Planetary Transits;

In astronomy, the term transit has three meanings. In this case it is the astronomical event that occurs when one entity appears to move across the face of another, hiding a small part of it, as seen by an observer from a particular vantage point. If the first entity hides a major part, or all of, the second entity, then it is an occultation rather than a transit.

Methods of Detecting Planets

There is a multitude of methods that are used to detect extrasolar planets, three of which I will briefly outline as shown on the screen:

Radial velocity

A star with a planet will move in its own small orbit in response to the planet's gravity. This leads to variations in the speed with which the star moves toward or away from Earth, i.e. the variations are in the radial velocity of the star with respect to Earth. The radial velocity can be deduced from the displacement in the parent star's spectral lines due to the Doppler effect. The radial-velocity method measures these variations in order to confirm the presence of the planet. The radial-velocity method has been by far the most productive technique used by planet hunters. It is also known as Doppler spectroscopy. The method is distance independent, but requires high signal-to-noise ratios to achieve high precision, and so is generally only used for relatively nearby stars out to about 160 light-years from Earth. It easily finds massive planets that are close to stars. Modern spectrographs can also easily detect Jupiter-mass planets orbiting 10 astronomical units away from the parent star but detection of those planets requires many years of observation.

Pulsar timing

A pulsar is the small, ultradense remnant of a star that has exploded as a supernova. They emit radio waves extremely regularly as they rotate, These can be tracked to determine the motion of the Star. Like an ordinary star, a pulsar will move in its own small orbit if it has a planet. Calculations based on pulse-timing observations can then reveal the parameters of that orbit. This method was not originally designed for the detection of planets, but is so sensitive that it is capable of detecting planets far smaller than any other method can, down to less than a tenth the mass of Earth. The main drawback of the pulsar-timing method is that pulsars are relatively rare so it is unlikely that a large number of planets will be found this way.

Transit Method

The transit method is based on the observation of a star's small drop in brightness, that occurs when the orbit (dashed line) of one of the star's planets passes ('transits') in front of the star The amount of light lost -typically between 0.01% and 1%- depends on the sizes of the star and the planet; and the duration of the transit depends on the planet's distance from the star and the star's mass. Since the star's mass and size can be determined from spectroscopic observations, the planet's size and distance can be determined. Of course, a transit has to occur once for every orbital revolution of the planet around the star. This repeated occurrence of transits is the major diagnostic tool to determine if an observed transit is really from a planet - it has to appear once in each of the planet's 'year'.

The repeatability of transits gives also the opportunity to observe a known transiting planet in the future with improved instrumentation - one day it may be possible to examine a planet's atmosphere (by spectroscopy of absorption lines from its atmosphere while it is transiting) and check it for indicators of life - such as the presence of free oxygen in the atmosphere.

Project – Transit of HAT-P-5b

HAT-P-5

HAT-P-5 is a star alike to our on sun in sharing the same classification, type G which is situated 340 (± 30) parsecs away. Observations from the HAT Net transit search programmes lead to arising suspicion of the potential orbiting of a transiting planet around this host star; a hypothesis which was later verified by spectroscopic observations. The planet causing the transit that we have been observing and analysing is called HAT-P-5b and was discovered on 9th October 2007.

Liverpool Telescope

Basic Information:

- The **Liverpool Telescope** is a 2-metre (6.6 ft) fully robotic telescope that observes /operates without human intervention.
- It is the largest robotic telescope in the world to be used primarily for astronomical research.
- The Telescope has a rapid-response capability where it can automatically interrupt regular observations to observe momentary phenomena with higher priority, such as gamma-ray bursts.

RiSE instrument

RiSE is a fast-readout camera designed and manufactured in the collaboration of a variety of people/places (Including mechanical design work being done at Liverpool John Moores). It was created for the precision measurement of transiting exoplanet timing.

Results

In our investigation we collected data of the brightness of three stars, HAT-P-5, C1 and C2 using 101 images collected by the Liverpool telescope. The images on the screen show the images from the brightest and darkest points of the 4.5 hours of exposure.

This graph displays the variation in brightness of the star HAT-P-5 over the course of the 4.5 hours that it was monitored. The change in luminosity of the host star in comparison to C1 was slight; the star, at most, only dimmed by 1.03% during the time it was monitored. From the results of our research into the topic that took, we managed to deduce that although the change in luminosity was very slight, in comparison to the other stars (referred to as C1 and C2),it is characteristic of an extra solar planetary transit.

Using the measurements of brightness from LTimage along with known data about the host star HAT-P-5, we were able to calculate the radius of the planet orbiting it with an accuracy of 92.6%.We calculated the planet radius to be 8.17×10^7m (=0.1167 solar radii); with a high degree of accuracy in comparison to the approximate suggested radius of the planet is 0.126 solar radii.

To conclude, we found through our investigation that there is an extra solar planet orbiting the host star HAT-P-5.