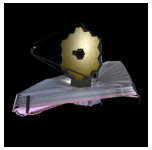

6456 - Using stellar contamination proxy TRAPPIST-1 b to search for an atmosphere on TRAPPIST-1 e

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	***Observation***	***Label***	***Observing Template***	***Science Target***
TRAPPIST-1 b + e				
	1	530	NIRSpec Bright Object Time Series	(1) TRAPPIST-1
	2	587	NIRSpec Bright Object Time Series	(1) TRAPPIST-1
	3	531	NIRSpec Bright Object Time Series	(1) TRAPPIST-1
	4	585	NIRSpec Bright Object Time Series	(1) TRAPPIST-1
	5	586	NIRSpec Bright Object Time Series	(1) TRAPPIST-1
	15	556	NIRSpec Bright Object Time Series	(1) TRAPPIST-1

ABSTRACT

The detection of the atmosphere of a terrestrial planet in the habitable zone of its host star is one of the main goals of the exoplanet community. In order to see the small signals from terrestrial atmospheres using transmission spectroscopy, small host stars are necessary, as the transit depth is directly dependent on the relative size of the planet to the star. However, early observations of terrestrial planets around small stars with JWST have shown that these small M dwarfs are dangerous. Heterogeneities on the stellar surface, common for M dwarfs, can contaminate the transmission spectrum and cause variations on a level much larger than any atmospheric signals. However, the TRAPPIST-1 system contains a possible solution to overcome this stellar contamination. Using the multiplicative effect of the stellar contamination signal to our advantage, we propose to observe close (but not overlapping) transits of TRAPPIST-1 b and TRAPPIST-1 e. The ratio of the resulting transmission spectrum will correct for the signal from the stellar contamination, and leave only the ratio of their atmospheric opacities. Assuming little to no atmospheric signal from TRAPPIST-1 b based on the thermal emission observations, we expect this ratio to result in the transmission spectrum of TRAPPIST-1 e normalized by the flat transit depth of TRAPPIST-1 b. Using this method, we can detect an Earthlike atmosphere on TRAPPIST-1 e using 15 close transits of TRAPPIST-1 b and e to 3 sigma significance.

OBSERVING DESCRIPTION

We will use NIRSpec/PRISM for our observations. Based on the results from GTO 1331 (priv. communication), we use 5 groups per integration, which is 1.377 seconds per integration, and use the 512 subarray. TRAPPIST-1 itself can be used for target acquisition, which has already had success with previous TRAPPIST-1 observations. The proposed lengths of all 15 stares, both science and charged in hours, are given in Table 1 in the proposal, and total 128.8 hours: 52.1 in Cycle 3 and 76.7 in Cycle 4.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3652 (346.6265217d) Dec: -05 02 36.70 (-5.04353d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.038 mas/yr Parallax: 0.0802123" Epoch of Position: 2016	

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

Taken from GTO 1331, updated based on Astrometry from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets, M stars]
Extended=NO

Observation

Proposal 6456, Observation 1: 530

Tue Mar 26 21:10:33 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(530 (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.

(530 (Obs 1)) Warning (Form): Record ETC Wkbk.Calc ID used to verify target acquisition.

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

(Visit 1:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3652 (346.6265217d) Dec: -05 02 36.70 (-5.04353d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.038 mas/yr Parallax: 0.0802123" Epoch of Position: 2016	

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

Taken from GTO 1331, updated based on Astrometry from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets, M stars]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	

Template

Subarray
SUB512

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	NRSRAPID	5	22070	1	1	22070	30400.101	

Special Requirements	Between Dates 05-JUL-2024:01:32:56 and 05-JUL-2024:02:32:56 Time Series Observation No Parallel Attachments

Observation

Proposal 6456, Observation 2: 587

Tue Mar 26 21:10:33 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(587 (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.

(587 (Obs 2)) Warning (Form): Record ETC Wkbk.Calc ID used to verify target acquisition.

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

(Visit 2:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3652 (346.6265217d) Dec: -05 02 36.70 (-5.04353d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.038 mas/yr Parallax: 0.0802123" Epoch of Position: 2016	

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

Taken from GTO 1331, updated based on Astrometry from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets, M stars]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	

Template

Subarray
SUB512

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	NRSRAPID	5	9830	1	1	9830	13540.235	

Special Requirements	Between Dates 17-JUN-2025:18:07:36 and 17-JUN-2025:19:07:36 Time Series Observation No Parallel Attachments

Observation

Proposal 6456, Observation 3: 531

Tue Mar 26 21:10:33 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(531 (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.

(531 (Obs 3)) Warning (Form): Record ETC Wkbk.Calc ID used to verify target acquisition.

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

(Visit 3:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3652 (346.6265217d) Dec: -05 02 36.70 (-5.04353d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.038 mas/yr Parallax: 0.0802123" Epoch of Position: 2016	

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

Taken from GTO 1331, updated based on Astrometry from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets, M stars]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	

Template

Subarray
SUB512

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	NRSRAPID	5	18480	1	1	18480	25455.091	

Special Requirements	Between Dates 11-JUL-2024:03:57:46 and 11-JUL-2024:04:57:46 Time Series Observation No Parallel Attachments

Observation

Proposal 6456, Observation 4: 585

Tue Mar 26 21:10:33 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(585 (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.

(585 (Obs 4)) Warning (Form): Record ETC Wkbk.Calc ID used to verify target acquisition.

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

(Visit 4:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3652 (346.6265217d) Dec: -05 02 36.70 (-5.04353d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.038 mas/yr Parallax: 0.0802123" Epoch of Position: 2016	

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

Taken from GTO 1331, updated based on Astrometry from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets, M stars]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	

Template

Subarray
SUB512

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	NRSRAPID	5	16840	1	1	16840	23196.09	

Special Requirements	Between Dates 05-JUN-2025:13:22:10 and 05-JUN-2025:14:22:10 Time Series Observation No Parallel Attachments

Observation

Proposal 6456, Observation 5: 586

Tue Mar 26 21:10:33 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(586 (Obs 5)) 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.

(586 (Obs 5)) Warning (Form): Record ETC Wkbk.Calc ID used to verify target acquisition.

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 5:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3652 (346.6265217d) Dec: -05 02 36.70 (-5.04353d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.038 mas/yr Parallax: 0.0802123" Epoch of Position: 2016	

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

Taken from GTO 1331, updated based on Astrometry from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets, M stars]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	

Template

Subarray
SUB512

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	NRSRAPID	5	13300	1	1	13300	18319.952	

Special Requirements	Between Dates 11-JUN-2025:15:45:09 and 11-JUN-2025:16:45:09 Time Series Observation No Parallel Attachments

Observation

Proposal 6456, Observation 15: 556

Tue Mar 26 21:10:33 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(556 (Obs 15)) 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.

(556 (Obs 15)) Warning (Form): Record ETC Wkbk.Calc ID used to verify target acquisition.

(Visit 15:1) 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 30.3652 (346.6265217d) Dec: -05 02 36.70 (-5.04353d) Equinox: J2000	Proper Motion RA: 930.788 mas/yr Proper Motion Dec: -479.038 mas/yr Parallax: 0.0802123" Epoch of Position: 2016	

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

Taken from GTO 1331, updated based on Astrometry from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets, M stars]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	

Template

Subarray
SUB512

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	PRISM/CLEAR	NRSRAPID	5	23370	1	1	23370	32190.773	

Special Requirements	Between Dates 10-DEC-2024:16:24:09 and 10-DEC-2024:17:24:09 Time Series Observation No Parallel Attachments