



5308 - Hunting for the source of Saturn's atmospherically driven aurora

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>
Saturn Pole Stare				
	1	SATURN-POLE-STARE	NIRSpec IFU Spectroscopy	(1) Saturn-Pole

ABSTRACT

Recent ground-based observations of Saturn's auroral dynamics have discovered aurorae produced by neutral winds in the planet's atmosphere, a process that overturns decades of orthodoxy describing aurorae as the product of currents following into the planet, caused by drivers within the surrounding space environment. Instead, roughly half of Saturn's auroral power results from currents created within the atmosphere itself. However, while these observations provide powerful evidence of an atmospheric driver, there is currently no understanding of how Saturn's atmosphere produces these neutral winds. Indeed, there is almost no understanding of how the ionosphere and thermosphere exchange energy in the upper atmosphere of Saturn.

Here, we propose to observe Saturn's northern auroral region through an entire Saturnian day, 10.6 hours in length, allowing us to observe the changing temperature of this region as the planet rotates. In addition to a wealth of complementary science returns, in revealing the atmospheric auroral energies for the first time we can hunt for a source of Saturn's atmospherically driven aurora, and thus contextualize this new process more widely, allowing us to understand whether the process is important at Earth, other planets in the solar system, and within astrophysical objects across the universe. JWST-NIRSpec is the only means of producing the needed maps of Saturn's upper atmospheric temperatures, and these maps will additionally serve as crucial constraints on global atmospheric dynamics.

OBSERVING DESCRIPTION

The observations proposed here will investigate Saturn's northern aurora for a complete Saturn day (10.6 hours) using the NIRSpec IFU. The F290LP/G395H filter grating combination provides coverage between 3 and 5 microns where a large number of bright H₃⁺ emission lines are located. As H₃⁺ is the dominant molecular ion in Saturn's ionosphere, it is an excellent probe of upper-atmospheric properties, so spectral analysis will yield auroral temperature and ion density maps.

A 4-point nod pattern will cover Saturn's entire northern auroral region, allowing for complete and continuous coverage after 26 such integrations.

Proposal 5308 - Targets - Hunting for the source of Saturn's atmospherically driven aurora

Solar System Targets	#	Name	Level 1	Level 2	Level 3
	(1)	Saturn-Pole	STD=SATURN	TYPE=TORUS, LONG=0, LAT=75, RAD=54706, POLE _LONG=0, POLE_LAT=90, O_LONG=0, O_LAT=0, O_ RAD=0	
	<i>Comments: Extended=YES</i>				

Proposal 5308 - Observation 1 - Hunting for the source of Saturn's atmospherically driven aurora

Wed Oct 09 22:00:30 GMT 2024

Observation	Proposal 5308, Observation 1: SATURN-POLE-STARE Diagnostic Status: Warning Observing Template: NIRSspec IFU Spectroscopy											
	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (SATURN-POLE-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)	Saturn-Pole	STD=SATURN	TYPE=TORUS, LONG=0, LAT=75, RAD=54706, POLE_LONG=0, POLE_LAT=90, O_LONG=0, O_LAT=0, O_RAD=0								
<i>Comments: Extended=YES</i>												
Template	TA Method											
	NONE											
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order					
	26	1	100.0	100.0	0.0	0.0	DEFAULT					
Dithers	#	Dither Type	Size	Starting Point	Number of Points	Points						
	1	4-POINT-NOD										
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	NRSIRS2RAPID	10	1	false	true	NONE	4	4	641.911	177978

Proposal 5308 - Observation 1 - Hunting for the source of Saturn's atmospherically driven aurora

Special Requirements

Between Dates 22-OCT-2024:00:00:00 and 09-DEC-2024:00:00:00

DEFAULT WINDOW: NOT OCCULTATION OF Saturn-Pole BY SATURN FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF Saturn-Pole BY TITAN FROM JWST
DEFAULT WINDOW: SEPARATION OF Saturn-Pole RHEA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Saturn-Pole TITAN FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE Saturn-Pole FROM JWST LESS THAN 0.075
ORBITAL LONGITUDE OF ENCELADUS FROM JWST BETWEEN 60 300