



5073 - What drives the aurora of Uranus?

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Uranus full rotation				
	1	Uranus-stare	NIRSpec IFU Spectroscopy	(1) Uranus

ABSTRACT

JWST Proposal 5073 (Created: Monday, November 4, 2024, 1:00:40PM Eastern Standard Time) - Overview

Very little is known about the aurora of Uranus. The conduit of the auroral currents is the magnetic field, which at Uranus is full of strange complexity. It is tilted 60 degrees from the rotational axis, which means that it rotates a full 360 degrees during one Uranian day (17.24 hours), switching polarity relative to the interplanetary magnetic field (IMF). This produces a very complex and poorly understood interaction between the field and the solar wind. Auroral emissions are the electromagnetic manifestation of this interaction. The first JWST NIRSpec IFU observations of Uranus were obtained in January 2023 (GTO-1248), showing strong auroral emissions present, and forms the proof of concept for this programme. Here, we expand on these, proposing to observe Uranus for a full rotation with the NIRSpec IFU, observing the evolution and morphology of the aurora as it moves in local-time, connected to field lines in the tail, to the magnetopause and back again. The magnetospheric mapping of these emissions yields their source mechanisms: are they produced via the interaction with the solar wind (like the Earth), or are there internal sources within the system (like Jupiter), or somewhere in-between (like Saturn)? In turn, the spectral analysis of these emissions provides the atmospheric viewpoint: how does the injection of auroral energy alter the physical state of the upper atmosphere, and how significant a heat source is it for the global energy budget? Lastly, since the longitude system of Uranus has been long lost, because of the substantial uncertainties of the Voyager 2 period, tracking the morphology of the auroral provides the means to establish a new system.

OBSERVING DESCRIPTION

These observations will observe the near-infrared aurora of Uranus over a whole rotation (17.24 h) using the NIRSpec IFU with the F290LP/G395H filter/grating. This wavelength region captures a large number of H3+ emission lines, generated by the auroral process and the solar EUV produced background ionosphere. The observations obtained by GTO-1248 of the planet at three individual longitudes serve as the proof of concept for this sequence of observations, and will be improved on here by increasing the signal-to-noise by using 9 Groups instead of 6, and using a Large 9-point Cycling Pattern, instead of a 4-point dither, to ensure the entire planet is captured. The proposal implements the 'stare' element of this proposal as a Mosaic Sequence with 100% overlap, generating sets of observations all taken about the centre of Uranus. GTO-1248 showed that JWST is capable of tracking the auroral emissions across the disk.

Timing constraints: To satisfy the Visit Splitting limit of 30" and to avoid the Micrometeoroid Avoidance Zone (MAZ), the observations can only be obtained between 18 Jan 2025 and the 12 Feb 2025. During this interval, Uranus moves less than 30" across the Fine Guidance Sensor (FGS), and so no new guidestar acquisition should be required over the 17.24 hours of observations.

Proposal 5073 - Targets - What drives the aurora of Uranus?

Solar System Targets	#	Name	Level 1	Level 2	Level 3
	(1)	Uranus	STD=URANUS		
<i>Comments: Extended=YES</i>					

Proposal 5073 - Observation 1 - What drives the aurora of Uranus?

Mon Nov 04 18:00:40 GMT 2024

Observation	Proposal 5073, Observation 1: Uranus-stare Diagnostic Status: Warning Observing Template: NIRSpec IFU Spectroscopy											
Diagnostics	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Uranus-stare (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)	Uranus	STD=URANUS									
	<i>Comments: Extended=YES</i>											
Template	TA Method NONE											
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order					
	20	1	100.0	100.0	0.0	0.0	DEFAULT					
Dithers	#	Dither Type	Size	Starting Point	Number of Points	Points						
	1	CYCLING	LARGE	1	5							
Spectral Elements	#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	G395H/F290LP	NRSIRS2	5	1	false	true	NONE	5	5	1896.556	176666

Proposal 5073 - Observation 1 - What drives the aurora of Uranus?

Special Requirements

Between Dates 31-DEC-2024:00:00:00 and 18-FEB-2025:00:00:00

DEFAULT WINDOW: ANGULAR RATE URANUS FROM JWST LESS THAN 0.075