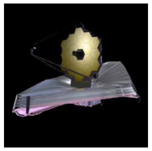

8233 - Mapping the Atmosphere and Interior of HAT-P-13b: The Next Benchmark for Exoplanetary Science

Cycle: 4, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Yamila Miguel (PI) (ESA Member)	**Universiteit Leiden**
Dr. Billy Edwards (CoI) (ESA Member)	Space Research Organization Netherlands
Ms. Amy Joan Louca (CoI) (ESA Member)	Universiteit Leiden
Esther van Dijk (CoI) (ESA Member)	Universiteit Leiden
Solene Ulmer-Moll (CoI) (ESA Member)	University of Geneva, Department of Astronomy
Dr. Sebastian Zieba (CoI) (US Admin CoI)	Smithsonian Institution Astrophysical Observatory

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	NIRISS Transit	NIRISS Single-Object Slitless Spectroscopy	(1) HAT-P-13
	2	NIRSpec Transit	NIRSpec Bright Object Time Series	(1) HAT-P-13

ABSTRACT

We propose to observe two transits of HAT-P-13b using JWST's NIRISS and NIRSpec instruments to perform the first atmospheric characterization of this unique exoplanet. HAT-P-13b stands out due to its precise Love number measurement, comparable to those of Solar System planets, offering valuable insights into its internal structure. However, the planet’s atmosphere remains unexplored, and measuring its atmospheric metallicity is crucial to fully interpreting its internal composition. This proposal aims to achieve two primary objectives: (1) Determine the atmospheric metallicity of HAT-P-13b by targeting the CO2 spectral feature at 4.5 microns and H2O features at wavelengths below 4 microns, and (2) Use this data to refine models of the planet’s interior structure. Combining atmospheric metallicity with the Love number will make HAT-P-13b one of the most

comprehensively understood exoplanets, setting a new benchmark for planetary studies and enhancing our understanding of planetary formation and evolution.

OBSERVING DESCRIPTION

We will take two observational sequences of HAT-P-13b, one with NIRISS GR700XD and a second with NIRSpec G395M. Both observations will be taken while HAT-P-13b is transiting its host star.

Proposal 8233 - Targets - Mapping the Atmosphere and Interior of HAT-P-13b: The Next Benchmark for Exoplanetary Science

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HAT-P-13	RA: 08 39 31.7694 (129.8823725d) Dec: +47 21 6.85 (47.35190d) Equinox: J2000	Proper Motion RA: -24.059812646440065 mas/yr Proper Motion Dec: -26.218103570902965 mas/yr Parallax: 0.004074990384384677" Epoch of Position: 2016	

Comments: Extracted from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets]

Observation

Proposal 8233, Observation 1: NIRISS Transit

Mon Jul 07 05:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRISS Single-Object Slitless Spectroscopy

Diagnostics

(NIRISS Transit (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)	HAT-P-13	RA: 08 39 31.7694 (129.8823725d)	Proper Motion RA: -24.059812646440065 mas/yr	
		Dec: +47 21 6.85 (47.35190d)	Proper Motion Dec: -26.218103570902965 mas/yr	
		Equinox: J2000	Parallax: 0.004074990384384677"	
			Epoch of Position: 2016	

Comments: Extracted from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets]

Acquisition

#	Target	Acquisition Mode	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	SOSSFAINT	F480M	NISRAPID	3	1	1	0.202	224811

Template

Subarray	Include Short First Exposure and F277W Exposure?
SUBSTRIP256	true

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	NISRAPID	1	1	1	1	11.008	
2	NISRAPID	3	1228	1	1228	27011.677	
3	NISRAPID	3	2	1	2	43.993	

Special Requirements

Phase 0.9392768871 to 0.9535646784 with period 2.91624268 Days and zero-phase 2455631.47279 HJD
Aperture PA Range 90 to 105 Degrees (V3 89.43873283 to 104.43873283)
Aperture PA Range 109 to 150 Degrees (V3 108.43873283 to 149.43873283)
Aperture PA Range 265 to 300 Degrees (V3 264.43873283 to 299.43873283)
Time Series Observation
No Parallel Attachments

Observation

Proposal 8233, Observation 2: NIRSpec Transit

Mon Jul 07 05:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRSpec Bright Object Time Series

Diagnostics

(NIRSpec Transit (Obs 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)	HAT-P-13	RA: 08 39 31.7694 (129.8823725d) Dec: +47 21 6.85 (47.35190d) Equinox: J2000	Proper Motion RA: -24.059812646440065 mas/yr Proper Motion Dec: -26.218103570902965 mas/yr Parallax: 0.004074990384384677" Epoch of Position: 2016	

Comments: Extracted from Gaia DR3.
Category=Star
Description=[Exoplanet Systems, Exoplanets]

Template

TA Method	Subarray
NONE	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	G395M/F290LP	NRSRAPID	8	3318	1	1	3318	27003.477	

Special Requirements

Phase 0.9392768871 to 0.9535646784 with period 2.91624268 Days and zero-phase 2455631.47279 HJD
Time Series Observation
No Parallel Attachments