EXOPLANETS

Ocean detection by polarization colours

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The detection of an ocean on the surface of an extrasolar planet is an eagerly awaited result. However, current observational techniques are not suited to investigate exoplanetary surfaces. Victor Trees and Daphne Stam make the case for polarization measurements of the reflected stellar light by the planet as a promising way to detect exo-oceans.

Reflected light from an ocean on an exoplanet is expected to produce specular reflection and a varying degree of polarization with the incidence angle. Both phenomena strongly depend on the angle between the directions towards the planet's star and the observer (the phase angle). The authors simulate the total and polarized fluxes at visible wavelengths of stellar light reflected by a full ocean world and by a planet with a black surface, at all phase angles (0–180°). The properties of the planet's surface and atmosphere (for example, its roughness due to waves on the ocean, and its cloud coverage) strongly affect the calculation, so the authors include an atmospheric model with simplified cloud characterization and winds at the surface–atmosphere interface.

Trees and Stam find that the colour variations of the polarized flux behave in a specific and unambiguous way for ocean worlds, unless they are fully covered by clouds. This information would be lost by looking only at the total reflected flux. In addition, ocean planets show a significantly higher variability of the degree of polarization than black-surface planets. Such encouraging results could be tested by current and future orbital exoplanet-dedicated telescopes such as NASA's Transiting Exoplanet Survey Satellite (TESS) or ESA's PLAnetary Transits and Oscillations of stars (PLATO).

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