000 km)

Rotation period (length of Planet's day): 0.444 Earth days (10 hrs 39.4 m)

Revolution period (Planet's year): 29.46 Earth years

Obliquity (tilt of axis): 26° 45'

Orbit inclination: 2° 29' 29"

Orbit eccentricity (deviation from circular): 0.05582

Mean surface temperature: -178°C

Atmospheric components: 93% hydrogen, 5% helium, 2% methane and traces of ammonia, ethane, phosphine.

Observing Saturn

Saturn is easily visible to the naked eye as it varies in magnitude from 0.5 to 1.1. This makes it look like a yellowish star rivalling Betelgeuse at its brightest and Pollux at its faintest. Its apparent angular size varies from 16" to 20". This is still too small to resolve into a disk with smaller binoculars (say up to 12x) but larger binoculars may show the rings as more than just 'jug ears'.

Even the smallest telescope, though, will show you the beautiful ring system. The larger the magnification, obviously, the better the view.

To find Saturn, you need only know which constellation it currently resides in. The planet soon becomes obvious once you locate that constellation.

Saturn's largest moon, Titan, is also observable in small telescopes. It helps to have an ephemeris to tell Titan's relative position each night to distinguish it from the faint background stars.