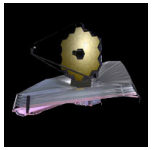

7407 - Completing the sub-Neptune Spectral Sequence with HD 86226 c

Cycle: 4, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRCam Grism Time Series	(1) HD-86226
	2		NIRCam Grism Time Series	(1) HD-86226
	3		MIRI Low Resolution Spectroscopy	(3) HD-86226-copy
	4		MIRI Low Resolution Spectroscopy	(2) HD-86226-background

ABSTRACT

We propose to acquire a panchromatic transmission (1-10 micron) spectrum of the hot (1300 K) sub-Neptune HD 86226 c by observing three transits: two with NIRCam using the DHS mode (one transit with F150W2 + F322W2, the second with F150W2 + F444W), and one with MIRI LRS. This is the best-suited sub-Neptune for atmospheric characterization that has an equilibrium temperature higher than 1000 K, filling an enormous gap in the parameter space of exisiting JWST programs, and presenting a unique opportunity to learn about a host of atmospheric and surface processes.

Theoretical studies of HD 86226 c show that it could either host a primary atmosphere, strongly shaped by atmospheric escape and magma-atmosphere interactions, or a secondary atmosphere consisting of evaporated volatile and rocky material. If the planet has a primary atmosphere, we will measure observable signatures of atmospheric escape and magma-atmosphere interactions by constraining the atmospheric metallicity and C/O ratio. If it has a secondary atmosphere, our observations will enable us to probe the surface composition of the planet. We will also be able to identify silicate cloud features if present. This will allow us to determine whether the hottest sub-Neptunes retain cloud-free atmospheres, similarly to the proposed cloud-free nature of sub-Neptunes with equilibrium temperatures close to 1000 K, a theory that is consistent with early JWST observations. Alternatively, if a cloud feature is detected, this would demonstrate that silicate clouds which form in hot Jupiter atmospheres can also exist in hot sub-Neptune atmospheres.

OBSERVING DESCRIPTION

We propose to observe three transits of the exoplanet HD 86226 c, using (1) NIRCam F150W2 + F322W2, (2) NIRCam F150W2 + F444W, and (3) MIRI LRS. Transits 1 and 2 will be observed in DHS mode, allowing for simultaneous short and long wavelength coverage.

We wish to use the DHS4 and DHS7 readout patterns for our NIRCam F322W2 and F444W visits respectively. These readout patterns cannot yet be specified in the APT, so we describe them below.

For our total exposure duration of 7.99 hours for the NIRCam F322W2 visit, the readout pattern DHS4 (nGroups = 3) does not exceed the 15GB data excess threshold given the JDox SW Grism Time Series Observing Strategies article. Therefore, we will update our program to use DHS4 pattern, nGroups = 3, prior to execution. In the submitted proposal, we use the RAPID readout pattern, nGroups = 3 (as instructed by JDox), which produces a predicted data excess of 57.5 GB. As noted above, we will change to the DHS4 pattern with nGroups = 3 if our proposal is accepted, which will result in a data excess of 8.29 GB, below the 15 GB middle threshold.

Following the JDox, we tested the feasibility of this observation using the RAPID readout pattern with nGroups = 5. This visit reaches 97% / 26% full well saturation for F332W / F150W2 (does not saturate).

For our total exposure duration of 7.99 hours for the NIRCam F444W visit, the readout pattern DHS7 (nGroups = 3) similarly does not data excess threshold given in the JDox SW Grism Time Series Observing Strategies article. Therefore, we plan to update our program to use DHS7 pattern, nGroups = 3, prior to execution. In the submitted proposal, we use the RAPID readout pattern, nGroups = 3 (as instructed in by JDox), which

produces a predicted data excess of 57.5 GB. As noted above, we will change to the DHS7 pattern with nGroups = 3 if our proposal is accepted, which will not lead to a data excess.

Following the JDox, we tested the feasibility of this observation using the RAPID readout pattern with nGroups = 8. This visit reaches 81% / 42% full well saturation for F44W / F150W2 (does not saturate).

For our MIRI LRS visit, our chosen nGroups = 6 does not lead to any data excess. This visit reaches 78% full well saturation.

PA angle will be specified when a newer version of ExoCTK is available with DHS overlap.

For each visit, we will use the main target for TA.

If these observations are approved, we will work with STScI to modify the specifics of our observing strategy if their planned DHS mode tests indicate that this is necessary.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HD-86226	RA: 09 56 29.8442 (149.1243508d) Dec: -24 05 57.80 (-24.09939d) Equinox: J2000	Proper Motion RA: -177.127 mas/yr Proper Motion Dec: 47.099 mas/yr Parallax: 0.0219301" Epoch of Position: 2000	
		Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.* *Category=Star* *Description=[Exoplanet Systems, Exoplanets, G dwarfs, G stars]* *Extended=NO*		
(2)	HD-86226-background	RA: 09 56 26.3913 (149.1099638d) Dec: -24 05 23.25 (-24.08979d) Equinox: J2000	Proper Motion RA: -177.127 mas/yr Proper Motion Dec: 47.099 mas/yr Parallax: 0.0219301" Epoch of Position: 2000	
		Comments: Dedicated background observation. *This object was generated by the targetselector and retrieved from the SIMBAD database.* *SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.* *Category=Calibration* *Description=[Telescope/sky background]* *Extended=NO*		
(3)	HD-86226-copy	RA: 09 56 29.8442 (149.1243508d) Dec: -24 05 57.80 (-24.09939d) Equinox: J2000	Proper Motion RA: -177.127 mas/yr Proper Motion Dec: 47.099 mas/yr Parallax: 0.0219301" Epoch of Position: 2000	
		Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.* *Category=Star* *Description=[Exoplanet Systems, Exoplanets, G dwarfs, G stars]* *Extended=NO*		

Observation

Proposal 7407, Observation 1

Wed Apr 22 18:00:17 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Grism 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): Data Excess over lower threshold

(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)	HD-86226	RA: 09 56 29.8442 (149.1243508d)	Proper Motion RA: -177.127 mas/yr	
		Dec: -24 05 57.80 (-24.09939d)	Proper Motion Dec: 47.099 mas/yr	
		Equinox: J2000	Parallax: 0.0219301"	
			Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=Star
Description=[Exoplanet Systems, Exoplanets, G dwarfs, G stars]
Extended=NO

Acquisition

#	Target	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
1	1 HD-86226	SUB32TA_DHS	F405N+F444W	RAPID	33	1	1	0.511	244635

Template

Subarray	No. of Output Channels	SW Channel Mode
SUB164S4_8-SPECTRA	4	GRISM

Spectral Elements

#	Short Pupil+Filter	Long Pupil+Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	GDHS0+F150W2	GRISMR+F444W	DHS4	3	3319	1	3319	28764.379	244635

Special Requirements	
	After Date 01-JUL-2026:00:00:00 Phase 0.949072470606345 to 0.9595298688391284 with period 3.98442 Days and zero-phase 2460738.7991707963 HJD Aperture PA Range 65.47541495 to 121.27541495 Degrees (V3 65.65 to 121.45) Aperture PA Range 287.00541495 to 331.62541495 Degrees (V3 287.18 to 331.8) Time Series Observation No Parallel Attachments

Observation

Proposal 7407, Observation 2

Wed Apr 22 18:00:17 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Grism Time Series

Diagnostics

(Observation 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): Data Excess over lower threshold

(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)	HD-86226	RA: 09 56 29.8442 (149.1243508d)	Proper Motion RA: -177.127 mas/yr	
		Dec: -24 05 57.80 (-24.09939d)	Proper Motion Dec: 47.099 mas/yr	
		Equinox: J2000	Parallax: 0.0219301"	
			Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=Star
Description=[Exoplanet Systems, Exoplanets, G dwarfs, G stars]
Extended=NO

Acquisition

#	Target	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
1	1 HD-86226	SUB32TA_DHS	F405N+F444W	RAPID	33	1	1	0.511	244635

Template

Subarray	No. of Output Channels	SW Channel Mode
SUB164S4_8-SPECTRA	4	GRISM

Spectral Elements

#	Short Pupil+Filter	Long Pupil+Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	GDHS0+F150W2	GRISMR+F322W2	DHS4	2	5523	1	5523	28764.557	244635

Special Requirements	
	After Date 01-JUL-2026:00:00:00 Phase 0.949072470606345 to 0.9595298688391284 with period 3.98442 Days and zero-phase 2460738.7991707963 HJD Aperture PA Range 65.95766958 to 121.75766958 Degrees (V3 65.65 to 121.45) Aperture PA Range 287.48766958 to 332.10766958 Degrees (V3 287.18 to 331.8) Time Series Observation No Parallel Attachments

Observation

Proposal 7407, Observation 3

Wed Apr 22 18:00:17 GMT 2026

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Background Observations:[Observation 4]

Diagnostics

(Observation 3) 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.

(Observation 3) Warning (Form): Groups/Int cannot be 1, Groups/Int = 2 requires permission and Groups/Int of 3-4 is allowed but not recommended.

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	HD-86226-copy	RA: 09 56 29.8442 (149.1243508d) Dec: -24 05 57.80 (-24.09939d) Equinox: J2000	Proper Motion RA: -177.127 mas/yr Proper Motion Dec: 47.099 mas/yr Parallax: 0.0219301" Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=Star
Description=[Exoplanet Systems, Exoplanets, G dwarfs, G stars]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
1	3 HD-86226-copy	F1000W	FAST	4	1	1	0.636	244635

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

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	Optional ETC ID	Filter
1	FASTR1	4	1	1	1	1	0.636		F1000W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	Optional ETC ID
1	FASTR1	6	25838	25838	1	1	28764.77	244635

Special Requirements

After Date 01-JUL-2026:00:00:00
Phase 0.949072470606345 to 0.9595298688391284 with period 3.98442 Days and zero-phase 2460738.7991707963 HJD
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, Non-interruptible

Observation

Proposal 7407, Observation 4 Wed Apr 22 18:00:17 GMT 2026

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Background Observation For: [Observation 3]

Diagnostics

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	HD-86226-background	RA: 09 56 26.3913 (149.1099638d) Dec: -24 05 23.25 (-24.08979d) Equinox: J2000	Proper Motion RA: -177.127 mas/yr Proper Motion Dec: 47.099 mas/yr Parallax: 0.0219301" Epoch of Position: 2000	

Comments: Dedicated background observation.

This object was generated by the targetselector and retrieved from the SIMBAD database.

SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=Calibration
Description=[Telescope/sky background]
Extended=NO

Acquisition

#	Target
1	NONE

Template

AcqFilter	Subarray	Obtain Verification Image?
F1000W	SLITLESSPRISM	false

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	NONE				

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	Optional ETC ID
1	FASTR1	6	10	10	1	1	10.974	244635

Special Requirements	
	Time Series Observation No Parallel Attachments Sequence Observations 3, 4, Non-interruptible