Are we a bit odd?

Tapping, Ken

Publisher's version / Version de l'éditeur:
https://doi.org/10.4224/23000221
Skygazing: Astronomy through the seasons, 2015-03-03

ARE WE A BIT ODD?

Ken Tapping, 3rd March, 2015

We have now found well over 1000 worlds orbiting other stars. Our theories as to how stars form suggest most stars should have planets. It is nice to know that is the case – for two reasons: firstly it suggests we are thinking in the right direction, and secondly, that we are less likely to be alone in the universe. However, the majority of planetary systems we have found out there are distinctly different from ours. Either our Solar System is unique, or there is something else going on.

We think we more or less understand our Solar System. Rocky balls located near the Sun, like Mercury, Venus, Earth and Mars, lost most of their volatile materials when they formed, and then baked by the newborn Sun, leaving small planets with relatively thin atmospheres. On the hand, the outer planets: Jupiter, Saturn, Uranus and Neptune, hung onto more or less everything, so they ended up as gas giant planets. The asteroids, Pluto and the other stuff in the outer Solar System is believed to be left over construction material.

However, what we are finding "out there" does not seem to fit this picture. Most of the planetary systems we are finding are starkly different from ours. We are finding Jupiter-sized planets orbiting so close to their stars they are almost red hot. Most of the worlds we are finding are big and close in. Half the planets in the Solar System are roughly Earth-sized. That does not seem to be the case with the systems we are seeing orbiting other stars. Out there, little, rocky worlds seem to be in the minority, with only a few of them at the right distances from their stars for them to have liquid water to sit on their surfaces. Either our theories need updating, or there is something wrong with our observations, or maybe a bit of both.

The obvious searching method is to use telescopes to see little faint dots orbiting other stars. Unfortunately this rarely works because of the glare of the star, but we have done it in a few cases. Most of the successful detections are being made using two other methods. Although stars are much bigger than planets, they still wobble a little as their planets move round them. We can see this through the star moving towards us and away again. Directly measuring the changes in distance is near impossible, but we can easily measure the speed with which the star is approaching and receding. However, interpreting the results is complicated by the fact we are making the observations from the surface of a spinning ball that is careering around the Sun.

The other method is to monitor the brightness of a star with high precision and look for tiny dimmings as its planets pass in front of them. By measuring the depth and duration of the dimmings, and the intervals between them we can estimate the size of a planet and how far it is from its star. Satellite telescopes can monitor thousands of stars simultaneously, hence the huge rate at which new planets are being found. Amateur astronomers are also discovering new worlds using this method.

In general, big things that happen quickly and often are much easier to detect than small things that happen less often. A big planet like Jupiter orbiting very close to a star is far easier to detect than an Earth-like world orbiting at a safe distance. It will cause big, rapid wobbles in the star and will make large and frequent dimmings. In addition, the chance of a world far from a star passing in front of it is smaller than when a world is close in. The result is that our search methods are highly biased towards finding big planets close to their stars. However, we are getting better at finding planets that could be like ours. We cannot yet conclude whether or not our Solar System is unique. But our instruments and methods are improving, and the work continues. Watch this space….

Venus lies in the southwest after sunset, with Mars close below and much fainter. Jupiter dominates the southern sky and Saturn rises around 1am. The Moon will be Full on 5th March..

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