WEATHER ON EXOPLANETS AFFECTS OUR OBSERVATIONS

Hot Jupiters have cloudy and dynamic atmospheres. And if our Solar System planets are any benchmark, then we should expect climate and weather processes to be important. Simulations show that atmospheric dynamics can cause a planet’s phase curve to vary orbit-to-orbit [1]. Changes in cloud coverage can have the same effect. These weather processes influence the observed phase curve and might bias the properties we derive. Most planet phase curves are only observed once. If phase curves change in time, then we are missing something important!

WE TOOK THREE REPEAT PHASE CURVES OF WASP-43B TO SAMPLE ITS WEATHER

We observed two new phase curves of WASP-43b at 4.5 microns with Spitzer/IRAC. We analyzed these along with doing a reanalysis of the phase curve previously measured by Stevenson et al. 2017 [2]. This gave us three epochs with which to test for weather induced variability between phase curves.

WE FIND NO SIGNIFICANT VARIATION BETWEEN THE PHASE CURVES

Different model phase curves of varying cloud thickness. Our observations prefer either thin or thick clouds, suggesting a complex balance between night and dayside. Our observations rule out variations by > 2 scale heights.

WHAT DOES IT MEAN?

We find no variation between the three Spitzer phase curves. Within uncertainties, the phase curve properties did not vary between observations. The three observations were best fit by a single model, rather than three individual models. Other planets have received single epoch Spitzer phase curves, which can likely be trusted to be giving us reliable insight into those atmospheric properties. These Spitzer results place upper limits on atmospheric variability. JWST’s higher precision may reveal smaller scale changes.

We also compared these observations to an active cloud forming GCM [3]. Given our observations, we find that WASP-43b’s max cloud thickness cannot be changing by more than 2 pressure scale heights between visits.

REFERENCES