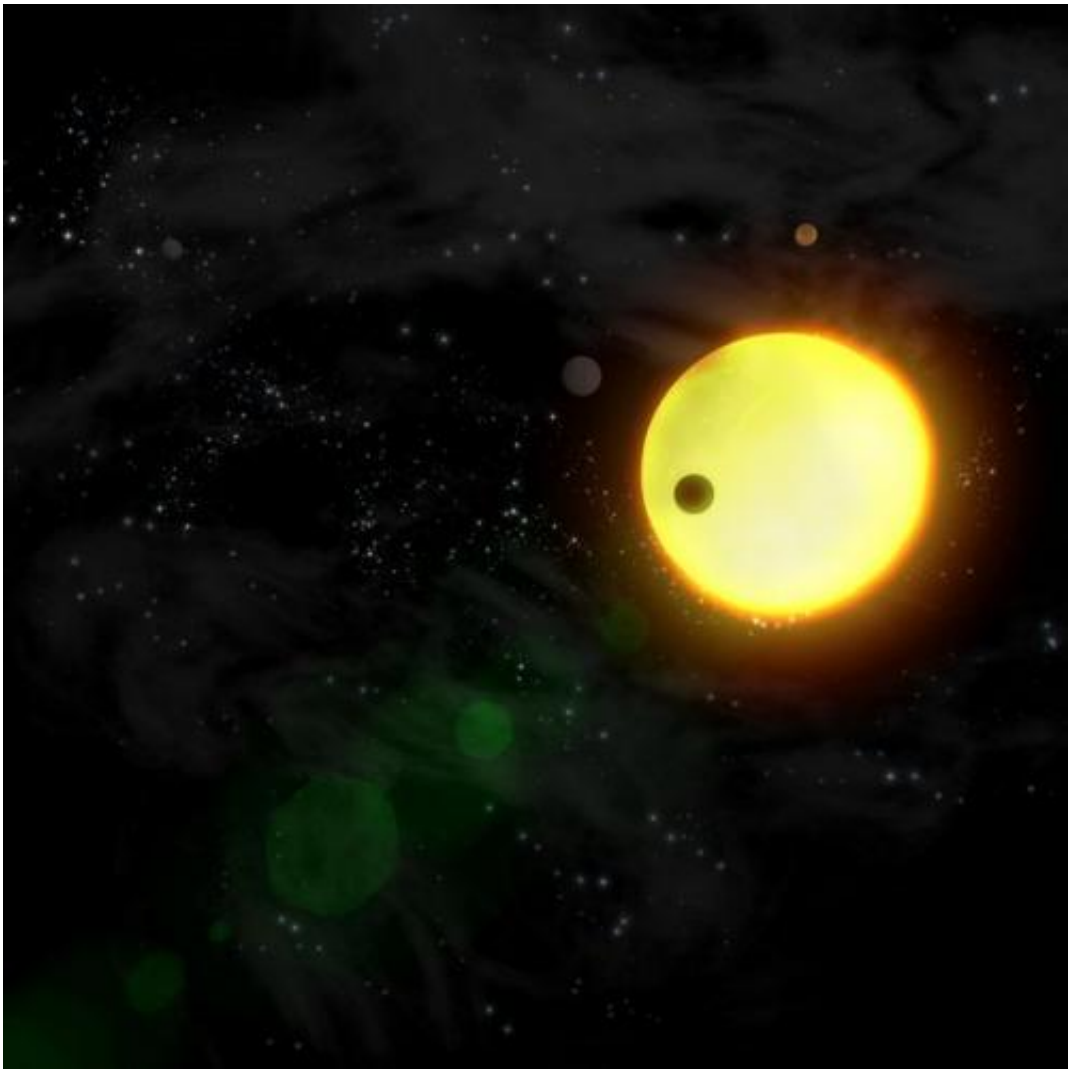
How well can astronomers study exoplanet atmospheres?

January 31 2012, By Ray Sanders



Artist's impression of exoplanets around other stars. Credits: ESA/AOES Medialab

Exoplanet discoveries are happening at a frenetic pace, and some of the latest newly discovered worlds are sometimes described as “Earth-Like” and “potentially habitable.”

The basis of this comparison is, in many cases, based on the distance between the exoplanet and its host star. Unfortunately the distance between a planet and its host star is only half the picture. The other half is determining if an exoplanet has an atmosphere, and what the contents of said atmosphere may be.

Basically, just because an exoplanet is in the “habitable zone” around its host star, it may not necessarily be habitable. If an exoplanet has a thick, crushing, Venus-Like atmosphere, it would most likely be too hot for surface water. The opposite holds true as well, as it could be entirely possible for an exoplanet to have a thin, wispy Mars-like atmosphere where any water would be locked up as ice.

At this point, how well can astronomers study the atmosphere around an exoplanet?

Currently, there are only a handful of methods researchers can use to make estimates of exoplanet atmospheres. Interestingly enough, one method makes use of the light coming from the host star. The basic principle is that the light from a star can be analyzed both before and after an exoplanet crosses in front of the star. By comparing the spectrum from the host star, and the spectrum of an exoplanet, the tell-tale signs of atmospheric contents can be detected.

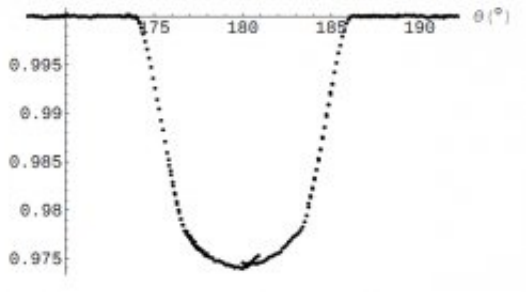
Methods to detect the atmospheric composition of such distant worlds are fairly new, as shown by work done with the Spitzer Space Telescope and ESO’s Very Large Telescope

Recently, astronomers from The Sternberg Astronomical Institute at

Moscow State University used data from the Hubble Space Telescope in an attempt to better detect atmospheres around exoplanets. Abubekerov and team created mathematical models to analyze light curves from distant stars. In the case of Abubekerov's research, the selected star was HD 189733 – a K-class star a bit cooler and smaller than our Sun.

About 60 light-years from Earth, HD 189733 also happens to have a binary companion orbiting it at a radius of about 200 A.U. So far, one exoplanet is known to orbit HD 189733. Discovered in 2005, HD 189733 b is a roughly Jupiter-size exoplanet which orbits its host star in just over two days. While not mentioned directly in Abubekerov's paper, other studies have detected methane, carbon monoxide, water vapor and sodium in HD 189733 b's atmosphere.

By applying their models to the light curves from HD 189733, Abubekerov's team was able to better understand how light at different wavelengths behaves when an exoplanet crosses in front of its host star.



Light curve from HD 189733 in 5500 - 6000 angstrom range.

According to Abubekerov and team, the end result of their research was unsuccessful. The team suspects dark spot activity on HD 189733 was a contributing factor to their models not agreeing with actual observations.

The team stressed that additional observational data from HD 189733 when spot activity is negligible would be required to further refine their work. Despite their models not being successful, the team is confident that exoplanet radius increases with decreasing wavelength, which may imply the presence of an atmosphere.

Research such as Abubekerov's will help astronomers build better models and pave the way for "sniffing" exoplanet atmospheres. Newer technology such as the James Webb Space Telescope and the European Extremely Large Telescope will also provide better data. In the not-too-distant future, astronomers and astrobiologists should be able to examine the atmospheres of exoplanets in the habitable zone.

If you'd like to read the full research paper, you can access a pre-print version at: http://arxiv.org/pdf/1201.4043v1.pdf

Source: Universe Today