# Saturn

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# SATURN

**Ken Tapping, 29th July, 2014**

It might not look like much, just a moderately bright, yellowish "star" in the southwest, but it is one of the most beautiful objects in the sky. You need only a small telescope to enjoy the spectacle. That object is the planet Saturn, the sixth planet from the Sun; we live on the third. A small telescope will show a tan-coloured sphere, possibly crossed by darker or lighter belts of cloud. However, what makes this planet so spectacular is that it is surrounded by a system of concentric rings of different brightnesses. This is what impressed Galileo, Cassini, Huygens, Herschel and astronomers ever since.

The planet is a huge sphere with a diameter of about 120,500 km. By comparison, our world's diameter is 12,756 km. Interestingly, a day on Saturn (how long the planet takes to rotate once on its axis) is only 0.44 of one of our days. The Earth's rotation means someone standing on the equator is moving eastwards at around 1670 km/h. Thanks to Saturn's larger diameter and shorter day, on that planet, that same person would be moving at more than 35,800 km/h. When looking at Saturn with a moderately large telescope, one does get a strong impression of a planet that it is spinning rapidly, with its clouds all pulled out into belts extending around it.

When we look at Saturn, we do not see its surface; we see the top of a deep layer of dense cloud. We actually have little idea as to what sort of body is concealed below that cloud. However, we can get an idea. One cubic centimetre of the body of our planet has a mass of 5.5 grams. This is consistent with a ball of rock with a core of iron and nickel. One cubic centimetre of water has a mass of one gram. If we take a lump of rock and drop it into water, it would sink, because a cubic centimetre of rock weighs more than a cubic centimetre of water.

Saturn has 95 times the mass of the Earth. However it has about 850 times its volume. So one cubic centimetre of Saturn would have a mass of only 0.6 grams. If we had a big enough bucket of water the planet would float. Saturn has to be mostly gas, with a small lump of rock inside.

The rings are fascinating things too. They consist of gravel, dust and ice particles, all orbiting Saturn in the same plane. They look solid because the particles are quite concentrated by cosmic standards. Two obvious questions are firstly how did those rings get like that, and secondly how, over billions of years, did they stay like that?

Our Solar System started as a collapsing cloud of gas and dust. Since almost every cloud has a bit of rotation in it somewhere, it collapsed into a rotating, flat disc of material. The core of this disc collapsed to form the Sun, and most of the rest coagulated into lumps that became the planets and other objects we see orbiting the Sun. So, if Saturn has a disc of material rotating around it, why hasn't that collapsed into lumps, perhaps into moons or asteroids? Certainly that is not happening, and over the centuries of observing Saturn, we have seen no sign of it happening. We do not have the whole answer as to why, but we certainly have at least part of an explanation.

The tides on Earth are due to the Sun and Moon attracting our oceans (and our land and atmosphere) more strongly on the side of our planet facing them than they do the other side. If we were close enough to the Sun, these tidal forces would pull the Earth apart. The rings on Saturn are so close to the planet that tidal forces would prevent ring particles coagulating into larger objects. Astronomers used to think that the rings of Saturn would not be round for long. Now it looks as though they have been around for billions of years and will stick around for a while yet.

Mars and Saturn are still well placed to enjoy. Venus and Mercury lie low in the predawn twilight. The Moon will reach First Quarter on the 3rd.

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