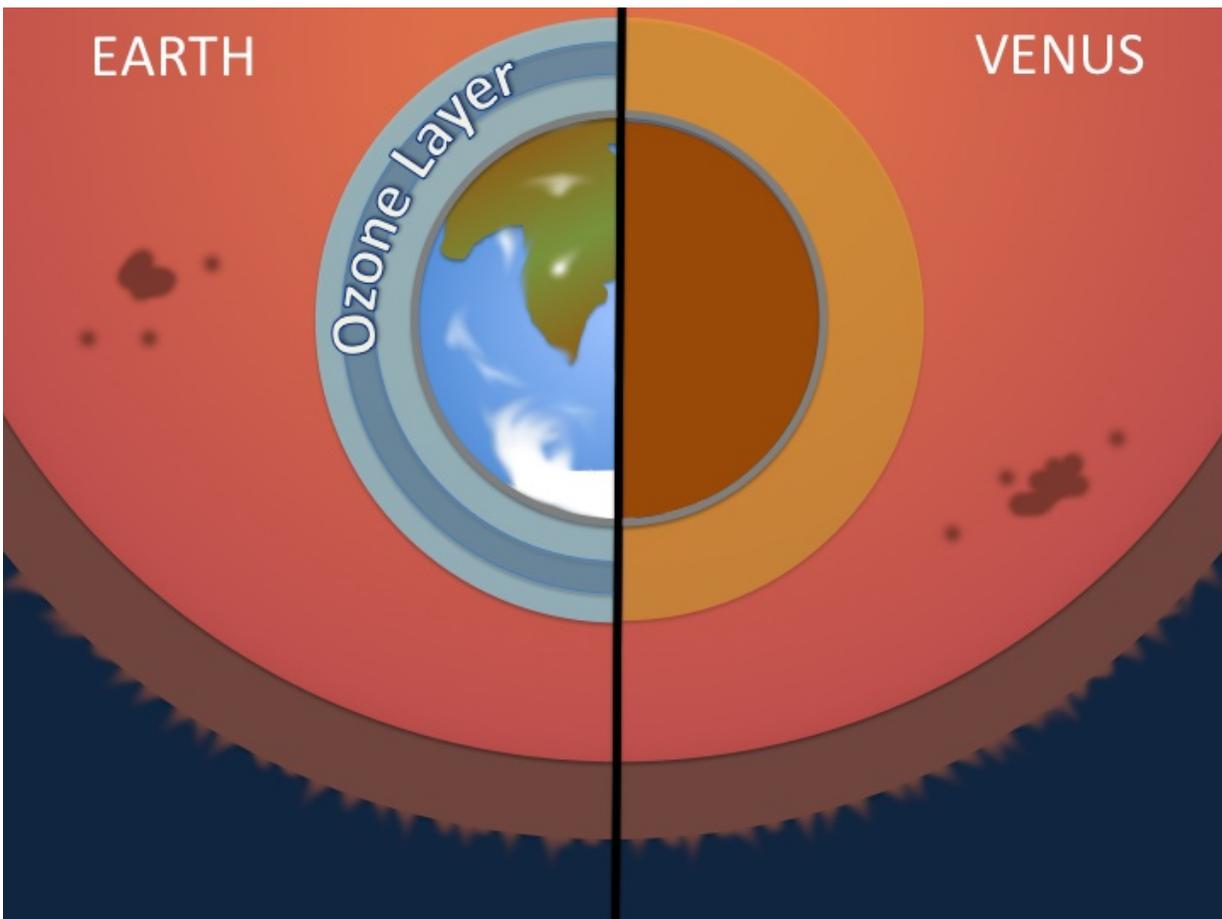


Seeking Earth-like planets with the James Webb Space Telescope

July 8 2015, by Dr Robert Massey



As the light from the star passes through the Earth's atmosphere some of it is absorbed in the ozone layer. This results in a clear feature that can be seen using telescopes like JWST. Venus, however, has no ozone layer so the feature is absent. Credit: J Barstow

Almost 2000 exoplanets have been discovered to date, ranging from rocky Earth-like planets to hot-Jupiters, and orbiting every type of star. But how many of these distant worlds are habitable? Today's technology means that we currently have very little information about what exoplanets are like beyond their presence, size and distance from star. With the launch of the James Webb Space Telescope (JWST), we may have our first glimpses into atmospheres of Earth-like exoplanets, according to the results of a study by Dr Joanna Barstow presented at the National Astronomy Meeting in Llandudno on Wednesday 8th July.

"A planet's [atmosphere](#) provides a good guide to likely conditions on the surface," said Barstow, of the University of Oxford. "The Earth's atmosphere contains significant amounts of nitrogen, oxygen, ozone and water. By contrast, its inhospitable 'evil twin', Venus, has an atmosphere made mostly of carbon dioxide, which drives its surface temperature to a blistering 450 degrees Celsius."

A successor to the Hubble Space Telescope, JWST is due for launch in 2018 and will study the universe in infrared wavelengths. Barstow's study shows that JWST may be able to differentiate between a planet with a clement, Earth-like atmosphere, and one with more hostile conditions such as are found on our neighbouring planet Venus. JWST will have the capability to detect key markers that could indicate the presence of a climate like our own when looking at Earth-sized planets around stars that are smaller and redder than our sun.

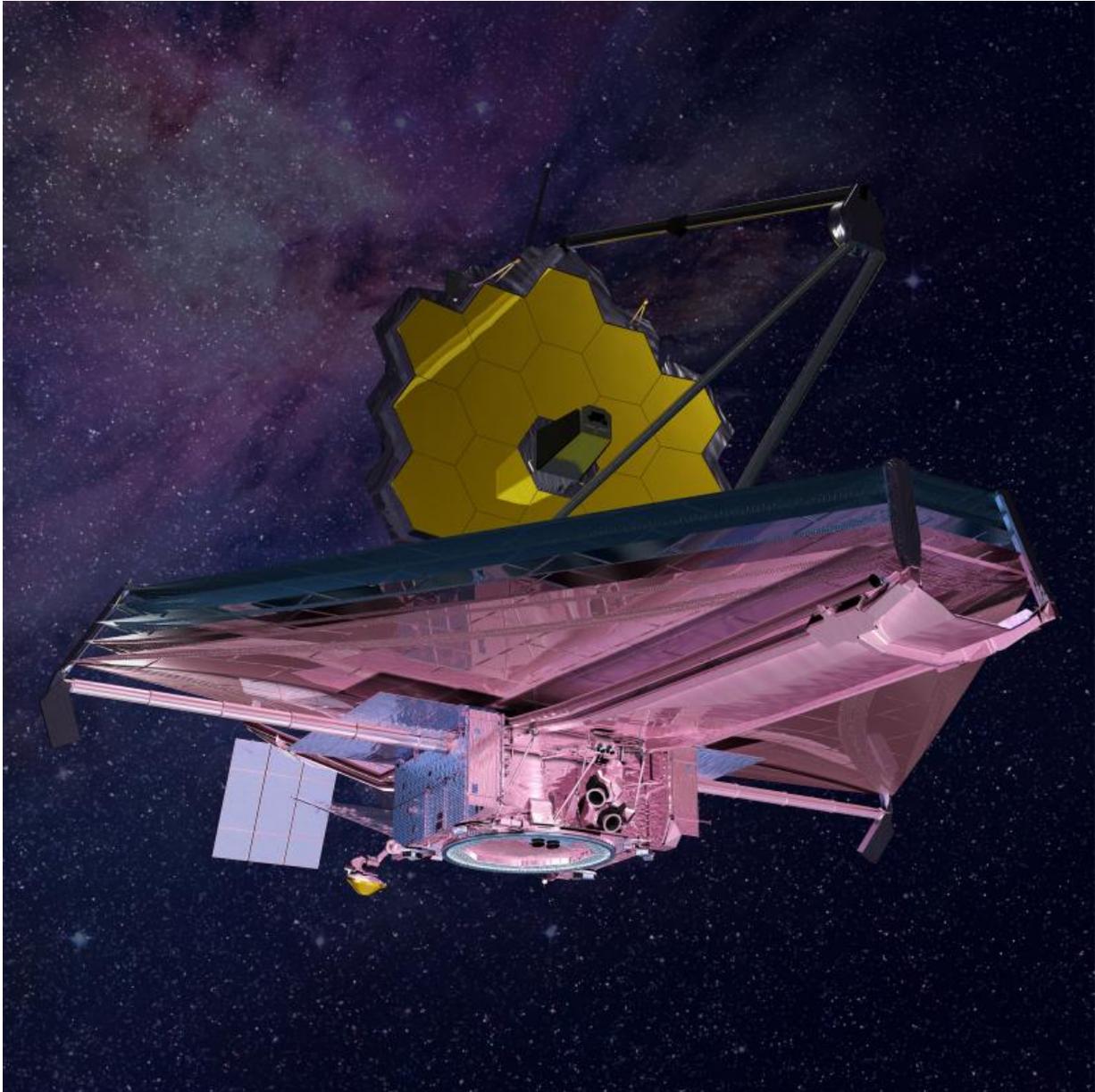
Different gases have already been identified successfully in the atmospheres of several large, hot, Jupiter-sized planets by studying tiny variations in the starlight that passes through their atmospheres when they cross in front of their parent stars. However, these variations are miniscule: the light filtered through the exoplanet's atmosphere is one ten-thousandth of the total starlight detected. Studying planets the size of the Earth is an even greater challenge. Although JWST would struggle

with analysing a solar system exactly like our own, it would be capable of studying Earth-like planets around cooler stars – if such a system were to be found.

"If we took the Earth and Venus, and placed them in orbit around a cool, red star that's not too far away, our study shows that JWST could tell them apart. Earth's [ozone layer](#), 10 kilometres above the surface, is produced when light from the sun interacts with molecules of oxygen in our atmosphere, and it produces an unmistakable signal that could be detected by JWST. Venus, without a substantial ozone layer, would look very different," said Barstow. "That's assuming that planets starting out like Earth and Venus would evolve in the same way around a cool star!"

However, JWST will be used for a wide range of astronomical applications, not just detecting exoplanets, and securing time on the telescope will be highly competitive. To make these detections, astronomers would need to observe the exoplanets at least 30 times, taking valuable telescope time.

"Future telescopes that are dedicated to observing the atmospheres of many rocky planets around different stars will be required to fully resolve the question of habitability on exoplanets. In the meantime, JWST will observe many other weird and wonderful [planets](#) in unprecedented detail," said Barstow.



James Webb Space Telescope Artist's Conception. Credit: Northrop Grumman/NASA

Provided by Royal Astronomical Society

Citation: Seeking Earth-like planets with the James Webb Space Telescope (2015, July 8)
retrieved 18 September 2024 from
<https://phys.org/news/2015-07-earth-like-planets-james-webb-space.html>

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