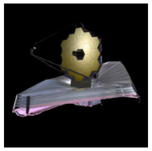

# 3712 - Warm Jupiters Dis-equilibrium and Thermo-chemistry in Transmission Spectroscopy

Cycle: 2, Proposal Category: GO

**INVESTIGATORS**

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|---|---|
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**OBSERVATIONS**

| *Folder* | *Observation* | *Label* | *Observing Template* | *Science Target* |
|---|---|---|---|---|
| NIRSpec/G395H WASP-69b | | | | |
| | 1 | | NIRSpec Bright Object Time Series | (1) WASP-69 |
| MIRI/LRS WASP-69b | | | | |
| | 2 | | MIRI Low Resolution Spectroscopy | (1) WASP-69 |
| | 3 | | MIRI Low Resolution Spectroscopy | (3) WASP-69-background |

**ABSTRACT**

Warm Jupiters (Jupiter-sized planets with equilibrium temperatures of ~1000 K) are uniquely favorable for atmospheric characterization since (1) they have strong spectroscopic features and (2) their compositions are highly sensitive to temperature variations and subjected to disequilibrium processes. We propose to observe two transits of the warm Jupiter WASP-69b with NIRSpec/G395H and MIRI/LRS (2.8--12.0 um) to make an exhaustive inventory of chemical species. High-resolution ground-based transit observations of this planet have already detected the presence of $H_2O$, $CH_4$, CO, $NH_3$, and $C_2H_2$, albeit without quantitative estimations of their abundances. These species and others, like the recently detected $SO_2$, have strong identifiable spectral features in the proposed observing spectral window. Their detectability will depend on their relative abundances, which in turn are determined by the interplay between thermochemical, quenching, and photochemical processes.

Thus, by measuring the concentration of multiple atmospheric species with JWST, we will be able to disentangle the impact of the different chemical processes at play. Particularly, we will be able to quantify imporant but pooly known parameter of our chemical models, like the eddy-diffution coefficient Kzz.

Ultimately, by combining the WASP-69b physical constraints with that of other similar warm Jupiters observed during cycle 1 (e.g., WASP-80b and WASP-107b), we will start to better understand how these chemical processes shape the atmospheres of exoplanets in general.

**OBSERVING DESCRIPTION**

The observations consist of two transit time-series of WASP-69b with NIRSpec/G395H and MIRI/LRS, to characterize it composition which will shed light on the different chemical processes that shape it's observable properties. The total exposure time per event is 6.21 h. The host star is a K-dwarf with a Ks magnitude of 7.459.

NIRSpec observation use the Bright Object Time Series mode (BOTS), S1600A1 aperture, 1.6"x1.6" fixed-slit aperture. G395H+F290LP grating/filter pair, SUB2048 subarray, and NRSRAPID readout patter. 5 groups per integration keep the detector below 80% of saturation. This requires 4115 integrations. For the WATA target acquisition, we use the nearby 5500~K, 16.8 G-magnitude star Gaia DR3 6910752844854895360 using the CLEAR filter and SUB32 subarray

MIRI obsservations use the slitless Low Resolution Spectroscopy mode (LRS), SLITLESSPRISM subarray, FASTR1 readout pattern, and P750L disperser, 15 groups per integration to remain at the 80% of saturation, and 8785 integrations. Target aquisition is on the target using the F1000W filter.

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | WASP-69 | RA: 21 00 6.2319 (315.0259663d)<br>Dec: -05 05 41.49 (-5.09486d)<br>Equinox: J2000 | Proper Motion RA: 0.002260798991594927 sec of time/yr<br>Proper Motion Dec: -0.09358100010103954 arcsec/yr<br>Parallax: 0.0198858"<br>Epoch of Position: 2015.5 | |
| *Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.<br>Category=Star<br>Description=[Exoplanets, K dwarfs]<br>Extended=NO* | | | | |
| (2) | GAIA-DR3-6910752844854895360 | RA: 21 00 8.2057 (315.0341904d)<br>Dec: -05 05 17.41 (-5.08817d)<br>Equinox: J2000 | Proper Motion RA: 0.1042 mas/yr<br>Proper Motion Dec: -3.6731 mas/yr<br>Parallax: 0.0001060"<br>Epoch of Position: 2016 | |
| *Comments: Gaia DR3 Object<br>Gaia G magnitude 16.8055 +/- 0.0005<br><br>Teff 5504 [5493, 5520] K<br>log(g) 4.419 [4.389, 4.484] log(cm s-2)<br>[M/H] -0.705 [-0.741, -0.669] dex<br>Category=Star<br>Description=[G stars]<br>Extended=NO* | | | | |
| (3) | WASP-69-background | RA: 21 00 14.5800 (315.0607500d)<br>Dec: -05 07 31.20 (-5.12533d)<br>Equinox: J2000 | | |
| *Comments: Background sky target for background characterization and subtraction for WASP-69 b<br>Category=Unidentified<br>Description=[Blank field]* | | | | |

## Observation

**Proposal 3712, Observation 1**

Fri Aug 30 23:00:10 GMT 2024

**Diagnostic Status: Warning**

Observing Template: NIRSpec Bright Object Time Series

Background Observations:[]

## 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.

(Observation 1) Warning (Form): Target requiring background exposure selected for template that doesn't require background 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) | WASP-69 | RA: 21 00 6.2319 (315.0259663d)<br>Dec: -05 05 41.49 (-5.09486d)<br>Equinox: J2000 | Proper Motion RA: 0.002260798991594927 sec of time/yr<br>Proper Motion Dec: -0.09358100010103954 arcsec/yr<br>Parallax: 0.0198858"<br>Epoch of Position: 2015.5 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=Star*
*Description=[Exoplanets, K dwarfs]*
*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 GAIA-DR3-6910752844854895360 | WATA | SUB32 | CLEAR | NRSRAPID | 3 | 1 | 1 | 0.08 | 143492 |

## 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 | 5 | 4115 | 1 | 1 | 4115 | 22354.655 | 143492 |

| Special Requirements | |
|---|---|
| | Phase 0.957128 to 0.967900 with period 3.8681382 Days and zero-phase 2455748.83422 HJD<br>Time Series Observation<br>No Parallel Attachments |

## Observation

**Proposal 3712, Observation 2**

Fri Aug 30 23:00:10 GMT 2024

**Diagnostic Status: Warning**

Observing Template: MIRI Low Resolution Spectroscopy

Background Observations:[Observation 3]

## Diagnostics

(Observation 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) | WASP-69 | RA: 21 00 6.2319 (315.0259663d)<br>Dec: -05 05 41.49 (-5.09486d)<br>Equinox: J2000 | Proper Motion RA: 0.002260798991594927 sec of time/yr<br>Proper Motion Dec: -0.09358100010103954 arcsec/yr<br>Parallax: 0.0198858"<br>Epoch of Position: 2015.5 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=Star*
*Description=[Exoplanets, K dwarfs]*
*Extended=NO*

## Acquisition

| # | Target | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
|---|---|---|---|---|---|---|---|---|
| 1 | SAME | F1000W | FAST | 10 | 1 | 1 | 1.59 | 143492 |

## 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 | PV ETC Wkbk.Calc ID | Filter |
|---|---|---|---|---|---|---|---|---|---|
| 1 | FASTR1 | 10 | 1 | 1 | 1 | 1 | 1.59 | | F1000W |

## Proposal 3712 - Observation 2 - Warm Jupiters Dis-equilibrium and Thermo-chemistry in Transmission Spectroscopy

**Spectral Elements**

| # | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Exposures/Dith | Total Dithers | Total Exposure Time | ETC Wkbk.Calc ID |
|---|---|---|---|---|---|---|---|---|
| 1 | FASTR1 | 15 | 8360 | 8360 | 1 | 1 | 21273.031 | 143492 |

**Special Requirements**

Phase 0.958743 to 0.969516 with period 3.8681382 Days and zero-phase 2455748.83422 HJD
Time Series Observation
No Parallel Attachments

Sequence Observations 2, 3, Non-interruptible

## Observation

**Proposal 3712, Observation 3**

Fri Aug 30 23:00:10 GMT 2024

**Diagnostic Status: Warning**

Observing Template: MIRI Low Resolution Spectroscopy

Background Observation For: [Observation 2]

*Comments: New background exposure to better estimate the background underneath scattered light.*

## Diagnostics

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

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (3) | WASP-69-background | RA: 21 00 14.5800 (315.0607500d)<br>Dec: -05 07 31.20 (-5.12533d)<br>Equinox: J2000 | | |

*Comments: Background sky target for background characterization and subtraction for WASP-69 b*
*Category=Unidentified*
*Description=[Blank field]*

## Acquisition

| # | Target |
|---|---|
| 1 | NONE |

## Template

| AcqFilter | 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 | PV ETC Wkbk.Calc ID | Filter |
|---|---|---|---|---|---|---|---|---|---|
| 1 | FASTR1 | 10 | 1 | 1 | 1 | 1 | 1.59 | | F1000W |

Proposal 3712 - Observation 3 - Warm Jupiters Dis-equilibrium and Thermo-chemistry in Transmission Spectroscopy

**Spectral Elements**

| # | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Exposures/Dith | Total Dithers | Total Exposure Time | ETC Wkbk.Calc ID |
|---|---|---|---|---|---|---|---|---|
| 1 | FASTR1 | 15 | 38 | 38 | 1 | 1 | 96.537 | 213995 |

**Special Requirements**

Time Series Observation
No Parallel Attachments

Sequence Observations 2, 3, Non-interruptible