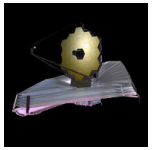

3235 - C,N,O in a Temperate Jupiter: Bridging the Gap Between Solar-System and Exoplanet Atmospheres

Cycle: 2, Proposal Category: GO

INVESTIGATORS

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Dr. Erin M May (CoI)	The Johns Hopkins University Applied Physics Laboratory

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	PH2b	NIRSpec Bright Object Time Series	(1) KEPLER-86B

ABSTRACT

We propose to use NIRSpec PRISM to measure the 0.6-5.5 micron transmission spectrum of planet PH2b, a 300K, temperate giant planet in orbit around a Sunlike star. The planet resides in a narrow region of temperature space where methane, ammonia, and water are the dominant C, N, and O-bearing molecules, respectively, and are found in the gaseous state, rather than condensed into clouds. It is the only known transiting gas giant in this temperature class around a bright Sunlike star. This makes the determination of atmospheric N/O and C/O ratios possible, which can be

compared to Jupiter and connected to models of planet formation. Important additional science includes connecting the planet's atmospheric metallicity to the planet's bulk metallicity and comparing atmospheric abundances to those of directly imaged planets and brown dwarfs in the same cold temperature regime.

OBSERVING DESCRIPTION

We will perform time-series observations to observe transits of the exoplanet Kepler-86b. The fundamental parameter that determines the length of our time-series observations is the transit duration of Kepler-86b, which is 10.5 hours. In addition to this length of time, we need to observe out-of-transit baseline in order to identify and effectively model any instrument systematics. Such systematics typically introduce red noise, which can occur on varying timescales and requires longer observational baselines to identify, characterize, and remove. We include ~10 hours of baseline, as a ~1:1 ratio of baseline to in-transit observing should allow us to successfully identify and remove systematics.

We will observe our target with NIRSpec/PRISM in the Bright Object Time Series (BOTS) mode, which uses the S1600A1 slit. We used PandExo to simulate our proposed observations and determine the optimal observing pattern. We will use the SUB512 subarray and the NRSRAPID readout pattern. Each transit observation will use 6 groups/integration, 42,000 integrations broken up over two exposures for 20 hours of observing time. This observing strategy will ensure we remain below 83% of the saturation limit, with the exception of the brightest region between 1 and 1.4 um. However, these regions are recoverable if utilizing 2 groups/integration as demonstrated by the JWST ERS team. The visits must cover transits of Kepler-86b, so the phase constraints we have placed ensure that there will be ~5 hours of out-of-transit baseline on either side of the ingress/egress.

TA is done on the target because there aren’t any alternatives within the visit splitting distance. The TA image only saturates the central pixel, which is acceptable according to the jdocs.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	KEPLER-86B	RA: 19 19 3.2691 (289.7636212d) Dec: +51 57 45.66 (51.96268d) Equinox: J2000	Proper Motion RA: 3.641825021700274E-4 sec of time/yr Proper Motion Dec: 0.016026 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 3235, Observation 1: PH2b

Thu May 11 00:04:11 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(PH2b (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

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	KEPLER-86B	RA: 19 19 3.2691 (289.7636212d) Dec: +51 57 45.66 (51.96268d) Equinox: J2000	Proper Motion RA: 3.641825021700274E-4 sec of time/yr Proper Motion Dec: 0.016026 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	1 KEPLER-86B	WATA	SUB32	F110W	NRSRAPID	3	1	1	0.08	143214

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	21000	2	1	42000	67351.2	143214

Special Requirements

Phase 0.9983334838 to 0.9984072234 with period 282.5255 Days and zero-phase 2455761.123 HJD
Time Series Observation
No Parallel Attachments