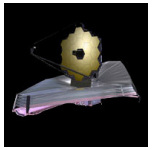

6491 - Revealing the Oblateness and Satellite System of an Extrasolar Jupiter Analog

Cycle: 3, 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-167

ABSTRACT

Jupiter and Saturn, our best-studied giant planets, likely formed in a very similar way. Consequently, they share many similar features: both host large satellite(s) that formed from the remains of their circumplanetary disks, and both are slightly oblate due to their inability to shed their

primordial angular momentum through tidal interactions with the Sun. Each of these properties is thought to be inevitable byproducts of the giant planet formation process, and thus their existence in more distant solar systems is essentially presupposed in our canonical theories. However, neither small moons nor planetary oblateness have been confidently detected in the transits of any planets, let alone cool giant exoplanets. Such measurements are simply not possible with facilities less precise than JWST. Now, however, we propose an opportunity to measure both with a single transit observation; a NIRSpec time series of the well-characterized cool gas giant Kepler-167 e. Injection-recovery experiments suggest that, should this planet be as flattened as Jupiter or Saturn, JWST could confidently detect the oblateness with a signal-to-noise of >10 and >20, respectively. Similarly, should Kepler-167 e host one or more Galilean-type moons, these observations would recover the satellites with a completeness rate of (93 ± 4)\%. Kepler-167 e is the ideal target for detecting both moons and oblateness, and indeed given the sensitivity of the proposed observations, non-detections of either would present a compelling scientific mystery. Given the planet's 1000+ day period and JWST's shifting fields of visibility and finite lifetime, there are limited opportunities for this experiment.

OBSERVING DESCRIPTION

We aim to observe one transit of the cool gas giant Kepler-167 e using NIRSpec in its BOTS, PRISM/Clear configuration. This long ~59 hour time series will be broken into six individual exposures to stay under the frames per exposure limit, though these exposures will be taken as close to back-to-back as is allowable.

Proposal 6491 - Targets - Revealing the Oblateness and Satellite System of an Extrasolar Jupiter Analog

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	Kepler-167	RA: 19 30 38.0262 (292.6584425d)	Proper Motion RA: 15.096999999999998 mas/yr	
		Dec: +38 20 43.44 (38.34540d)	Proper Motion Dec: 36.352 mas/yr	
		Equinox: J2000	Epoch of Position: 2000	

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

Observation

Proposal 6491, Observation 1 Wed Oct 09 22:00:37 GMT 2024

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-167	RA: 19 30 38.0262 (292.6584425d)	Proper Motion RA: 15.096999999999998 mas/yr	
		Dec: +38 20 43.44 (38.34540d)	Proper Motion Dec: 36.352 mas/yr	
		Equinox: J2000	Epoch of Position: 2000	

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

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 Kepler-167	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	164898

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	6	22368	6	1	134208	215215.949	164898

Special Requirements

Phase 0.998798 to 0.998876 with period 1071.23205 Days and zero-phase 2455253.28756 HJD
Aperture PA Range 217.55295105 to 217.55295105 Degrees (V3 78.7 to 78.7)
Time Series Observation
No Parallel Attachments