HD80606b TRANSIT OBSERVED BY MOST

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Overview

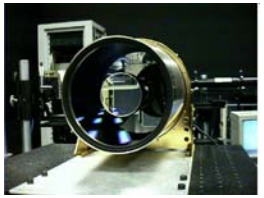
With an unusually high orbital eccentricity, HD80606b must be considered one of the most interesting planets discovered to date. Using the Canadian telescope MOST (Microvariability and Oscillations of Stars), we obtained data for both HD80606b's secondary and primary eclipses occurring on January 8th and 14th respectively. MOST is a space based telescope, and we were therefore able to observe the ~12 hour primary transit, which is an impossible task for ground based telescopes. We are currently fitting the primary transit using an algorithm detailed in Barnes 2007. One of our main goals is to determine a best fit of the primary eclipse to better constrain multiple parameters of the planet. The primary parameters of concern include: stellar and planetary radii, inclination, one or two limb darkening coefficients, time at periastron, and longitude of periapsis. We will also fit for the secondary eclipse in order to determine temperature and albedo of HD80606b, which will better our understanding of the chemical make-up of its atmosphere as well as its thermal evolution.

HD80606b Notes

View of HD80606b's orbit

— has greatest eccentricity (~.9336) of any planet discovered to date
— mass is ~4 times that of Jupiter, while radius is roughly equal to Jupiter
— period of 111.436 days in which it orbits at a distance of ~0.03AU to ~0.88AU
— large varriance of distances from star creates extreme temperature changes and causes its atmosphere to cross many chemical abundance boundaries
— likely has unique atmospheric dynamics and weather patterns compared to other transiting planets due to rapid heating and cooling

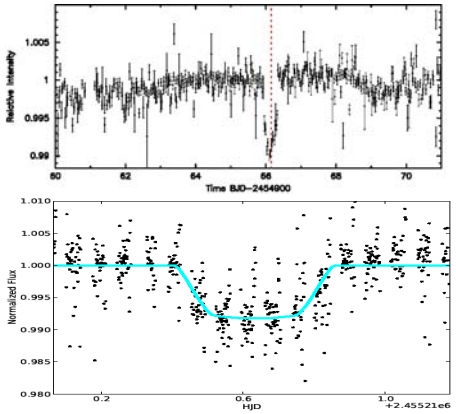
MOST Notes



MOST telescope with the primary mirror in the back of the tube. (Credited to the MOST gallery for the image)

— housed in a microsattelite 65 x 65 x 30cm with mass ~60kg
— posses an optical mirror 15cm in diameter
— a single broadband filter selects light at wavelengths from 350-700nm
— array of Fabry micro lenses projects a large stable image of target star
— for more information, visit http://www.astro.ubc.ca/MOST

HD80606b Transit Data



Top figure:
— full dataset of HD80606b (data binned in 30min intervals)
— red dotted line marks the location of the primary eclipse

Bottom figure:
— close-up of the primary transit
— blue line represents the best fit for primary eclipse of star mass = 1.0Msolar
— best fit variables listed below

Constant Variables	Fitted Variables
Stellar Mass = 1.0 Msolar	Stellar Radius = 0.98 Rsolar
Semimajor Axis = .453 AU	Planetary Radius = 0.911 Rjupiter
Orbital Period = 111.436 days	Inclination = 89.262°
Eccentricity = 0.9336	Limb Darkening = 0.404
Longitude of Periapsis = 300.651°	Time at Periastron = 2455204.917 HJD

— Error: $\mathbf{X^2 = 1.92717}$

Future Work

— have just begun fitting transit data, best fit shown here only one of very few done thus far
— unable to determine own stellar mass, literature shows that HD80606 has a stellar mass range of 0.9 – 1.1 Msolar, goal is to determine a best fit at each mass and compare
— once primary eclipse is properly fitted, will fit secondary eclipse for albedo and temperature
— using best fits to determine time of eclipse and transit, will calculate best time at periastron in order to find best longitude of periapsis
— all results found during this will be compared to ground-based observations and the recent Spitzer data of this same transit whose data varies greatly from previous results (examples of varying results listed below for comparison)

	Ground-based (Winn et al. 2009)	Spitzer (Hebrard et al. accepted)
Stellar Mass	1.05 +/- 0.032 Msolar	1.01 +/- 0.05 Msolar
Stellar Radius	0.968 +/- 0.028 Rsolar	1.007 +/- 0.024 Rsolar
Planetary Radius	0.974 +/- 0.030 Rjupiter	0.981 +/- 0.023 Rjupiter
Inclination	89.324 +/- 0.029 Deg	89.268 +/- 0.018 Deg
Argument of Pericenter	300.83 +/- 0.15 Deg	300.77 +/- 0.15 Deg

References

1) Barnes, J. W. (2007), PASP 119: 986
2) Gillion, M. (2009), MNRAS 380:1488
3) Hebrard G., et al. (accepted), A&A
4) Hidas, M. G., et al. (submitted), MNRAS
5) Naef, D., et al. (2001), A&A 375: L27
6) Rowe, J. F., et al. (2008), ApJ 689: 1345
7) Winn, J. N., et al. (2009), ApJ 709: 2091