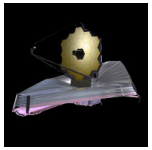

11553 - Playing the long game: Observing the long-term temperature trend of Neptune's upper atmosphere

Cycle: 5, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Neptune-Cycle-5				
	1	NEPTUNE-LON1	NIRSpec IFU Spectroscopy	(1) Neptune
	2	NEPTUNE-LON2	NIRSpec IFU Spectroscopy	(1) Neptune
	3	NEPTUNE-LON3	NIRSpec IFU Spectroscopy	(1) Neptune

ABSTRACT

Recent thermosphere and ionosphere findings at Neptune have been successful in detecting H3+ emission presenting a ~400 K drop in global temperatures since Voyager II in 1989, with no current explanation. This drop in global temperatures has also been observed at Uranus but at a rate of 8 K per year over the last 33 years. Unlike at Uranus, the dramatic change in temperature at Neptune is currently unconstrained, it may have followed a similar pattern as observed at Uranus and so could be inter-linked, both driven by the decline in solar wind's kinetic power or the global temperatures could change dramatically each year as observed at Saturn. To test both theories we propose to observe the H3+ emission from Neptune’s upper atmosphere once per year, with three observational frames taken at ~120 longitude seperation for each year visit to maximise latitudinal and longitudinal coverage. In total we will use JWST/NIRSPEC with the G395H/F290LP filter to observe the infrared spectrum of H3+ (2 – 5 m) of Neptune over a five year period. These will run in parallel with on-going ground-based campaigns observing the long-term measurements of Uranus’s upper atmosphere. Our results will produce five distinct global averages over five years to measure Neptune's current global temperature trend and understand if the planet's upper atmosphere is driven by the decline in solar activity between 2026 to 2031, independent of planetary season.

OBSERVING DESCRIPTION

In cycle 5, we aim to observe a full rotation of Neptune with JWST/NIRSpec over 3 longitudes at ~120o intervals to complete a global average of upper atmosphere temperatures for 2026. Each observation will take 10 groups of 4 integrations which will take 0.5 hrs and a total charge time of 3.9 hrs. This can be completed by using the G395H/F290LP filter to document infrared emissions of Neptune between 2 - 5 microns, through spectral fitting of known emission lines we can calculate emission brightness and temperatures. As Neptune's disk diameter (2.34 arcsec) is less than the FOV of NIRSPEC and so no dithering will be required in the observational setup. As this investigation requires long-term monitoring, we will copy the same observational setup for cycle 5 into cycles 6 to 9,.

Proposal 11553 - Targets - Playing the long game: Observing the long-term temperature trend of Neptune's upper atmosphere

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	Neptune	STD=NEPTUNE		

Comments: Extended=YES

Observation

Proposal 11553, Observation 1: NEPTUNE-LON1

Fri Apr 24 17:01:07 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

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

(NEPTUNE-LON1 (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	Neptune	STD=NEPTUNE		

Comments: Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	NONE				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	G395H/F290LP	NRSIRS2RAPID	10	4	false	false	NONE	1	4	641.911	273621

Special Requirements

2 After 1 by 5 Hours to 7 Hours

DEFAULT WINDOW: ANGULAR RATE NEPTUNE FROM JWST LESS THAN 0.075

Observation

Proposal 11553, Observation 2: NEPTUNE-LON2

Fri Apr 24 17:01:07 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(NEPTUNE-LON2 (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	Neptune	STD=NEPTUNE		

Comments: Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	NONE				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	G395H/F290LP	NRSIRS2RAPID	10	4	false	false	NONE	1	4	641.911	273621

Special Requirements

2 After 1 by 5 Hours to 7 Hours
3 After 2 by 5 Hours to 7 Hours

DEFAULT WINDOW: ANGULAR RATE NEPTUNE FROM JWST LESS THAN 0.075

Observation

Proposal 11553, Observation 3: NEPTUNE-LON3

Fri Apr 24 17:01:07 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

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

(NEPTUNE-LON3 (Obs 3)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	Neptune	STD=NEPTUNE		

Comments: Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	NONE				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	G395H/F290LP	NRSIRS2RAPID	10	4	false	false	NONE	1	4	641.911	273621

Special Requirements

3 After 2 by 5 Hours to 7 Hours

DEFAULT WINDOW: ANGULAR RATE NEPTUNE FROM JWST LESS THAN 0.075