



4938 - A Tale of Two Warm Giants: Characterizing the Atmospheres of TOI-2525 b & c

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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Mr. Quanyi Liu (CoI)	Tsinghua University
Dr. Qinghui Sun (CoI)	Tsinghua University
Dr. Rafael Brahm (CoI)	Universidad Adolfo Ibanez

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
	1	TOI-2525 b	NIRSpec Bright Object Time Series	(1) TOI-2525
	2	TOI-2525 c	NIRSpec Bright Object Time Series	(1) TOI-2525

ABSTRACT

Warm giant planets with equilibrium temperatures between 300 and 600 K are unique objects where carriers of C, N, and O all exhibit visible signatures in the atmospheric absorption spectra. As a result, warm giants are sensitive probes to planet formation models as both C/O and N/O ratios can be constrained observationally. We propose to observe the transmission spectra of the warm giant pair, TOI-2525 b and c, which has the highest Transmission Spectroscopic Metric among all appropriate systems hosting multiple transiting warm giants. Having two co-natal warm giant planets provides distinctive leverages in constraining the co-growth and interactions of the pair in the protoplanetary disk, including scenarios where the outer planet may block the inward drifting pebbles and alter the composition of the inner planet. In addition, the atmospheres of warm giants are scarcely observed compared with hot Jupiters or even cold Jupiters in our own Solar System, which have multiple in-depth and in-situ probes. Therefore, theories predicting disequilibrium chemistry and cloud formation in the 300-600K temperature range are rarely tested. This pair of warm giants will serve as an important benchmark in both intra-system and inter-system comparative studies differential to our Solar System, and it will also provide more context for other warm and temperature giants and T/Y transition brown dwarfs that will be observed with JWST spectroscopy or direct imaging.

OBSERVING DESCRIPTION

We propose to observe TOI-2525\,b and c with JWST NIRSpec PRISM using the Bright Object Time Series (BOTS) mode with the S1600A1 slit to obtain transmission spectra from 0.5 to 5.3 microns. The transit duration is 4.1 hours for TOI-2525 b 5.5 hours for TOI-2525 c. We also need to observe a 1:1 in-transit/out-of-transit baseline to obtain high signal-to-noise ratio spectra and to remove potential instrument systematics. Therefore, the exposure time is 8.2 hours and 11 hours for TOI-2525 b and c, respectively, resulting in a total exposure time and total charged time of 24.29 and 19.2 hours, respectively.

For detector settings, we use the NRSRAPID readout patterns and SUB512 subarray with 6 groups/integration, which is the maximal number before saturation. As a result, each integration is 1.6s, and the total integrations are 18409 and 24695 for TOI-2525 b and c, respectively. The Timing Special Requirements are set with a one-hour window to ensure the observation will start before the transit. The windows are calculated based on the transit-timing variation (TTV) predictions.

We will use Wide Aperture Target Acquisition (WATA) to reach the best pointing accuracy. We will use TOI-2525 itself as the guide star with

SUB32 subarray, NRSRAPID readout pattern, and F110W filter.

Proposal 4938 - Targets - A Tale of Two Warm Giants: Characterizing the Atmospheres of TOI-2525 b & c

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	TOI-2525	RA: 05 47 24.1880 (86.8507833d) Dec: -60 31 17.07 (-60.52141d) Equinox: J2000	Proper Motion RA: 21.759 mas/yr Proper Motion Dec: 23.299 mas/yr Parallax: 0.00249" Epoch of Position: 2000	
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=Star Description=[Exoplanet Systems, K dwarfs, K stars] Extended=NO				

Proposal 4938 - Observation 1 - A Tale of Two Warm Giants: Characterizing the Atmospheres of TOI-2525 b & c

Fri Aug 08 20:00:10 GMT 2025

Observation	<p>Proposal 4938, Observation 1: TOI-2525 b</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec Bright Object Time Series</p>										
Diagnostics	<p>(TOI-2525 b (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>(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>										
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	<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Exoplanet Systems, K dwarfs, K stars]</i></p> <p><i>Extended=NO</i></p>										
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	167222
Template	<p>Subarray</p> <p>SUB512</p>										
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	6	18409	1	1	18409	29520.672	167222	

Proposal 4938 - Observation 1 - A Tale of Two Warm Giants: Characterizing the Atmospheres of TOI-2525 b & c

Special Requirements	Between Dates 31-JUL-2024:06:02:51 and 31-JUL-2024:07:02:51 Between Dates 23-AUG-2024:13:57:54 and 23-AUG-2024:14:57:54 Between Dates 15-SEP-2024:22:27:26 and 15-SEP-2024:23:27:26 Between Dates 09-OCT-2024:07:10:04 and 09-OCT-2024:08:10:04 Between Dates 01-NOV-2024:15:59:31 and 01-NOV-2024:16:59:31 Between Dates 25-NOV-2024:01:01:58 and 25-NOV-2024:02:01:58 Between Dates 18-DEC-2024:09:26:35 and 18-DEC-2024:10:26:35 Between Dates 10-JAN-2025:18:29:41 and 10-JAN-2025:19:29:41 Between Dates 03-FEB-2025:01:56:52 and 03-FEB-2025:02:56:52 Between Dates 26-FEB-2025:10:08:38 and 26-FEB-2025:11:08:38 Between Dates 21-MAR-2025:16:12:01 and 21-MAR-2025:17:12:01 Between Dates 13-APR-2025:22:12:31 and 13-APR-2025:23:12:31 Between Dates 15-JUL-2025:16:49:27 and 15-JUL-2025:17:49:27 Between Dates 07-AUG-2025:22:26:14 and 07-AUG-2025:23:26:14 Between Dates 31-AUG-2025:04:42:33 and 31-AUG-2025:05:42:33 Between Dates 23-SEP-2025:11:46:19 and 23-SEP-2025:12:46:19 Between Dates 16-OCT-2025:19:34:14 and 16-OCT-2025:20:34:14 Time Series Observation No Parallel Attachments
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Proposal 4938 - Observation 2 - A Tale of Two Warm Giants: Characterizing the Atmospheres of TOI-2525 b & c

Fri Aug 08 20:00:10 GMT 2025

Observation	<p>Proposal 4938, Observation 2: TOI-2525 c</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec Bright Object Time Series</p>																															
Diagnostics	<p>(TOI-2525 c (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.</p> <p>(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>																															
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>TOI-2525</td> <td>RA: 05 47 24.1880 (86.8507833d) Dec: -60 31 17.07 (-60.52141d) Equinox: J2000</td> <td>Proper Motion RA: 21.759 mas/yr Proper Motion Dec: 23.299 mas/yr Parallax: 0.00249" Epoch of Position: 2000</td> <td></td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Exoplanet Systems, K dwarfs, K stars]</i></p> <p><i>Extended=NO</i></p>										#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous	(1)	TOI-2525	RA: 05 47 24.1880 (86.8507833d) Dec: -60 31 17.07 (-60.52141d) Equinox: J2000	Proper Motion RA: 21.759 mas/yr Proper Motion Dec: 23.299 mas/yr Parallax: 0.00249" Epoch of Position: 2000													
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1	PRISM/CLEAR	NRSRAPID	6	24695	1	1	24695	39600.902	167222																							
Special Requirements	<p>Between Dates 28-AUG-2024:14:15:25 and 28-AUG-2024:15:15:25</p> <p>Between Dates 16-OCT-2024:19:23:26 and 16-OCT-2024:20:23:26</p> <p>Between Dates 05-DEC-2024:00:32:02 and 05-DEC-2024:01:32:02</p> <p>Between Dates 23-JAN-2025:05:51:56 and 23-JAN-2025:06:51:56</p> <p>Between Dates 13-MAR-2025:11:38:20 and 13-MAR-2025:12:38:20</p> <p>Between Dates 01-MAY-2025:18:11:45 and 01-MAY-2025:19:11:45</p> <p>Between Dates 08-AUG-2025:07:33:10 and 08-AUG-2025:08:33:10</p> <p>Time Series Observation</p> <p>No Parallel Attachments</p>																															