A New Way to Find Earths

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90-cm telescopes at the University Observatory Jena in Germany. Credit: AIU Jena

Astronomers have used a completely new technique to find an exotic extrasolar planet. The same approach might even be sensitive enough to find planets as small as the Earth in orbit around distant stars.

A team of astronomers from Germany, Bulgaria and Poland have used a completely new technique to find an exotic extrasolar planet. The same approach is sensitive enough to find planets as small as the Earth in orbit around other stars.

The group, led by Dr. Gracjan Maciejewski of Jena University in

Germany, used Transit Timing Variation to detect a planet with 15 times the mass of the Earth in the system WASP-3, 700 light-years from the Sun in the constellation of Lyra. They publish their work in the journal Monthly Notices of the Royal Astronomical Society.

Transit Timing Variation (TTV) was suggested as a new technique for discovering planets a few years ago. Transits take place where a planet moves in front of the star it orbits, temporarily blocking some of the light from the star. So far this method has been used to detect a number of planets and is being deployed by the Kepler and Corot space missions in its search for planets similar to the Earth.

If a (typically large) planet is found, then the gravity of additional smaller planets will tug on the larger object, causing deviations in the regular cycle of transits. The TTV technique compares the deviations with predictions made by extensive computer-based calculations, allowing astronomers to deduce the makeup of the planetary system.

For this search, the team used the 90-cm telescopes of the University Observatory Jena and the 60-cm telescope of the Rohzen National Astronomical Observatory in Bulgaria to study transits of WASP-3b, a large planet with 630 times the mass of the Earth.

“We detected periodic variations in the transit timing of WASP-3b. These variations can be explained by an additional planet in the system, with a mass of 15 Earth-mass (i.e., one Uranus mass) and a period of 3.75 days”, said Dr. Maciejewski.

“In line with international rules, we called this new planet WASP-3c”. This newly discovered planet is among the least massive planets known to date and also the least massive planet known orbiting a star which is more massive than our Sun.

This is the first time that a new extrasolar planet has been discovered using this method. The new TTV approach is an indirect detection technique, like the previously successful transit method.

The discovery of the second, 15 Earth-mass planet makes the WASP-3 system very intriguing. The new planet appears to be trapped in an external orbit, twice as long as the orbit of the more massive planet. Such a configuration is probably a result of the early evolution of the system.

The TTV method is very attractive, because it is particularly sensitive to small perturbing planets, even down to the mass of the Earth. For example, an Earth-mass planet will pull on a typical gas giant planet orbiting close to its star and cause deviations in the timing of the larger objects' transits of up to 1 minute.

This is a big enough effect to be detected with relatively small 1-m diameter telescopes and discoveries can be followed up with larger instruments. The team are now using the 10-m Hobby-Eberly Telescope in Texas to study WASP-3c in more detail.

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