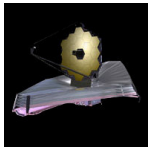

4320 - Seeking New Clues to the Habitability and Plume Activity of the Ocean World Enceladus using JWST-NIRSpec

Cycle: 2, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Christopher Glein (PI)	**Southwest Research Institute**
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Dr. Bryan Jason Holler (CoI)	Space Telescope Science Institute
Dr. Geronimo Villanueva (CoI)	NASA Goddard Space Flight Center
Dr. Sara Faggi (CoI)	NASA Goddard Space Flight Center
Dr. Lorenz Roth (CoI) (ESA Member)	Royal Institute of Technology
Dr. Kevin P. Hand (CoI)	Jet Propulsion Laboratory

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	NIRSpec Enceladus	NIRSpec IFU Spectroscopy	(1) ENCELADUS

ABSTRACT

We propose to make the first measurements of Enceladus's leading hemisphere with JWST-NIRSpec. These data are needed to test results from Cassini, to put them in greater context, and to support a path between the Cassini era of Enceladus exploration and the next stage of spacecraft exploration. Enceladus has dazzled the science community and the public alike, and is among the highest-priority targets in the solar system as affirmed by the recently released Decadal Survey. Yet, important questions remain pertaining to the habitability of its ocean and its plume activity, despite Cassini's in-depth investigations and JWST's previous fleeting glimpse of the trailing hemisphere. We aim to address the following

questions:
Are ocean-derived materials relatively abundant on Enceladus's surface?
Are carbon-bearing compounds relatively abundant on Enceladus's surface?
Are strong oxidants relatively abundant on Enceladus's surface?
Do Enceladus's gas plume and torus exhibit variability?
Sensitive searches for key signatures of indicator molecules (carbonate salts, ammonia, CO2, CH-organics, hydrogen peroxide, and water vapor in the range 1.66-5.1 μm) that strike at the heart of these questions will be performed using NIRSpec's integral field unit with G235H and G395M gratings. Much longer exposures, driven by the need to detect CO2, will provide a substantial boost in SNR, which is one of several advancements over the previous GTO observation of Enceladus. By providing access to required spectral regions that are opaque or compromised from the ground, JWST will enable the next breakthrough in our understanding of Enceladus, which otherwise may not happen for at least 20 years.

OBSERVING DESCRIPTION

We propose for JWST to make one observation of Saturn's moon Enceladus using NIRSpec IFU with G235H and G395M gratings. This observation will require 1.67 hours of science time and a total allocation of 3.44 hours, with 4-point dithering included. The expected data volume is 10147 MB. These values were calculated using the JWST Exposure Time Calculator (ETC) and APT to provide sufficient SNR to meet our science goals. An observationally-based surface spectrum uploaded from the Planetary Spectrum Generator, together with best-available compositional constraints, served as the basis of these estimates.

We require the proposed observation to be made when Enceladus's leading hemisphere is facing JWST (sub-observer longitudes between 75 and 105°W). We also require Enceladus to be separated by >10" from Titan and Rhea. If selected, our final requirement is for this observation to occur in JWST's trailing field of regard (FOR) during Cycle 2.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	ENCELADUS	STD=SATURN	STD=ENCELADUS	

Comments: Extended=YES

Observation

Proposal 4320, Observation 1: NIRSpec Enceladus

Thu May 11 18:05:45 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

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

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	ENCELADUS	STD=SATURN	STD=ENCELADUS	

Comments: Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

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	G235H/F170LP	NRSRAPID	11	5	false	true	NONE	4	20	2576.825	
2	G395M/F290LP	NRSRAPID	17	5	false	true	NONE	4	20	3865.237	

Special Requirements

After Date 04-JUN-2024:00:00:00

DEFAULT WINDOW: NOT OCCULTATION OF ENCELADUS BY SATURN FROM JWST
DEFAULT WINDOW: SEPARATION OF ENCELADUS RHEA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF ENCELADUS TITAN FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE ENCELADUS FROM JWST LESS THAN 0.075
CENTRAL MERIDIAN LONGITUDE OF ENCELADUS FROM JWST BETWEEN 75 105