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SATURN

Ken Tapping, 16th January, 2018

A few years ago, we were lucky enough at our observatory to be loaned an accurate replica of one of the telescopes Galileo used in the 16th and 17th Centuries to revolutionize our view of the universe. When we looked through that telescope, two things struck us: firstly what an incredible observer Galileo was, and secondly how much telescopes have improved since then.

Galileo looked at many things, including the Moon and Jupiter, seeing the giant planet and for the first time its four largest moons, and then he pointed the telescope at Saturn. Unlike the other objects he observed, Saturn was not just a disc; it looked as though it had carrying handles. He was seeing, again for the first time, the spectacular system of rings surrounding the planet. In the 17th Century, Huygens, using a substantially improved telescope, concluded that Saturn is “surrounded by a thin, flat, ring, nowhere touching”. For backyard astronomers, Saturn, with its system of rings, remains one of the most beautiful sights in the sky.

Saturn is the sixth planet out from the Sun. The planet itself is like a rather smaller version of Jupiter, a bit colder because it is further from the Sun. Like Jupiter, Saturn is mainly gas. It has a diameter of 120,500 km, compared with Jupiter's 143,000 km and Earth's 12,756 km. Despite its size, its mass is only 95 times that of the Earth. This means on average, one cubic metre of Saturn weighs in at 690 kg, compared with 1,330 kg for Jupiter and 5,500 kg for the Earth. A cubic metre of water weighs 1,000 kg, meaning that if we had a big enough bucket of water, we could put Saturn into it and the planet would float! If there is a solid object in the centre of Saturn, it is small.

Like Jupiter, Saturn rotates quickly, once every 10 hours or so, pulling the clouds and storms into belts extending around the planet. The Cassini spacecraft, during several years observing Saturn and its moons, showed a perfectly hexagonal storm at the planet's North Pole. However, Saturn

has no equivalent of Jupiter's Great Red Spot. There are lots of storms, but smaller than Jupiter's.

Saturn's rings are thin, just a few kilometres, and composed of lots of small pieces of ice and rock. When we see them edge on, they become very hard to see. There are gaps between the rings caused by small moons. The gaps are produced by the moons' gravity. Any ring material straying into the gap is either decelerated, falling towards the planet, or accelerated, throwing it outwards. The biggest was observed by Cassini and named after him, as “Cassini's Division”. You can see this thin, dark gap using backyard telescopes. The current idea for the origin of the rings is that they are a moon that could not form because of Saturn's tidal forces, and should last a long time.

Like Jupiter, Saturn has lots of moons. Also like Jupiter, many are temporarily captured asteroids, spending some time orbiting the giant planet before wandering off again. Others are permanent. One of these is Titan, the only moon in the Solar System with a thick atmosphere. Titan has lakes and streams of liquid hydrocarbons. Some form of frigid life cannot be ruled out. Another moon of particular interest is Enceladus, which like Europa, the second moon out from Jupiter, has a deep ocean beneath an icy cover, heated by tidal forces inflicted by the planet they orbit.

The Moon, Jupiter and Saturn have long been favourites for backyard observers with small telescopes and possibly light-polluted skies. It is interesting to look at Saturn today and try to imagine how much it surprised Galileo.

Jupiter and Mars lie close together in the South before dawn. Mercury and Saturn are low in the dawn twilight. The Moon will be New on the 16th and reaches First Quarter on the 24th.

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