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Light years away from us

The planets in the solar system have company. Newer planets, thousands of light years away, are constantly being discovered beyond the solar system. This year, a network of small telescopes called HATNET detected a planet, HAT-P-7b, about a thousand light years away. Its orbit is hardly five million kilometres from its parent star. This is about one-tenth of the distance between Mercury (the innermost planet in our solar system) and the Sun. This proximity implies that this planet receives approximately four thousand times as much thermal energy as the Earth receives from the Sun. That is, a square metre on this planet's surface would get four mega watts of radiation! If the Earth receives this much of radiation, all its oceans would soon evaporate! Surface temperatures on this planet would reach a torrid high of 2500 C, melting all metals! It would be interesting to see how the planet's atmosphere would distribute this energy or the kind of weather that would prevail.

Meanwhile, methane has been detected for the first time on an extrasolar planet, HD 189733b. Water vapour was also found on the planet's atmosphere. This particular planet is another 'hot Jupiter', orbiting only at one-thirtieth of the Earth-Sun distance from its star. This implies that it is heated to a searing 1500 C! A day-night temperature map of this planet implies the presence of fast winds that can equalize temperatures.

A recent discovery has revealed that two planets orbit a primary star of half solar mass. This star is about five thousand light years away. The planets orbit the star at distances (from the star) of about 2.3 and 4.6 times the Earth's distance from the Sun. More than 25 multi-planet systems have been detected so far. The star 55 Cancri has five planets orbiting it.

Water has already been seen on three hot Jupiters - TrES-1, HD 209458b and HD 189733b. Recent observations from the Cassini-Huygens mission suggest that Titan has an ocean buried beneath several tens of kilometres of ice. Titan would then be the fourth known object in the solar system with a deep ocean, after the Galileo mission found such liquid layers in the large Jovian moons, Europa, Ganymede and Callisto. There are now around 300 exoplanets known and the list is growing rapidly. Most of these are Jupiter-like gas giants with masses between half to three times of Jupiter's mass. The most massive exoplanet known, XO-3b is more than ten times Jupiter's mass.

However, there is an unexpectedly large range in the sizes of these giant exoplanets. Many of them have very low densities, the extreme example being TrES-4, with a density that is one-ninth of Jupiter.

Again, some low mass planets like Gliese 581c have been seen with a mass hardly five times the Earth mass. These so called 'Super-Earth' planets do not feature in our solar system but seem to be common elsewhere!

Some of them are hot (400 C) called Super hot Earths. Ten times the earth mass is about the theoretical critical mass, above which hydrogen can be accreted and retained by the growing planet. Above this it is likely to grow into gas giants like Neptune. Smaller solid planets can have very varied material compositions. Quite generally, two distinct families are expected, that is, 'ocean planets' with water making up a tenth of their mass and rocky, Earth-like planets that may have oceans (water makes up only one-thousandth of the earth mass).

Finding exoplanets down to earth size and below is a top priority and the Kepler Space Mission is designed to find such objects by 2014. There is an exotic future for exotic exoplanets!

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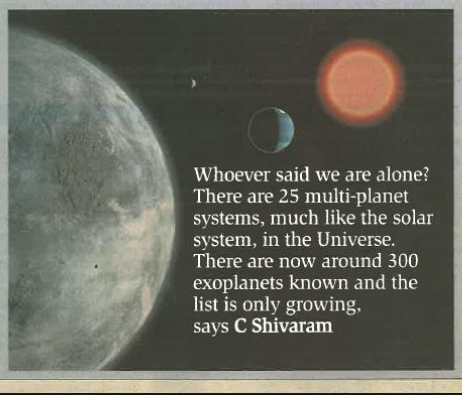

Whoever said we are alone? There are 25 multi-planet systems, much like the solar system, in the Universe. There are now around 300 exoplanets known and the list is only growing, says **C Shivaram**

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