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JUPITER – UP CLOSE

Ken Tapping, 12th July, 2016

Just a few hours before I started writing this, the Juno spacecraft went into orbit around Jupiter. Its rocket motor fired to slow the spacecraft down enough to be caught by the giant planet.

Otherwise it would have shot past and gone off into deep space. The mission objective is to orbit Jupiter in a highly-elliptical path, taking it close in and far out, and to tell us more about the biggest planet in the Solar System. In Roman mythology, Juno is the wife of Jupiter, the king of the gods.

Jupiter is low in the western sky these evenings, and it is still worth getting out the telescope for a look. From here on Earth we can see a lot, but actually, Jupiter hides his secrets very well. Telescopes reveal a tan-coloured disc crossed by cloud belts. There is a huge storm that has been there for centuries, called the Great Red Spot. From above the turbulence of the Earth's atmosphere, the Hubble Space Telescope shows storms and a lot of turbulence. The scale and vigour of Jupiter's weather dwarfs anything we have here on Earth, which is a good thing.

The engine driving this weather is the high speed of Jupiter's rotation. It rotates once in 0.41 of our days. However, the planet has a diameter of almost 143,000km, compared with the Earth's diameter of almost 12,800 km. That means at its equator, Jupiter is rotating at almost 46,000 km/h, compared with just under 1700 km/h for our world!

We know those coloured clouds, ranging from reds and browns to beige and grey, are made of organic chemicals, in an atmosphere made up mainly of hydrogen, methane and ammonia. However, those clouds stop us seeing what is going on below; despite our grandstand view of the planet, there is a lot we don't know about Jupiter, and we hope that Juno will help with that.

One of the big questions is about water. A probe dropped into Jupiter's atmosphere from the Galileo spacecraft detected no water. This is really odd,

because it does not fit what we think we know about the way the Solar System formed.

The standard picture is that a big cloud of gas, dust, organic chemicals and ice collapsed about 5 billion years ago to form the Sun and planets. The planets nearest the Sun got their volatiles (organic chemicals and water (from the ice)) largely blasted away by the young Sun. Planets further out hung onto their volatiles. All those retained volatiles are what make the outer planets so large. Was our failure to detect water in Jupiter's atmosphere a failure of our probe? Did the probe just happen to descend in a dry place, or are our ideas wrong? Is the water there as a big lump of ice deep down below the clouds? We hope that the instruments on Juno will tell us more about what lies hidden by the clouds, including whether there is any detectable water.

One big problem with Jupiter is that it has a strong magnetic field that supports radiation belts thousands of times stronger than those surrounding the Earth. Extremely strong magnetic fields are being generated inside the planet. We could not survive going into those belts, and even though the electronics on Juno are in radiation-screened enclosures and containers, most of the instruments need to be outside, exposed to the radiation. We believe that eventually the spacecraft will succumb to radiation damage, but before that happens we hope to get a better idea as to what Jupiter is like below the clouds - and is there water down there? This raises a question lying much closer to home. If our ideas as to how the planets formed are right, why does our world have so much water?

Jupiter is very low in the west after sunset, and Mars and Saturn lie in the southern sky. Mars is the bright one; Saturn is fainter and to Mars' left. The Moon will be Full on the 19th.

Ken Tapping is an astronomer with the National Research Council's Dominion Radio Astrophysical Observatory, Penticton, BC, V2A 6J9.
Tel (250) 497-2300, Fax (250) 497-2355
E-mail: ken.tapping@nrc-cnrc.gc.ca