

U3A-GROUP ASTRONOMY (27-4-07)

THE SOLAR SYSTEM'S "GAS-GIANTS"

Beyond the 4 rocky inner-planets + the *Asteroid Belt* (failed planet?), come the four so-called Gas Giants: Jupiter – Saturn – Uranus – Neptune. Not really balls of gas: pressure in core is so high, that the 'gas' (H, He, methane etc.) is as hard as metal. Outwards follow thick layers of more or less fluid material, and finally gas (with minor variations).

JUPITER is by far the largest planet. Its mass is larger than that of all the other planets + meteorites etc. combined (but still less than 1/1000th of that of the Sun).

It orbits the Sun in c. 12 years at an average distance of 778 mln km. (Earth: 150 mln km.) and spins around its axis in about 10 hours! Enormous spin, causing the sphere to be flattened: polar diameter is 10,000 km less than the equatorial diameter.

The atmosphere shows large cloud belts with enormous wind speeds (up to more than 600 km/h). There are also giant, on-going storms. Biggest: *The Big Red Spot* – as big as the Earth, already spotted through telescopes in the 17th century! Changes shape and colour constantly.

Around J. there is a system of faint rings + 63 moons. The four biggest moons – Europa, Ganymede, Io and Callisto - are called the *Galilean moons* (important discovery in 1610!).

Missions - Only 'fly-by's' (impossible to 'land', as there is no land!). Important ones:

- *Pioneers 10 and 11 + Voyagers 1 and 2 in the 1970's.*
- *New Horizons*, launched in January 2006 to Pluto. End February 2007 it flew past Jupiter at a distance of 2.3 mln km. and supplied much new information + pictures.

SATURN is the most beautiful object in the sky, with its spectacular set of rings. In many respects comparable to Jupiter, but somewhat smaller (but still more than 750 times the Earth's volume). It also has a long 'year' (29 yrs) and short days (10 hrs 14 mins, again resulting in polar flattening), and also a large number of moons (49). Biggest of the moons is *Titan* (50% larger than our Moon). Discovered in 1656 by Christiaan Huygens.

Saturn's rings are much clearer than those of the other outer planets. Biggest ones are called B- and A-ring, separated by the 'Cassini Division' (discovered by Italian astronomer of this name). These major rings have a diameter of over 270,000 km (would just fit between Earth and Moon), but they are only some tens of meters thick. They consist of ice particles, varying in size from grains of dust to blocks the size of houses.

Galileo was, in 1610, the first person to see them. We are still not sure about their origin, how old they are, if they will remain there for ever or not, etc.

Missions - *Pioneer* and *Voyager* fly-by's gave, around 1980, much new information about S. and its moons and rings.

In October 1997 *Cassini* – the size of a double-decker bus and weighing 6 tons – was launched and came into orbit around Saturn in July 2004. It has worked perfectly ever since and can continue to do so until at least 2010 (money!).

The most spectacular event was the landing on S's moon *Titan* of the Huygens-probe in January '05. It had travelled on piggy-back with Cassini, and from there descended through T's atmosphere in 2 hours – the last bit hanging on a parachute – to land in a muddy area, from where it continued to send information for another two hours (via Cassini). Fantastic accomplishment: first landing of a probe in the SS's outer area, almost 1300 mln km from here!

We know now that Titan has a cycle of precipitation (constant drizzle), rivers, erosion etc., very similar to that on Earth, only not with water but probably with methane.

URANUS + NEPTUNE are a lot smaller than Jup. and Sat., and also quite different from these two in other respects. Both have dim ring systems and considerable numbers of moons (so far, 27 and 13 resp.). Like Jup. and Sat., they also spin very rapidly around their axis, but take long times to orbit around the Sun: the four 'seasons' on Neptune last over 41 years each! Interesting ways in which they were discovered: *Uranus* in 1781 by William Herschel, the first to recognize it as a planet, and *Neptune* 'indirectly' in 1846, as the result of irregularities in the movement of Uranus.

Missions: so far only fly-by's: *Voyager-2* in 1986 (Ur) and 1989 (Nept).