2508 - The First and Only Multi-wavelength Map of an Ultra-short-period sub-Earth

Cycle: 1, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	Science	MIRI Low Resolution Spectroscopy	(1) CD-45-5378

ABSTRACT

We propose to obtain a spectroscopic (5--12 um) phase curve of GJ 367b (TOI 731.01), an iron-rich 0.72 R_earth, 0.53 M_earth sub-Earth. GJ 367b is likely to forever remain the most observationally favorable sub-Earth outside the solar system, and the only one accessible to study by JWST. The phase curve will constrain the planet's dayside and nightside temperatures, phase offset, Bond albedo, and heat recirculation efficiency. A significant atmosphere would manifest as a diminished day-night temperature contrast, non-zero phase offset, and if there are clouds, high albedo. If there is significant eccentricity, the resulting tidal heating would be visible as anomalously high thermal emission. If there is no atmosphere, observations may be capable of distinguishing between different surface compositions. A metal-rich primary crust, for example, would be featureless and have higher brightness temperature, while an Earth-like granitoid tertiary crust (created by plate tectonics) will have lower brightness temperature, with an absorption feature at 8--10 um. Our observations would shed light on the properties and origins of iron-rich ultra-short-period planets, and serve as a

pathfinder to future studies of the planet.

OBSERVING DESCRIPTION

We propose to observe GJ 367b for 10.5 hours, slightly longer than the 7.7 h orbital period of the planet. The observations start shortly before a secondary eclipse and end shortly after the following secondary eclipse, enabling us to capture two eclipses in one phase curve observation. We add 1 hour of extra padding at the beginning of the observation in case there is a ramp effect, as was seen with Spitzer/IRS (5--14 µm) in the first 0.5-1 hours of observation, due to a combination of telescope settling and charge trapping. The Spitzer ramp has proven difficult to model, and our proposed observations demand high precision, making it preferable to discard the first hour of data.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CD-45-5378	RA: 09 44 29.1514 (146.1214642d) Dec: -45 46 44.46 (-45.77902d) Equinox: J2000	Proper Motion RA: -0.044214767739125416 sec of time/yr Proper Motion Dec: -0.5828140000176063 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, M stars]
Extended=NO

Observation

Proposal 2508, Observation 1: Science

Thu Jul 08 16:00:10 GMT 2021

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Diagnostics

(Science (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

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Description=[Exoplanet Systems, M dwarfs, M stars]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	F1500W	FAST	4	1	1	0.636	60127

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

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	FAST	4	1	1	0.636	60127

Proposal 2508 - Observation 1 - The First and Only Multi-wavelength Map of an Ultra-short-period sub-Earth

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	5	15973	47919	3	1	45725.749	60127

Special Requirements

Phase 0.055 to 0.12 with period 0.6438414 Days and zero-phase 2459036.3530 HJD
Time Series Observation
No Parallel