Exploring the atmosphere of exoplanet WASP-14b

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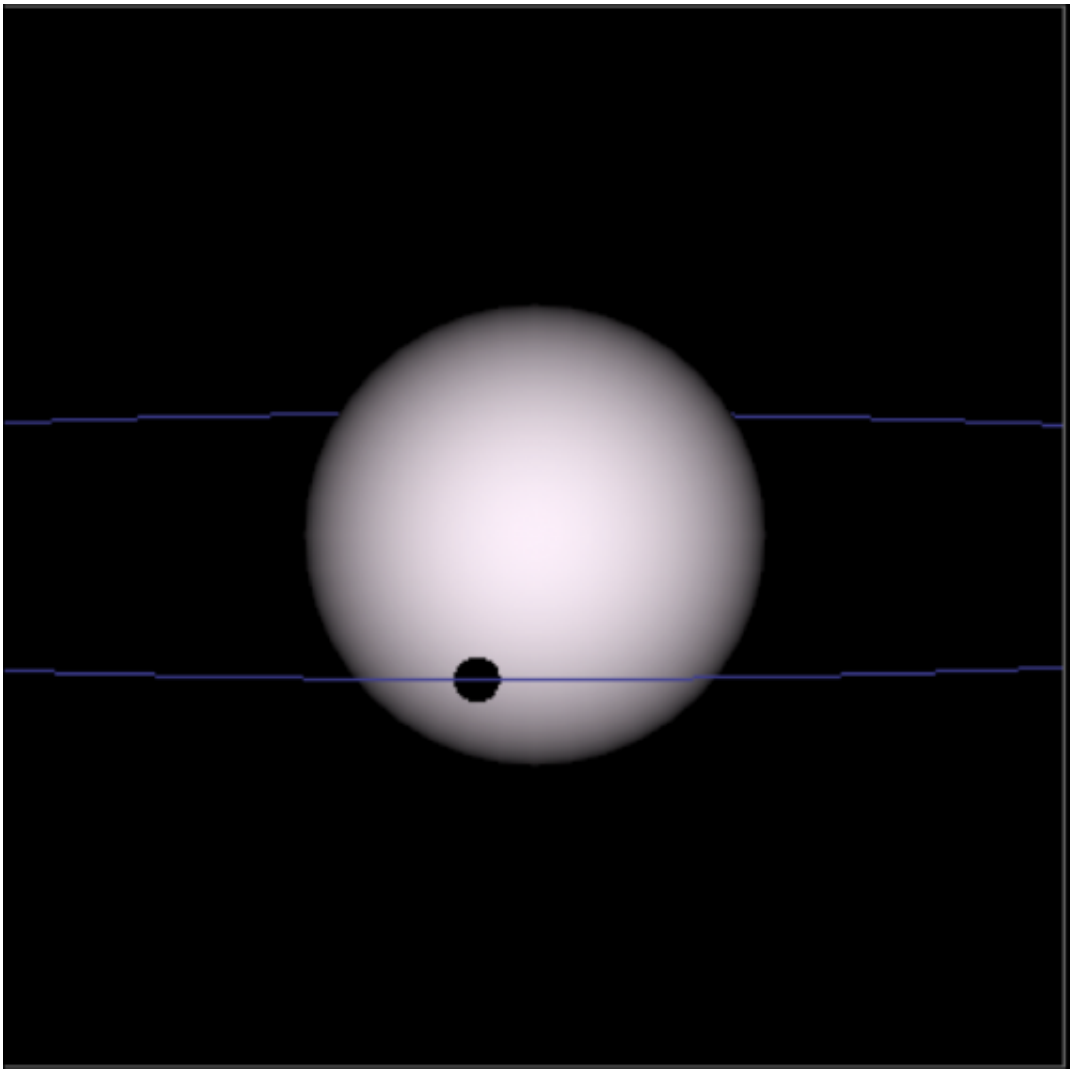

Conceptual orbit of WASP 14b system. Credit: SuperWASP team

First discovered in 2008, WASP 14b is an interesting exoplanet. It is roughly seven times as massive as Jupiter, but only 30% larger, making it among the densest known exoplanets. Recently, it was the target of observations from the Spitzer space telescope which was able to pick out the infrared radiation emitted by the planet and is giving astronomers new clues to how the atmospheres of Hot Jupiters function, contradicting expectations based on observations of other exoplanet atmospheres.

Images of the system were taken by a team of astronomers led by Jasmina Blecic and Joseph Harrington at the University of Central Florida. The team took images using three filters which allowed them to analyze the light at specific wavelengths. The brightness in each one was then compared to predictions made by models of atmospheres which included molecules such as H2O, CO, CH4, TiO, and VO as well as more typical atmospheric gasses like hydrogen, oxygen, and nitrogen.

While not having a large number of filters wouldn't allow the team to conclusively match a specific model, they were able to confidently rule out some possible characteristics. In particular, the team rules out the presence of a layer of atmosphere that changes sharply in temperature from the regions directly around it, known as a "thermal inversion layer". This comes as quite a surprise since observations of other hot Jupiters have consistently shown evidence of just such a layer. It was believed that all hot Jupiter type exoplanets should feature them if their atmospheres contained TiO or VO, molecules which filter out visible light. If they were present at a specific altitude, then that sudden layer of absorption would create a sudden shift in the temperature. The lack of this layer supports a 2009 study which suggested that such heavy molecules should settle out of the atmosphere and not be responsible for the thermal inversion layers. But this leaves astronomers with a fresh puzzle: If those molecules don't cause them, then what does?

The team also found that the planet was brighter than expected when it

was near the full phase which suggested that it is not as capable of redistributing its heat as some other exoplanets have been found to be. The team also confirmed that the planet has a notably elliptical orbit, despite being close to the star which should circularize the orbit. The astronomers that originally made the discovery of this planet postulated that this may be due to the presence of another planet which had a recent interaction that placed WASP 14b into its present orbit.

Source: Universe Today