Saturn is the second of the 4 gas giants. Like Jupiter it gives off more heat than it gets from the Sun. But unlike Jupiter, it has a magnificent set of rings, and it's so light that it would float in water - if you could find a bath big enough!

Saturn is about 120,000 km across. It takes 29.46 years to go around the Sun. Like Jupiter, it spins very rapidly - the day lasts for 10 hours and 39 minutes. It has a similar structure to Jupiter. It has a solid core, which is surrounded by a shell of solid hydrogen, which is in turn surrounded by a shell of liquid hydrogen, and then the giant shell of atmosphere. This atmosphere is made of hydrogen and helium gases, and ammonia, with small amounts of other gases. Like Jupiter, Saturn seems to be a bubbling cauldron of liquid and gas. Like Jupiter, the atmosphere of Saturn is NOT in chemical balance, with some unknown process making trace amounts of various gases.

Like Jupiter, Saturn gives out more heat than it gets from the Sun. But the heat is made in a different way. On Saturn, the heat comes from the condensing of helium as it sinks in the atmosphere. In the same way that steam gives off heat as it turns from gas into liquid, so helium gives off heat. This heat is is the power supply for the weather of Saturn.

Saturn has fierce winds which travel at some 1,700 km/hr near the equator - 3.5 times faster than the winds on Jupiter. For some unknown reason, the winds travel around Saturn in only 10 hours and 15 minutes, some 24 minutes faster than Saturn rotates. While Jupiter has the Great Red Spot, Saturn has the Small Red Spot - about 6,000 km across.

But Saturn has a surprise - the Great White Spot. It appears about every 30 years - fairly close to the 29.46 year of Saturn. It has previously appeared in 1876, 1903, 1933, and 1960, and it last appeared on September 24, 1990. As before, it appeared in the mid-summer of the northern hemisphere of Saturn. It very rapidly grew to an oval big enough to swallow 3 Earths, and then stayed the same size for about 3 weeks. Then the 1,700 km/hr winds began to change the Great White Spot, and it became even larger as it grew a long tail that began to stretch around the planet. This cloud of crystals of ammonia ice reached some 240 km above the cloud tops.

But while the Great White Spot is a 30-year event, the rings are always there. They were first seen by Galileo in July 1610. His telescope was not very sharp, so he thought that Saturn was actually a central planet with two very large moons - one on each side. But when he looked again in 1617, the rings had tilted to be edge-on and almost invisible. He thought that Saturn had "swallowed its children". But telescopes improved, and around 1650, Huygens first saw the rings.

The rings are very thin, less than 1,000 metres thick. They are very flimsy sheets of blocks of water ice. There are over 10,000 separate sets of rings. In the range 9 to 11 metres of size (size of a small truck), there are about 150 ice boulders per square kilometre of ring. But when you look at ice blocks the size of a car (3-5 metres across), there are about 3,000 lumps of ice per square kilometre. There are also strange dark spokes that break up and reform over several days.

There are even very thin braided rings, that are kept in place by tiny "shepherd" moons. These shepherd moons are like sheep dogs - they continually push the braided rings back into place. These tiny moons have very close orbits (just 50 km apart) and they play a game of "musical chairs". Whenever they get close to other, they swap orbits with each other.

Altogether there are at least 17 moons orbiting around Saturn. Some of them have solid water ice on the surface (and maybe oceans of liquid water underneath). But the most interesting moon of all is Titan. Titan is a huge moon that is bigger than the planet Mercury. It has an atmosphere that is about 1.6 times thicker than our own atmosphere on Earth. This opaque orange smog of an atmosphere is about 50 km thick. Water is essential for life on Earth - it carries various chemical from the environment into our bodies, and back out again. Methane could take the place of water on Titan. Earth is just 15Co above the triple point of water (of 0oC). On Earth we have solid water ice and snow (near the Poles), liquid water (in the oceans and our bodies) and water gas or vapour (in the air we breathe in and out). Titan is just 4Co above the "triple-point" temperature of methane. So there could be methane snow and solid methane ice, methane liquid and methane vapour or gas. This means that Titan is certainly a very good place to look for life.

The planned spacecraft to Titan has been put back many times. Soon the politicians who control the funding will come to their senses, and grant funding to look at this place that is very likely to have life on it

http://www.abc.net.au/science/space/planets/saturn.htm