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Thermal Phase Variations of WASP-12b

Nicolas B. Cowan (1), P. Machalek (2), B. Croll (3), D. Deming (4), A. Burrows (5), J. Hora (6), T. Greene (2)
(1) Northwestern, IL, USA (n-cowan@northwestern.edu), (2) NASA Ames, CA, USA, (3) MIT, MA, USA, (4) University of Maryland, MD, USA, (5) Princeton, NJ, USA, (5) Harvard-Smithsonian CfA, MA, USA

Abstract

The short-period planet WASP-12b is among the hottest known transiting planets. Space- and ground-based secondary eclipse depths imply that this planet has a C/O ratio greater than 1 (Madhusudhan et al. 2011), in stark contrast to the chemistry in the Solar System and the assumed chemistry of other planets. These same eclipse data put the planet's day-side effective temperature at ∼3000 K. This indicates a low albedo and poor recirculation of heat to the night-side, as has been found for all of the hottest transiting giant planets (Cowan & Agol 2011b). But these trends were based solely on day-side observations (eclipse depths) rather than full phase variations, which directly probe night-side temperature. The short period (1.1 day) and inflated radius (1.8 R_J) of WASP-12b has led to speculation that it may be undergoing Roche-lobe overflow (Li et al. 2010, Lai et al. 2010), and UV observations by Fossati et al. (2010) seem to support this idea. We have recently obtained thermal phase curves of this planet with Warm Spitzer (PI: Machalek; PID 70060). Our data include two eclipses, a transit, and full phase coverage at each of 3.6 and 4.5 micron. Because of the planet's high temperature and large size, this is one of the highest S/N phase curves yet obtained with Spitzer. These data (currently being analyzed) will allow us to directly measure the planet's night-side temperature and the longitudinal offset of its day-side hotspot. Since the 3.6 and 4.5 micron bands probe different depths in the atmosphere, we will strongly constrain climate models for the hottest gas giants. The high precision transit and eclipse photometry offered by Spitzer will also allow us to search for signs of accretion in this system.

References

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