JWST Proposal 1249 (Created: Friday, June 16, 2023 at 6:00:50 PM Eastern Standard Time) - Overview



# **1249 - Neptune**

Cycle: 1, Proposal Category: GTO

### **INVESTIGATORS**

Name	Institution
Prof. Leigh Fletcher (PI) (ESA Member)	University of Leicester
Dr. Stefanie N. Milam (CoI) (US Admin CoI)	NASA Goddard Space Flight Center

#### **OBSERVATIONS**

Folder	Observation	Label	Observing Template	Science Target					
Neptune Spectral Map									
	1	Neptune-Lon000	MIRI Medium Resolution Spectroscopy	(1) NEPTUNE					
	2	Neptune-Lon180	MIRI Medium Resolution Spectroscopy	(1) NEPTUNE					
	4	Neptune-Background	MIRI Medium Resolution Spectroscopy	(4) NEPTUNE-BACKGROUND					
	5	NIRSPEC-Lon000	NIRSpec IFU Spectroscopy	(1) NEPTUNE					
	6	NIRSPEC-Lon180	NIRSpec IFU Spectroscopy	(1) NEPTUNE					
	7	NIRSPEC-Background	NIRSpec IFU Spectroscopy	(4) NEPTUNE-BACKGROUND					

### **ABSTRACT**

We propose to explore the middle atmospheric circulation of this archetypal ice giant world using spatially-resolved global maps of atmospheric temperatures and tracers of dynamics and chemistry (e.g., hydrocarbon species). With simultaneous multi-wavelength (5-29 m) spectral imaging, we will: (i) reveal the unusual environmental conditions within Neptune's summer south polar vortex; (ii) search for evidence of vertical coupling between tropospheric storm systems/wind fields and stratospheric dynamics; and (iii) search for evidence of tropical vertical oscillation patterns.

JWST results for Neptune and Uranus will be intercompared to understand the similarities and differences between the two ice giants.

### **OBSERVING DESCRIPTION**

JWST Proposal 1249 (Created: Friday, June 16, 2023 at 6:00:50 PM Eastern Standard Time) - Overview Neptune global spatial-spectral map using MIRI and NIRSPEC, sampling two opposite hemispheres of the planet, 180 degrees apart. Neptune rotates in 16 hours, 6 minutes. The time between adjacent observations should therefore be ~8 hours.

### Notes:

- 1. SCHEDULING: Each longitude has been defined seperately to allow the visits to be seperated if necessary, but it makes most sense to execute all observations during one 16-hour rotation of Neptune, reducing the need for major slews.
- 2. PRECISE LONGITUDES ARE FLEXIBLE: As long as there is 180 degrees between each MIRI frame, then we still sample all 360 degrees of longitude. A "time after" constraint has been used to enforce this.
- 3. DITHERING: MIRI assumes a 4-point dither pattern to optimise the imaging of this 2.3" diameter disc. Large 1" dither offsets should be avoided, as the purpose is to improve spatial sampling for ALL of the MIRI channels. If a 2-point dither pattern is found to be sufficient for these moving targets, then we would consider changing the dithering technique prior to execution to increase the exposure time. NIRSPEC also assumes a 4-point dither pattern.
- 4. BACKGROUND: MIRI and NIRSPEC observations assume a single offset to a background region of sky (20" is acceptable, provided no Neptunian satellites are in the field of view). This would be best scheduled immediately before or after one of the science exposures.
- 5. SATURATION: The SHORT detector (channels 1 and 2) show no sign of saturating for 10 groups in the methane band at 7.66  $\mu$ m (the brightest spectral point from 5-11  $\mu$ m). The LONG detector (channels 3 and 4) saturate in the 5th group near C2H2 emission at 13.7  $\mu$ m, so we selected 5 groups (the minimum recommended).

Proposal 1249 - Targets - Neptune

<u> </u>	<u> </u>	103ai 1243 - Taigeis - Nepil	4110		
t S	#	† Name	Level 1	Level 2	Level 3
e	#	(1) NEPTUNE	STD=NEPTUNE		
<u>a</u>	(	Comments: Extended=YES			
ľε	(	(4) NEPTUNE-BACKGROUND	STD=NEPTUNE	TYPE=POS_ANGLE,RAD=300,ANG=0,REF=NORT	
l st		Comments: Extended=YES		Н	
Syster		Comments. Extended—TES			
olar					
Sol					
٠,	_				

Proposal 1249 - Observation 1 - Neptune	
Proposal 1249, Observation 1: Neptune-Lon000	

Fri Jun 16 23:00:50 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

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

(Neptune-Lon000 (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 1:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

ets	# Name	Level 1	Level 2	Level 3
l g	(1) NEPTUNE	STD=NEPTUNE		
Targ	Comments: Extended=YES			
stem				
Sys				
Slar				
So				

Target

NONE

Template Acquisition AcqFilter **Grating Wheel Direction Primary Channel Simultaneous Imaging Imager Subarray** F1500W YES ALL **FULL** NEUTRAL

Γ	rs	#	Dither Type	Optimized For	Direction
-	:he	1	4-Point	EXTENDED SOURCE	NEGATIVE
ı	۵				

	0	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/E xp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
ľ	เกเร	1		IMAGER	F1000W	FASTR1	5	6	1	Dither 1	4	24	388.506	
ı	e	1	SHORT(A)	MRSLONG		FASTR1	5	6	1	Dither 1	4	24	388.506	
Ŀ	E E	1	SHORT(A)	MRSSHORT		FASTR1	8	4	1	Dither 1	4	16	388.506	
		2		IMAGER	F1000W	FASTR1	5	6	1	Dither 1	4	24	388.506	
1.	iral	2	MEDIUM(B)	MRSLONG		FASTR1	5	6	1	Dither 1	4	24	388.506	
ı	၁၅	2	MEDIUM(B)	MRSSHORT		FASTR1	8	4	1	Dither 1	4	16	388.506	
ŀ	g	3		IMAGER	F1000W	FASTR1	5	6	1	Dither 1	4	24	388.506	
		3	LONG(C)	MRSLONG		FASTR1	5	6	1	Dither 1	4	24	388.506	
ı		3	LONG(C)	MRSSHORT		FASTR1	8	4	1	Dither 1	4	16	388.506	

Proposal 1249 - Observation 1 - Neptune

Special Requirements

After Date 22-JUN-2023:03:56:48

Sequence Observations 1, 4, 5, 7, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE NEPTUNE FROM JWST LESS THAN 0.03 DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF NEPTUNE BY TRITON FROM JWST

Proposal 1249 - Observation 2 - Nept	une
--------------------------------------	-----

Observation Proposal 1249, Observation 2: Neptune-Lon180 Fri Jun 16 23:00:50 GMT 2023 **Diagnostic Status: Warning** Observing Template: MIRI Medium Resolution Spectroscopy Diagnostics (Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Neptune-Lon180 (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results. (Visit 2:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements. Solar System Targets Name Level 1 Level 2 Level 3 **NEPTUNE** STD=NEPTUNE (1) Comments: Extended=YES Acquisition **Target** NONE Template <u>Acq</u>Filter **Primary Channel Grating Wheel Direction Simultaneous Imaging Imager Subarray** F1500W ALL YES **FULL NEUTRAL** Dithers **Dither Type** Optimized For Direction 4-Point EXTENDED SOURCE NEGATIVE **Total Dithers** Total ETC Wavelength Detector Filter Readout Groups/Int Integrations/E Exposures/Dit Dither Total Integrations Range Pattern h **Exposure** Wkbk.Calc ID хp Time Spectral Elements 5 6 4 24 **IMAGER** F560W FASTR1 Dither 1 388.506 SHORT(A) MRSLONG FASTR1 5 Dither 1 24 388.506 6 SHORT(A) MRSSHORT FASTR1 4 Dither 1 16 388.506 FASTR1 24 **IMAGER** F560W 6 Dither 1 388.506 MEDIUM(B) MRSLONG FASTR1 5 6 Dither 1 24 388.506 MEDIUM(B) FASTR1 8 16 388.506 MRSSHORT 4 Dither 1 4 5 **IMAGER** F560W FASTR1 6 Dither 1 24 388.506 FASTR1 5 24 388.506 LONG(C) MRSLONG 6 Dither 1 8 LONG(C) MRSSHORT FASTR1 Dither 1 16 388.506

Proposal	1249 -	Observation	4 -	Nentune

Observation Proposal 1249, Observation 4: Neptune-Background Fri Jun 16 23:00:50 GMT 2023 **Diagnostic Status: Warning** Observing Template: MIRI Medium Resolution Spectroscopy Diagnostics (Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Neptune-Background (Obs 4)) Informational (Form): The Visit Planner and Spike may produce different schedulability results. (Visit 4:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements. Solar System Targets Name Level 1 Level 2 Level 3 (4) NEPTUNE-BACKGROUND STD=NEPTUNE TYPE=POS\_ANGLE,RAD=300,ANG=0,REF=NORT Comments: Extended=YES Acquisition **Target** NONE Template <u>Acq</u>Filter **Primary Channel Grating Wheel Direction Simultaneous Imaging Imager Subarray** F1500W YES ALL **FULL NEUTRAL** Total Dithers Total ETC Wavelength Detector Filter Readout Groups/Int Integrations/E Exposures/Dit Dither Total Range Pattern **Integrations** Exposure Wkbk.Calc ID хp h Time Spectral Elements **IMAGER** F560W FASTR1 5 6 None 6 97.126 5 SHORT(A) MRSLONG FASTR1 6 None 6 97.126 SHORT(A) 8 4 MRSSHORT FASTR1 None 97.126 **IMAGER** F560W FASTR1 5 6 None 6 97.126 5 MEDIUM(B) MRSLONG FASTR1 6 None 97.126 6 MEDIUM(B) MRSSHORT FASTR1 4 None 4 97.126 5 97.126 **IMAGER** F560W FASTR1 6 None 6 LONG(C) MRSLONG FASTR1 5 6 None 6 97.126 LONG(C) MRSSHORT FASTR1 8 None 97.126

## Proposal 1249 - Observation 4 - Neptune

Special Requirements Between Dates 21-JUN-2023:00:00:00 and 24-JUN-2023:00:00:00

Sequence Observations 1, 4, 5, 7, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE NEPTUNE-BACKGROUND FROM JWST LESS THAN 0.03 DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF NEPTUNE-BACKGROUND BY TRITON FROM JWST

Diagnostics Observation	Proposal 1249 - Observation 5: N. Diagnostic Status: Warning Observing Template: NIRSpec IFU (Visit 5:1) Warning (Form): Overh (NIRSPEC-Lon000 (Obs 5)) Inform (Visit 5:1) Informational (Form): V	IRSPEC-Lon000  J Spectroscopy  eads are provisional (Form): The	l until the Visit l ne Visit Planner	and Spike may prod	uce different s	-		teoroid impact risk.	This is likely due		:00:50 GMT 2023
Solar System Targets	# Name (1) NEPTUNE Comments: Extended=YES	Level STD=1	1 NEPTUNE			Level 2			Level 3		
Template	TA Method NONE										
Dithers	1	<b>Dither Type</b> 4-POINT-DITHE	R	Size		Starting Poi	nt	Number of Poi	nts	Points	
_	# Grating/Filter	Readout Pattern	Groups/Int	Integrations/Ex	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
Spectral Elements	1 G395H/F290LP 2 G235H/F170LP	NRSRAPID	10	4	false false	true true	NONE NONE	4 4	16 16	1889.672 1889.672	
Special Requirements	Between Dates 21-JUN-2023:00:00 Sequence Observations 1, 4, 5, 7, N DEFAULT WINDOW: NOT ECL DEFAULT WINDOW: ANGULA	Non-interruptible		F NEPTUNE BY TR LESS THAN 0.03	RITON FROM	JWST					

Observation 1	Proposal 1249 - Observation 6: NI Diagnostic Status: Warning Observing Template: NIRSpec IFU	RSPEC-Lon18								Fri Jun 16 23	:00:50 GMT 2023
Diagnostics 0	(Visit 6:1) Warning (Form): Overhor (NIRSPEC-Lon180 (Obs 6)) Inform (Visit 6:1) Informational (Form): V	national (Form):	The Visit Planner	and Spike may prod	luce different s	•		teoroid impact risk.	This is likely due	to scheduling specia	al requirements.
Solar System Targets	# Name (1) NEPTUNE Comments: Extended=YES	Lev STE	el 1 =NEPTUNE			Level 2			Level 3		
Template	TA Method NONE										
Dithers	1	<b>Dither Type</b> 4-POINT-DITE	IER	Size		Starting Po	int	Number of Poi	nts	Points	
Spectral Elements	# Grating/Filter  1 G395H/F290LP 2 G235H/F170LP		Groups/Int  10 10	Integrations/Ex p 4	<b>Leakcal</b> false false	<b>Dither</b> true true	Autocal NONE NONE	Total Dithers  4 4	Total Integrations 16 16	<b>Total Exposure Time</b> 1889.672 1889.672	ETC Wkbk.Calc ID
Special Requirements	Between Dates 21-JUN-2023:00:00 Sequence Observations 2, 6, Non-in DEFAULT WINDOW: NOT ECLI DEFAULT WINDOW: ANGULAI	nterruptible		F NEPTUNE BY TF LESS THAN 0.03	RITON FROM	I JWST					

#### Proposal 1249 - Observation 7 - Neptune Observation Proposal 1249, Observation 7: NIRSPEC-Background Fri Jun 16 23:00:50 GMT 2023 **Diagnostic Status: Warning** Observing Template: NIRSpec IFU Spectroscopy Diagnostics (Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (NIRSPEC-Background (Obs 7)) Informational (Form): The Visit Planner and Spike may produce different schedulability results. (Visit 7:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements. **System Targets** Level 2 Level 3 Name Level 1 (4) NEPTUNE-BACKGROUND STD=NEPTUNE TYPE=POS\_ANGLE,RAD=300,ANG=0,REF=NORT Н Comments: Extended=YES Solar Template **TA Method** NONE Dithers Dither Type Size **Starting Point Number of Points Points** NONE Spectral Elements Grating/Filter Readout Groups/Int Integrations/Ex Leakcal Dither **Total Dithers** Total Exposure ETC Autocal Total Wkbk.Calc ID Pattern **Integrations** Time G395H/F290LP NRSRAPID 10 4 false false NONE 1 4 472.418 G235H/F170LP NRSRAPID 10 4 false NONE 1 472.418 false Special Requirements Between Dates 21-JUN-2023:00:00:00 and 24-JUN-2023:00:00:00 Sequence Observations 1, 4, 5, 7, Non-interruptible DEFAULT WINDOW: NOT OCCULTATION OF NEPTUNE-BACKGROUND BY NEPTUNE FROM JWST DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF NEPTUNE-BACKGROUND BY TRITON FROM JWST DEFAULT WINDOW: ANGULAR RATE NEPTUNE-BACKGROUND FROM JWST LESS THAN 0.03