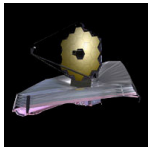

4195 - Constraining the Oxidation State of the Super-Earth TOI-1685 b

Cycle: 2, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	TOI-1685b transit 1	NIRSpec Bright Object Time Series	(1) TOI-1685
	2	TOI-1685b transit 2	NIRSpec Bright Object Time Series	(1) TOI-1685
	3	TOI-1685b transit 3	NIRSpec Bright Object Time Series	(1) TOI-1685
	4	TOI-1685b transit 4	NIRSpec Bright Object Time Series	(1) TOI-1685
	104	TOI-1685b transit 4	NIRSpec Bright Object Time Series	(1) TOI-1685

ABSTRACT

Characterising the atmosphere of a rocky exoplanet can provide valuable insight into the interior conditions of the planet. In particular, by constraining the ratio of CO2 and CO abundances, we can infer the oxidation state (or oxygen fugacity) of the planet's mantle. In the Solar System, their exists a relationship between planet mass and oxidation state, with larger planets being more oxidized. By constraining the oxidation state of a super-Earth exoplanet, we can determine if novel interior dynamics are operating, contrasting what we know from our Solar System. The super-Earth TOI-1685 b is on an ultra-short period orbit around an M dwarf, and has a low density compared with other similar targets, making it ideal for atmospheric characterisation. We propose to use JWST/NIRSpec in BOTS mode with the G395H disperser to observe four transits of TOI-1685 b. Mock retrievals showed this planets can be well-characterised in this mode, providing valuable constraints on its oxidation state. Due to the lack of super-Earths in the Solar System versus their prevalence around other stars, the information we learn about TOI-1685 b is likely to be widely applicable to thousands of other exoplanets.

OBSERVING DESCRIPTION

We will observe four transits of TOI-1685 b using NIRSpec in BOTS mode. We will use the G395H disperser and the default S1600A1 slit. We will use the F290LP filter with the SUB2048 subarray with NRSRAPID mode.

The observations must cover the full transit, along with sufficient out-of-transit baseline before and after. To obtain this, we will take half the transit

time before and after. This leads to a visit duration of 6.18 hours for each transit.

Proposal 4195 - Targets - Constraining the Oxidation State of the Super-Earth TOI-1685 b

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TOI-1685	RA: 04 34 22.5504 (68.5939600d) Dec: +43 02 13.30 (43.03703d) Equinox: J2000	Proper Motion RA: 37.76220114208268 mas/yr Proper Motion Dec: -87.0623864067154 mas/yr Parallax: 0.026589300033944568" Epoch of Position: 2016	
Comments: Input by Matthew Hooton using values from Gaia DR3 *Category=Star* *Description=[Exoplanet Systems, M dwarfs, M stars]* *Extended=NO*				
(2)	2MASS04342521+4302330	RA: 04 34 25.2249 (68.6051037d) Dec: +43 02 32.97 (43.04249d) Equinox: J2000	Proper Motion RA: 6.955961846860765 mas/yr Proper Motion Dec: -5.15792157298598 mas/yr Parallax: 0.00006350571070489938" Epoch of Position: 2016	
Comments: Input by Matthew Hooton using values from Gaia DR3 *Category=Star* *Description=[K dwarfs, K stars]* *Extended=NO*				

Observation

Proposal 4195, Observation 1: TOI-1685b transit 1

Wed Mar 13 00:01:57 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(TOI-1685b transit 1 (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.

(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)	TOI-1685	RA: 04 34 22.5504 (68.5939600d) Dec: +43 02 13.30 (43.03703d) Equinox: J2000	Proper Motion RA: 37.76220114208268 mas/yr Proper Motion Dec: -87.0623864067154 mas/yr Parallax: 0.026589300033944568" Epoch of Position: 2016	

Comments: Input by Matthew Hooton using values from Gaia DR3
Category=Star
Description=[Exoplanet Systems, M dwarfs, 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	2 2MASS04342521 +4302330	WATA	SUB32	F140X	NRSRAPID	3	1	1	0.08	145592.2

Template

Subarray
SUB2048

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSRAPID	16	1032	1	1	1032	15845.823	145592.1

Special Requirements

Phase 0.81625593 to 0.87852499 with period 0.66913923 Days and zero-phase 2459910.93830 HJD
Time Series Observation
No Parallel Attachments

Observation

Proposal 4195, Observation 2: TOI-1685b transit 2

Wed Mar 13 00:01:57 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(TOI-1685b transit 2 (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)	TOI-1685	RA: 04 34 22.5504 (68.5939600d) Dec: +43 02 13.30 (43.03703d) Equinox: J2000	Proper Motion RA: 37.76220114208268 mas/yr Proper Motion Dec: -87.0623864067154 mas/yr Parallax: 0.026589300033944568" Epoch of Position: 2016	

Comments: Input by Matthew Hooton using values from Gaia DR3
Category=Star
Description=[Exoplanet Systems, M dwarfs, 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	2 2MASS04342521 +4302330	WATA	SUB32	F140X	NRSRAPID	3	1	1	0.08	145592.2

Template

Subarray
SUB2048

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSRAPID	16	1032	1	1	1032	15845.823	145592.1

Special Requirements

Phase 0.81625593 to 0.87852499 with period 0.66913923 Days and zero-phase 2459910.93830 HJD
Time Series Observation
No Parallel Attachments

Observation

Proposal 4195, Observation 3: TOI-1685b transit 3

Wed Mar 13 00:01:57 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(TOI-1685b transit 3 (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)	TOI-1685	RA: 04 34 22.5504 (68.5939600d) Dec: +43 02 13.30 (43.03703d) Equinox: J2000	Proper Motion RA: 37.76220114208268 mas/yr Proper Motion Dec: -87.0623864067154 mas/yr Parallax: 0.026589300033944568" Epoch of Position: 2016	

Comments: Input by Matthew Hooton using values from Gaia DR3
Category=Star
Description=[Exoplanet Systems, M dwarfs, 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	2 2MASS04342521 +4302330	WATA	SUB32	F140X	NRSRAPID	3	1	1	0.08	145592.2

Template

Subarray
SUB2048

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSRAPID	16	1032	1	1	1032	15845.823	145592.1

Special Requirements

Phase 0.81625593 to 0.87852499 with period 0.66913923 Days and zero-phase 2459910.93830 HJD
Time Series Observation
No Parallel Attachments

Observation

Proposal 4195, Observation 4: TOI-1685b transit 4 Wed Mar 13 00:01:57 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(TOI-1685b transit 4 (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)	TOI-1685	RA: 04 34 22.5504 (68.5939600d) Dec: +43 02 13.30 (43.03703d) Equinox: J2000	Proper Motion RA: 37.76220114208268 mas/yr Proper Motion Dec: -87.0623864067154 mas/yr Parallax: 0.026589300033944568" Epoch of Position: 2016	

Comments: Input by Matthew Hooton using values from Gaia DR3
Category=Star
Description=[Exoplanet Systems, M dwarfs, 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	2 2MASS04342521 +4302330	WATA	SUB32	F140X	NRSRAPID	3	1	1	0.08	145592.2

Template

Subarray
SUB2048

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSRAPID	16	1032	1	1	1032	15845.823	145592.1

Special Requirements

Phase 0.81625593 to 0.87852499 with period 0.66913923 Days and zero-phase 2459910.93830 HJD
Time Series Observation
No Parallel Attachments

Observation

Proposal 4195, Observation 104: TOI-1685b transit 4

Wed Mar 13 00:01:57 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(TOI-1685b transit 4 (Obs 104)) 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 104:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TOI-1685	RA: 04 34 22.5504 (68.5939600d) Dec: +43 02 13.30 (43.03703d) Equinox: J2000	Proper Motion RA: 37.76220114208268 mas/yr Proper Motion Dec: -87.0623864067154 mas/yr Parallax: 0.026589300033944568" Epoch of Position: 2016	

Comments: Input by Matthew Hooton using values from Gaia DR3
Category=Star
Description=[Exoplanet Systems, M dwarfs, 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	2 2MASS04342521 +4302330	WATA	SUB32	F140X	NRSRAPID	3	1	1	0.08	145592.2

Template

Subarray
SUB2048

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSRAPID	16	1032	1	1	1032	15845.823	145592.1

Special Requirements

Phase 0.81625593 to 0.87852499 with period 0.66913923 Days and zero-phase 2459910.93830 HJD
Time Series Observation
No Parallel Attachments