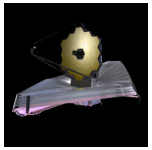

3731 - Problem Planets: Understanding the Formation of Giant Planets around Low Mass Stars

Cycle: 2, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Andres Jordan (PI)	**Universidad Adolfo Ibanez**
Dr. Nestor Espinoza (CoI) (US Admin CoI)	Space Telescope Science Institute
Dr. Daniel Bayliss (CoI) (ESA Member)	The University of Warwick
Prof. Thomas K. Henning (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Paul Molliere (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Melissa Janice Hobson (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Rafael Brahm (CoI)	Universidad Adolfo Ibanez
Mr. Edward Bryant (CoI) (ESA Member)	The University of Warwick
Remo Burn (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Martin Schlecker (CoI)	University of Arizona

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRSpec Bright Object Time Series	(1) TOI-3235
	2		NIRSpec Bright Object Time Series	(3) TOI-5205

ABSTRACT

Planetary formation models predict that giant planets should not form around stars with masses less than 0.5 M_Sun. This is due to two fundamental factors: (1) slow accretion due to long orbital timescales, and (2) low protoplanetary disk masses, limiting the available planetary building material. Nature has proven this prediction wrong. The TESS mission has recently enabled the discovery of the first transiting giants around low mass stars.

We propose to obtain NIRSpec/PRISM transmission spectra for the only two well-characterized giant exoplanets that transit M dwarfs with masses less than 0.5 M_Sun: TOI-3235b and TOI-5205b. We will characterize their atmospheric enrichment and composition with precisions in [Fe/H] and C/O ratios better than ~0.22 dex and ~0.13, respectively, observing one transit per target. We will use these measurements to constrain the formation pathways for these planets. A modest investment of JWST time will provide the data we need to move forward in elucidating how these planets bypassed the hurdles to their formation.

OBSERVING DESCRIPTION

We will observe two primary transits occuring on two M dwarfs that host giant planets with masses M_p > 100 M_earth (TOI-3235 and TOI-5205). The objective is to measure their transmission spectra. The two observations will be done with NIRPSpec/PRISM with the SUB512 (TOI-5205) and SUB512S (TOI-3235) subarrays. Target Aquision has been requested, with the same target for one of our objects and a nearby target for the other one. Using the JWST ETC we find that we can use 4 groups for TOI-3235 and 3 groups for TOI-5205. The integration durations including overheads as obtained from the APT are 0.925 s (TOI-5205) and 0.74 s (TOI-3235). To calculate the time to request on this exposure we use the dwell equation. The transit duration times for our targets are T14 = 1.3992 hr (TOI-5205) and T14 = 1.4796 hr (TOI-3235), resulting in total integration times of 5.1492 hr and 5.2296 hr, respectively. Dividing this by the total time per integration for each target gives a grand total of 20,040 (TOI-5205) and 25,441 (TOI-3235) integrations for the exposures. The total request of our program as calculated with APT including smart accounting is 14.05 hours (7.85 hours of science time)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	TOI-3235	RA: 13 49 53.7237 (207.4738488d) Dec: -46 03 59.45 (-46.06651d) Equinox: J2000	Proper Motion RA: -0.01638295278548458 sec of time/yr Proper Motion Dec: -0.06426400004784227 arcsec/yr Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Exoplanet Systems, M dwarfs]* *Extended=NO*				
(3)	TOI-5205	RA: 20 55 4.9600 (313.7706667d) Dec: +24 21 39.54 (24.36098d) Equinox: J2000	Proper Motion RA: 41.7717000 mas/yr Proper Motion Dec: 52.1607000 mas/yr Epoch of Position: 2016	
Comments: *Category=Star* *Description=[Exoplanets, M dwarfs]* *Extended=NO*				
(4)	13495292-4603447	RA: 13 49 52.9243 (207.4705179d) Dec: -46 03 44.79 (-46.06244d) Equinox: J2000		
Comments: This object was generated by the targetselector and retrieved from the 2MASS database. *Category=Star* *Description=[Disk stars]*				

Observation

Proposal 3731, Observation 1

Thu May 11 02:07:38 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

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.

(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-3235	RA: 13 49 53.7237 (207.4738488d) Dec: -46 03 59.45 (-46.06651d) Equinox: J2000	Proper Motion RA: -0.01638295278548458 sec of time/yr Proper Motion Dec: -0.06426400004784227 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Exoplanet Systems, M 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	4 13495292-4603447	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	140470

Template

Subarray
SUB512S

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	4	25441	1	1	25441	18828.375	140470

Special Requirements

Phase 0.9439145193117845 to 0.9599857786069348 with period 2.59261842 Days and zero-phase 2459690.00173 HJD
Time Series Observation
No Parallel Attachments

Observation

Proposal 3731, Observation 2

Thu May 11 02:07:38 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

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
(3)	TOI-5205	RA: 20 55 4.9600 (313.7706667d) Dec: +24 21 39.54 (24.36098d) Equinox: J2000	Proper Motion RA: 41.7717000 mas/yr Proper Motion Dec: 52.1607000 mas/yr Epoch of Position: 2016	

Comments:
Category=Star
Description=[Exoplanets, M 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	SAME	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	140435

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	3	20040	1	1	20040	18539.405	140435

Special Requirements

Phase 0.9118609741774321 to 0.9374114802716367 with period 1.630757 Days and zero-phase 2459443.47179 HJD
Time Series Observation
No Parallel Attachments