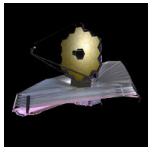

10290 - Mistaken Identity? Resolving Ultra-hot Jupiter NUV Absorption to Measure Refractory-to-Volatile Ratios

Cycle: 5, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Joshua D. Lothringer (PI)	**Space Telescope Science Institute**
Prof. David K. Sing (CoI)	The Johns Hopkins University
Dr. Kevin Stevenson (CoI)	The Johns Hopkins University Applied Physics Laboratory
Dr. Dominic Samra (CoI)	University of Chicago
Dr. Leonardo Dos Santos (CoI)	Space Telescope Science Institute
Ms. Lakeisha M. Ramos Rosado (CoI)	The Johns Hopkins University
Ms. Katherine Bennett (CoI)	The Johns Hopkins University
Dr. Hannah Wakeford (CoI) (ESA Member)	University of Bristol
Mr. Stephen Paul Schmidt III (CoI)	The Johns Hopkins University
Dr. Reza Ashtari (CoI)	The Johns Hopkins University Applied Physics Laboratory
Dr. Ryan J MacDonald (CoI) (ESA Member)	University of St Andrews
Dr. Katy Chubb (CoI) (ESA Member)	University of Bristol
Elijah Mullens (CoI)	Cornell University
Helena Lecoq-Molinos (CoI) (ESA Member)	University of Bern
Dr. Sarah E. Moran (CoI)	University of Maryland
Zafar Rustamkulov (CoI)	California Institute of Technology

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		MIRI Low Resolution Spectroscopy	(1) HD-134004

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	2		MIRI Low Resolution Spectroscopy	(2) HD-134004-BKGD

ABSTRACT

Ultra-hot Jupiters offer the unique opportunity to measure the rock and metal content of gas giant planets. Such a measurement provides valuable insight into the reservoir of material from which a planet formed, which can subsequently inform models that constrain a planet's formation mechanism and history. One way in which this is done is by measuring the absorption of refractory species in the NUV transit spectrum. Recent measurements have revealed enormous >10 scale-height NUV absorption features, however the cause of this absorption has remained controversial.

WASP-178b was the first planet to show this large NUV absorption, but atmospheric retrievals are consistent with either SiO or atomic metals causing the absorption. Inferences about WASP-178b's formation hinges on properly attributing the NUV absorption: Retrievals indicate that if SiO causes the absorption, it implies a sub-stellar/stellar refractory abundance. However, if Fe and Mg cause the NUV absorption, it implies a super-stellar refractory abundance.

We propose to observe WASP-178b with MIRI/LRS to measure the 8 micron gaseous SiO. If the NUV absorption is caused by SiO, we expect to see a large SiO feature in the MIR. If SiO is not contributing to the NUV absorption, we expect to only see H2O in the MIR transit spectrum. These two scenarios are distinguished at very high statistical significance (delta-BIC > 80) with our efficient <10 hour observations. By properly identifying WASP-178b's NUV absorption, we will progress toward more robust exoplanet formation inferences.

OBSERVING DESCRIPTION

We propose to obtain a transmission spectrum of WASP-178b with MIRI/LRS (5-12 microns). Only one transit is necessary to identify SiO at high statistical significance according to simulations with PandExo. We will use 104 groups per integration with 1620 integrations in the visit to observe for a total of 7.5 hours, covering the 3.47 hour long transit with adequate out-of-transit baseline, including the JDox recommended 30-minutes for detector settling.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HD-134004	RA: 15 09 4.8934 (227.2703892d) Dec: -42 42 17.79 (-42.70494d) Equinox: J2000	Proper Motion RA: -10.243 mas/yr Proper Motion Dec: -5.636000082631654 mas/yr Parallax: 0.0024248" Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.

AKA WASP-178
Category=Star
Description=[A dwarfs, A stars, Exoplanet Systems, Exoplanets]
Extended=NO

(2)	HD-134004-BKGD	RA: 15 08 56.0000 (227.2333333d) Dec: -42 42 17.79 (-42.70494d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Parallax: 0" Epoch of Position: 2000	

Comments: Background field associated with WASP-178. Relatively clear.
Category=Calibration
Description=[Telescope/sky background]
Extended=NO

Observation

Proposal 10290, Observation 1

Wed May 20 22:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Background Observations:[Observation 2]

Diagnostics

(Observation 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.

(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HD-134004	RA: 15 09 4.8934 (227.2703892d) Dec: -42 42 17.79 (-42.70494d) Equinox: J2000	Proper Motion RA: -10.243 mas/yr Proper Motion Dec: -5.636000082631654 mas/yr Parallax: 0.0024248" Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.

AKA WASP-178
Category=Star
Description=[A dwarfs, A stars, Exoplanet Systems, Exoplanets]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
1	SAME	F1000W	FAST	6	1	1	0.954	273071.2

Template

Subarray	Obtain Verification Image?
SLITLESSPRISM	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	NONE				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	Optional ETC ID	Filter
1	FASTR1	10	1	1	1	1	1.59		F1000W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	Optional ETC ID
1	FASTR1	104	1590	1590	1	1	26551.569	273071.1

Special Requirements

Phase 0.947 to 0.96 with period 3.3448334281314875 Days and zero-phase 2456612.6581 HJD
Time Series Observation
No Parallel Attachments

Group Observations 1, 2, Non-interruptible

Observation

Proposal 10290, Observation 2

Wed May 20 22:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Background Observation For: [Observation 1]

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	HD-134004-BKGD	RA: 15 08 56.0000 (227.2333333d) Dec: -42 42 17.79 (-42.70494d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Parallax: 0" Epoch of Position: 2000	

Comments: Background field associated with WASP-178. Relatively clear.
Category=Calibration
Description=[Telescope/sky background]
Extended=NO

Acquisition

#	Target
1	NONE

Template

AcqFilter	Subarray	Obtain Verification Image?
	SLITLESSPRISM	false

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	NONE				

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	Optional ETC ID
1	FASTR1	104	5	5	1	1	83.337	

Special Requirements	
	Time Series Observation No Parallel Attachments Group Observations 1, 2, Non-interruptible