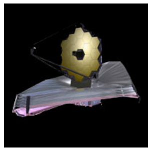

5191 - Bare rocks are not supposed to do that

Cycle: 3, Proposal Category: GO

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Dr. Megan Weiner Mansfield (CoI)	University of Maryland

OBSERVATIONS

Folder	***Observation***	***Label***	***Observing Template***	***Science Target***
TRAPPIST-1				
	1	Visit1	MIRI Imaging	(1) TRAPPIST-1
	2	Visit2	MIRI Imaging	(1) TRAPPIST-1
	3	Visit3	MIRI Imaging	(1) TRAPPIST-1
	4	Visit4	MIRI Imaging	(1) TRAPPIST-1

ABSTRACT

We propose to elucidate the origin of several puzzling observations relative to the thermal fluxes of TRAPPIST-1 b and c in the mid-infrared. Recent observations of five secondary eclipses of TRAPPIST-1 b and a partial eclipse of c in the F1280W band have revealed two puzzling findings:

- During one visit, JWST recorded a partial eclipse of TRAPPIST-1 c with an unexpectedly large occultation depth, contradicting previous 15microns measurements and equilibrium temperature predictions.
- Brightness variations between visits during the five TRAPPIST-1 b eclipses, not seen at 15 microns, suggest intriguing potential origin such as star-planet interactions through photochemistry or outgassing.

To solve both these mysteries at once and save telescope time, we propose to observe four eclipses of TRAPPIST-1 b and c one after the other during the same visits, requiring a total of 23.3 hours. This proposal is key to unraveling the TRAPPIST-1 innermost planets' internal heating and atmospheric characteristics, and will have major implications for the system’s outer, potentially habitable planets

OBSERVING DESCRIPTION

Our observations consist of time series photometry during four eclipses of the planets TRAPPIST-1 c and TRAPPIST-1 b, that we will time in the same visits.

For each eclipse, the observations will be performed with the MIRI Imaging F1500W filter using the FASTR1 read-out mode and the MIRI SUB256 subarray to maximize groups per integration. These observations must be executed in a continuous sequence. Each of the four visits must be timed to coincide with eclipses of the the two planets and such that they append within enough time from each other to provide adequate baselines (minimum of 42 minutes between the egress of the first eclipse and the ingress of the second eclipse). We have reported several observing windows over the Cycle 3 period that fulfill these criteria (6 possible windows but only 4 required).

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 29.3685 (346.6223688d) Dec: -05 02 29.04 (-5.04140d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.0380000258665 mas/yr Parallax: 0.0802123" 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.
Category=Star
Description=[M dwarfs]
Extended=NO

Observation

Proposal 5191, Observation 1: Visit1

Wed Sep 03 17:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

(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)	TRAPPIST-1	RA: 23 06 29.3685 (346.6223688d) Dec: -05 02 29.04 (-5.04140d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.0380000258665 mas/yr Parallax: 0.0802123" 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.
Category=Star
Description=[M dwarfs]
Extended=NO

Template

Subarray
SUB256

Spectral Elements

#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	F1280W	FASTR1	93	310	1	None	1	310	8727.713	

Special Requirements

Between Dates 29-OCT-2024:00:00:00 and 31-OCT-2024:00:00:00
Phase 0.469031215326 to 0.47763365549 with period 2.42179346 Days and zero-phase 2460469.9030580 HJD
Time Series Observation
No Parallel Attachments

Observation

Proposal 5191, Observation 2: Visit2

Wed Sep 03 17:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

(Visit2 (Obs 2)) 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 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 29.3685 (346.6223688d) Dec: -05 02 29.04 (-5.04140d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.0380000258665 mas/yr Parallax: 0.0802123" 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.
Category=Star
Description=[M dwarfs]
Extended=NO

Template

Subarray
SUB256

Spectral Elements

#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	F1280W	FASTR1	93	394	1	None	1	394	11092.723	

Special Requirements

Between Dates 10-NOV-2024:00:00:00 and 12-NOV-2024:00:00:00
Phase 0.4578480432008891 to 0.4664504833665 with period 2.42179346 Days and zero-phase 2460469.9030580 HJD
Time Series Observation
No Parallel Attachments

Observation

Proposal 5191, Observation 3: Visit3 Wed Sep 03 17:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

(Visit3 (Obs 3)) 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 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 29.3685 (346.6223688d) Dec: -05 02 29.04 (-5.04140d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.0380000258665 mas/yr Parallax: 0.0802123" 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.
Category=Star
Description=[M dwarfs]
Extended=NO

Template

Subarray
SUB256

Spectral Elements

#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	F1280W	FASTR1	93	491	1	None	1	491	13823.747	

Special Requirements

Between Dates 22-NOV-2024:00:00:00 and 24-NOV-2024:00:00:00
Phase 0.44494438295233 to 0.45354682311803 with period 2.42179346 Days and zero-phase 2460469.9030580 HJD
Time Series Observation
No Parallel Attachments

Proposal 5191 - Observation 4 - Bare rocks are not supposed to do that

Observation

Proposal 5191, Observation 4: Visit4

Wed Sep 03 17:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

(Visit4 (Obs 4)) 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 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 29.3685 (346.6223688d) Dec: -05 02 29.04 (-5.04140d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.0380000258665 mas/yr Parallax: 0.0802123" 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.
Category=Star
Description=[M dwarfs]
Extended=NO

Template

Subarray
SUB256

Spectral Elements

#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	F1280W	FASTR1	93	555	1	None	1	555	15625.659	

Special Requirements

Between Dates 04-DEC-2024:00:00:00 and 06-DEC-2024:00:00:00
Phase 0.4363419429148 to 0.444944383080 with period 2.42179346 Days and zero-phase 2460469.9030580 HJD
Time Series Observation
No Parallel Attachments