2334 - Exploring the nature of a temperate exoplanet in the Fulton gap

Cycle: 1, Proposal Category: GO

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Mario Damiano (PI)	**Jet Propulsion Laboratory**	**mario.damiano@jpl.nasa.gov**
Dr. Renyu Hu (CoI) (CoPI)	Jet Propulsion Laboratory	renyu.hu@jpl.nasa.gov

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRSpec Bright Object Time Series	(1) NAME-G-268-38B
	2		NIRSpec Bright Object Time Series	(1) NAME-G-268-38B

ABSTRACT

Among the main sequence stars, the sub-group comprising smaller and cooler stars than theSun, e.g. M-dwarfs, represents the ideal environment to discover and characterize temperateterrestrial planets. With an equilibrium temperature <300K LHS 1140b is an important target to expand the knowledge on the habitability of cool small planets. The measured mass and radius of LHS 1140b are compatible with a rocky core with an envelope. The radius (1.7 Rearth) places the planet right in the middle of the Fulton gap. HST observations have set hints on the possibility of a H_2-dominated envelope with the presence of H_2O. However, the star has shown activity on its surface and this is likely to contamine the planetary spectral signature especially in the optical and HST/WFC3 wavelength ranges. We propose to use NIRSpec to measure the planet's transmission spectrum at 1.7 – 5.2 microns, and we expect the precision achieved not only will definitely disentangle the stellar activity spectral signature from the planetary spectrum, but also shed light onto the nature of LHS 1140b atmosphere.

OBSERVING DESCRIPTION

We will acquire a transmission spectrum of the temperate exoplanet LHS 1440 b with NIRSpec, using the G235H and G395H gratings to cover the wavelength range 1.7 – 5.2 microns. We propose to observe one transit with G235H and another one with G395H to achieve a precision of 30 – 65 ppm per spectral element at a resolution of R ~ 100.

We choose the number of groups to keep the saturation level within 60%, to make sure that the observations would be well within the detector's linear regime and maximize the efficiency of the observations. We perform target acquisition (TA) on the target itself.

As it is recommended for exoplanet transit observations, we include an out-of-transit portion of the light curve. This is necessary to establish a baseline from which the transit depth can be determined and which instrumental systematics can be modelled. For each visit, we include 176 minutes of baseline for the 117-minute transit, half of which is before the transit, and half of which is after. Additionally, since any timing constraint narrower than 1 hour is considered "tight" and incurs a 1-hour scheduling overhead penalty, we use a timing window of exactly 1 hour, centered at 88+30 = 118 minutes before the predicted start of the transit. The extra baseline also gives the instrument time to stabilize and thus reduce systematics.

Proposal 2334 - Targets - Exploring the nature of a temperate exoplanet in the Fulton gap

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	NAME-G-268-38B	RA: 00 44 59.6717 (11.2486321d) Dec: -15 16 26.79 (-15.27411d) Equinox: J2000	Proper Motion RA: 0.021947597949246233 sec of time/yr Proper Motion Dec: -0.5966169999510385 arcsec/yr Epoch of Position: 2015.5	
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=Star Description=[M stars]			
(2)	TA-LHS1140	RA: 00 44 59.2172 (11.2467383d) Dec: -15 16 14.07 (-15.27058d) Equinox: J2000	Proper Motion RA: 38.905 mas/yr Proper Motion Dec: 9.732 mas/yr Parallax: 0.0031133" Epoch of Position: 2015.5	
	Comments: Gaia DR2 2371032989200665984, bp=18.0018, g=16.6863, br=15.5614 PSO J004459.204-151613.960, g=18.37, r=17.11, i=15.99, z=15.47, y=15.21 WFC3/IR F130N, mag=15.07 Not in 2MASS or WISEA LHS1140/TA-LHS1140 separation at epoch=J2023.00 is 19.32 arcsec Category=Unidentified Description=[Infrared sources] Extended=NO			

Observation

Proposal 2334, Observation 1

Mon Apr 12 17:00:21 GMT 2021

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)	NAME-G-268-38B	RA: 00 44 59.6717 (11.2486321d) Dec: -15 16 26.79 (-15.27411d) Equinox: J2000	Proper Motion RA: 0.021947597949246233 sec of time/yr Proper Motion Dec: -0.5966169999510385 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[M stars]

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 TA-LHS1140	WATA	SUB32	F140X	NRSRAPIDD6	3	1	1	0.26	63124.8

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	15	1342	1	1	1342	19395.228	53279

Special Requirements

Phase 0.9942021090937316 to 0.9958865013068894 with period 24.73712 Days and zero-phase 2456915.6997 HJD
Time Series Observation
No Parallel

Proposal 2334 - Observation 2 - Exploring the nature of a temperate exoplanet in the Fulton gap

Observation

Proposal 2334, Observation 2 Mon Apr 12 17:00:21 GMT 2021

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
(1)	NAME-G-268-38B	RA: 00 44 59.6717 (11.2486321d) Dec: -15 16 26.79 (-15.27411d) Equinox: J2000	Proper Motion RA: 0.021947597949246233 sec of time/yr Proper Motion Dec: -0.5966169999510385 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[M stars]

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 TA-LHS1140	WATA	SUB32	F140X	NRSRAPIDD6	3	1	1	0.26	63124.8

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	G235H/F170LP	NRSRAPID	8	2382	1	1	2382	19385.859	53729

Special Requirements

Phase 0.9942021090937316 to 0.9958865013068894 with period 24.73712 Days and zero-phase 2456915.6997 HJD
Time Series Observation
No Parallel