



# 2008 - A Blast From the Past: A Spectroscopic look at the Flash Heating of HD80606b

Cycle: 1, Proposal Category: GO

## INVESTIGATORS

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Dr. Laura C Mayorga (CoI) (CoPI)	The Johns Hopkins University Applied Physics Laboratory
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Dr. Charles A. Beichman (CoI)	Jet Propulsion Laboratory
Dr. Gregory Laughlin (CoI)	Yale University
Dr. Mark S. Marley (CoI)	University of Arizona

## OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1	HD 80606b phase curve	MIRI Low Resolution Spectroscopy	(1) HD-80606

## ABSTRACT

High-eccentricity exoplanets are a unique class of planets that experience dramatic increases in insolation and tidal forcing near periastron passage. By observing the thermal response of the atmosphere before, during, and after periastron passage (the ‘flash-heating’ event), we can constrain physical processes within a single set of observations. We propose to utilize MIRI/LRS to observe a partial spectroscopic phase curve of the eccentric hot Jupiter HD 80606b. In conducting our spectroscopic observations from 12 hrs before through to 8 hrs after periastron, we will capture the time- and wavelength-dependent flux before, during and after HD 80606b’s flash-heating event. This information will allow us to constrain the internal

heating of HD 80606b, probe variations in clouds and chemistry throughout HD 80606b's orbit, and assess the role of dynamical mixing in HD 80606b's atmosphere. Our proposed MIRI/LRS observations of HD~80606b will build upon the rich legacy of Spitzer, Hubble, and now TESS and bring a new experimental look into fundamental processes that shape the phase-curve observations of not only eccentric hot Jupiters, but all hot Jupiters.

## **OBSERVING DESCRIPTION**

These observations aim to capture the temporal thermal variations in the highly eccentric exoplanet HD80606b's atmosphere during its periastron passage. The overall length of the observations and the achievable precision are key to meeting the science goals. We will use the MIRI LRS slitless mode to maximize both the signal from the planet and the achievable precision. Our observations will be taken in the standard MIRI LRS slitless configuration that uses the slitlessprism subarray, fast readmode, and no filter. We have selected 14 groups per integration so as to not exceed 80% full well and avoid saturation while maximizing the observing efficiency. The observations will consist of 32337 integrations with 2.3856 seconds per integration covering roughly 20 hours of HD80606b's orbit centered on the secondary eclipse event and inclusive of periastron passage. Given the target brightness and leveraging simulations from JWST PandExo, we expect to achieve a one-sigma precision of 100 ppm at 8 micron on a 1 hour timescale. We have allowed for a full 60 minute window/phase range at the start of the observation, which will still allow for capture of the relevant events/timescales during the course of the observations. This observation start window has been specified to ensure that sufficient time before and after the periastron passage of the planet are captured to allow for characterization of the planet's heating and subsequent response. We will consider discarding the first 30-45 minutes of the observation if necessary due to detector ramp effects with no impact on the overall science goals. Given the observability of the target and its orbital period, there are two opportunities to capture the periastron passage of HD80606b during cycle 1.

For target acquisition we have followed the procedure outlined in JDox for MIRI LRS slitless observations. We will acquire on the science target using the slitlessprism subarray with the fast readout pattern with 4 groups per integration and 1 integration resulting in a 0.64 second exposure time. We have selected the F1000W filter in our target acquisition strategy to avoid saturation while still achieving a SNR of 389 during the target acquisition.

Proposal 2008 - Targets - A Blast From the Past: A Spectroscopic look at the Flash Heating of HD80606b

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	HD-80606	RA: 09 22 37.6680 (140.6569500d) Dec: +50 36 13.60 (50.60378d) Equinox: J2000	Proper Motion RA: 0.005875195586551243 sec of time/yr Proper Motion Dec: 0.01034 arcsec/yr Epoch of Position: 2015.5	
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=Star Description=[Exoplanet Systems, G stars] Extended=NO				

Proposal 2008 - Observation 1 - A Blast From the Past: A Spectroscopic look at the Flash Heating of HD80606b

Mon Mar 24 19:00:09 GMT 2025

<b>Observation</b>	<p><b>Proposal 2008, Observation 1: HD 80606b phase curve</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: MIRI Low Resolution Spectroscopy</p> <p><i>Comments: As stated in proposal, observations should begin ~12 hours before periastron passage. Upcoming periastron passages:</i></p> <p>2025-04-11 06:33:17                  2025-07-31 17:03:20                  2025-11-20 03:30:2</p>																												
<b>Diagnostics</b>	<p>(HD 80606b phase curve (Obs 1)) Warning (Form): Exposure Duration exceeds the limit of 10000.0 seconds. Above this limit it is possible that a High Gain Antenna move may occur during the exposure.</p> <p>(HD 80606b phase curve (Obs 1)) Warning (Form): Groups/Int cannot be 1, Groups/Int = 2 requires permission and Groups/Int of 3-4 is allowed but not recommended.</p> <p>(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>																												
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Spectral Elements	#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	Special Requirements	1	FASTR1	14	10812	32436	3	1	77378.844
	Between Dates 10-APR-2025:17:33:17 and 10-APR-2025:18:33:17 Aperture PA Range 100 to 247 Degrees (V3 95.16455103 to 242.16455103) Aperture PA Range 282 to 65 Degrees (V3 277.16455103 to 60.16455103) Time Series Observation No Parallel Attachments								