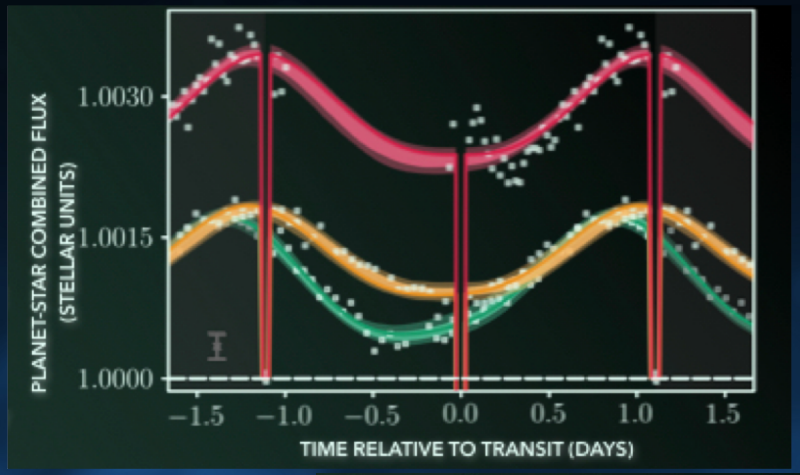
Reassessing Exoplanet Meteorology

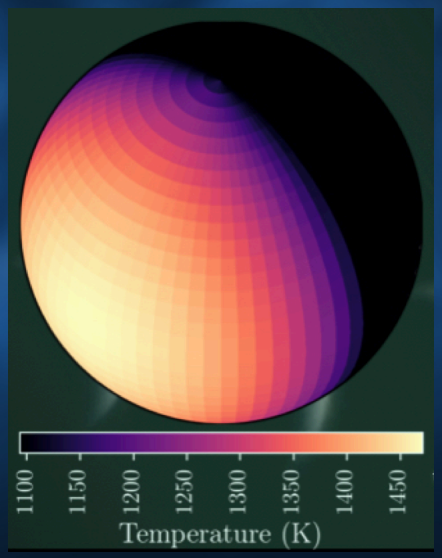
from the Thermal Phase Variations

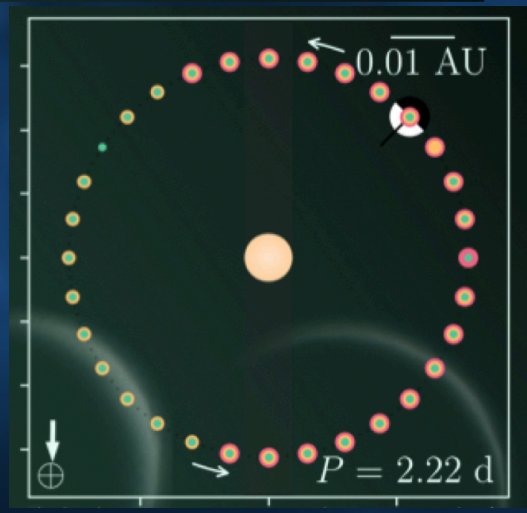
OBSERVATIONS: The Spitzer Space Telescope has observed 12 planets, all close-in giants, over the entirety of their orbits in at least one band of its infrared camera (IRAC). Having IR photometry of entire orbits gives us glimpses of planetary "phases", representing their thermal emission. These allow us to learn about properties of the planets' atmospheres on a global scale, such as wind speed, heating rate, temperature, and reflectivity to starlight. Multiple wavelengths of observations all us to probe different layers of the atmospheres, where temperature and pressure differences extend our understanding into the 3rd dimension.

NEW RESULTS: Exoplanet phase variations have now been modeled using the simplest set of physics, while retaining accuracy. The research team focused on getting major features correct, rather than trying to fit time-scale properties beyond the signal available in the data. The analysis indicates both that while there are a diversity of atmospheric properties, conclusions are limited by the quality of current data.

IMPLICATIONS FOR FUTRE MISSIONS: The push to accurately model exoplanet atmospheres has been underway for over a decade. To keep pace with the advances in model physical complexity, and eventually characterize the atmospheres of habitable worlds, increased resolution alone will not suffice. We need continued, thoughtful treatment of complex noise sources which come not only from planetary systems, but also from the instruments themselves. This will become particularly important as we approach the era of the James Webb Telescope, which promises a greater insight into the climates of these extrasolar worlds.







The brightness variations over an orbit (top), a sample of a thermal map (bottom left) and the corresponding position on an orbital diagram (bottom right). The radius of the host relative to the radius of the orbit in the diagram is accurate.

Adams, A. D. and Laughlin, G. (2018). *A.J.* 156 (1), 28. DOI: 10.3847/1538-3881/aac437