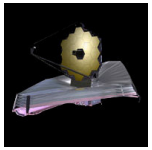

2454 - Unveiling the Nature of the Impossible Planets

Cycle: 1, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRSpec Bright Object Time Series	(1) KEPLER-51

ABSTRACT

Super-puffs are a distinct class of low mass, large radii planets that challenge models of planet formation and evolution. Their inferred large gas mass fractions suggest that they formed at large semi-major axes, beyond the water iceline, and migrated to their current locations among the similar-mass but much more abundant sub-Neptunes. Their large gas mass fractions also make super-puffs vulnerable to catastrophic atmospheric loss, which makes their continued existence a mystery. A possible solution to the problems faced by super-puffs is that they are enshrouded in high altitude haze layers that make them look bigger than they would look if they had clear atmospheres. Hubble Space Telescope observations of three super-puffs lend credence to this hypothesis, as they showed featureless transmission spectra. We propose to observe the 0.6-5.3 micron transmission spectrum of the super-puff Kepler-51b using NIRSpec PRISM to test the high altitude haze hypothesis and also to search for spectral signatures of diagnostic gases and haze composition. We will also be able to test alternate hypotheses for super-puffs' large radii and featureless NIR transmission spectra, including high atmospheric metallicity coupled with a high internal heat flux and the existence of planetary rings. Detection of any haze spectral features will constrain their composition and help guide laboratory haze experiments. Measurements of gas spectral features will for the first time give us information on super-puffs' atmospheric composition, which will shed light on whether they have suffered atmospheric loss and whether they migrated from beyond the water iceline.

OBSERVING DESCRIPTION

We will observe Kepler-51b in transit with NIRSpec prism with clear filter and S1600S1 fixed slit. The total exposure time of 11.33 hours will give us equal in and out of the transit coverage. The phase constraint is between 7 hours and 6 hours before the mid-transit to ensure any potential detector systematics at the beginning of the observation will not affect the transit. We choose 17 groups per integration, as computed by the JWST Exposure Time Calculator and PandExo and use the SUB512 subarray.

Kepler-51 itself is suitable for target acquisition and we will use F110W filter with 0.08 seconds total exposure time for a SNR of ~51.

The long visibility window over about 7 months ensures that Kepler-51 has 4 transit opportunities to schedule in Cycle 1.

Proposal 2454 - Targets - Unveiling the Nature of the Impossible Planets

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	KEPLER-51	RA: 19 45 55.1430 (296.4797625d) Dec: +49 56 15.54 (49.93765d) Equinox: J2000	Proper Motion RA: 6.214838901307212E-7 sec of time/yr Proper Motion Dec: -0.0074579999136403785 arcsec/yr Epoch of Position: 2015.5	

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

Observation

Proposal 2454, Observation 1

Wed Mar 31 04:10:16 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)	KEPLER-51	RA: 19 45 55.1430 (296.4797625d) Dec: +49 56 15.54 (49.93765d) Equinox: J2000	Proper Motion RA: 6.214838901307212E-7 sec of time/yr Proper Motion Dec: -0.0074579999136403785 arcsec/yr Epoch of Position: 2015.5	

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

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	62819

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	17	10612	1	1	10612	43417.512	

Special Requirements

Phase 0.9935406526 to 0.9944634165 with period 45.1542 Days and zero-phase 2457565.95248 HJD
Time Series Observation
No Parallel