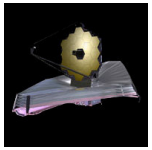

10128 - Ganymede's CO2 and H2O exospheres: global distribution, sources and sinks

Cycle: 5, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NIRSPec IFU G395H+235H				
	1	Ganymede G395H+235H - 45	NIRSpec IFU Spectroscopy	(1) Ganymede

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	2	Ganymede G395H+235H - 135	NIRSpec IFU Spectroscopy	(1) Ganymede
	3	Ganymede G395H+235H - 225	NIRSpec IFU Spectroscopy	(1) Ganymede
	4	Ganymede G395H+235H - 315	NIRSpec IFU Spectroscopy	(1) Ganymede
NIRSPec IFU G235H				
	5	Ganymede G235H - 90	NIRSpec IFU Spectroscopy	(1) Ganymede
	6	Ganymede G235H - 270	NIRSpec IFU Spectroscopy	(1) Ganymede

ABSTRACT

Jupiter's icy moons have weakly-bound tenuous exospheres, composed primarily of H2O and its radiolytic and photolysis products, and sustained via sublimation and plasma sputtering. The characterization of these exospheres has been challenging in the pre-JWST era. The first ever detection of Ganymede's CO2 exosphere, obtained during JWST Cycle 1, revealed large latitudinal/longitudinal variations in its distribution. Remarkably, a large CO2 gas enhancement is found on the leading's north polar cap where abundant amorphous ice and CO2 trapped in amorphous ice are found. CO2 may be radiolytically produced from dark terrains, more widespread in the leading north hemisphere, and then transported and redistributed towards the polar cap via cold trapping and be diurnally released. If validated, this scenario would provide the first univocal evidence in the Solar System for the formation of CO2 from the irradiation of carbon-bearing material, helping in elucidating how CO2 is sourced in icy bodies exposed to harsh environments. During Cycle 1, the leading and trailing sides were observed. We propose a global mapping of Ganymede's CO2 and H2O exospheres to test this scenario, explore CO2/H2O relationships and get pivotal constraints on the processes that influence exosphere formation. Observations are designed to capture diurnal variations of these exospheres to constrain the release mechanisms. Ganymede features the greatest diversity of terrains and of environmental conditions among Galilean icy moons. The understanding of surface-atmosphere interactions and space weathering at Ganymede has broad implications to understand these processes at icy moons across the Solar System.

OBSERVING DESCRIPTION

To further explore the relationships between CO2 gas and surface reflectance properties we propose NIRSPec/395H observations at four Ganymede's central meridian longitudes (45, 135, 225, 315°W), complementing 90°W (leading) and 270°W (trailing) phases observed during Cycle 1. For the observations of the H2O 2.7 micron gas band using NIRSPec G235H, we propose (45, 90, 135, 225, 270 and 315°W) phases, to cover the well documented phases of exospheric CO2 and O (from HST), and to get CO2 and H2O maps under same precipitating plasma environments. 235H/395H gratings with resolving power 2700 are necessary and suitable to enable the identification of rovibrational lines of CO2 and H2O against

2.7 and 4.27 microns CO2-solid absorption bands.

Specific requirement: We require observations to be scheduled when Jupiter is away from NIRSPec's MSA to avoid contamination of the spectra by leaked Jupiter light. This has the consequence that the 225 and 315° W central meridian longitudes should be observed in the leading field of regard (FOR), which overlaps the Micrometeorid Avoidance Zone (MAZ). The 45, 90, 135 and 270°W observations should be scheduled in the trailing FOR, which is outside the MAZ.

Proposal 10128 - Targets - Ganymede's CO2 and H2O exospheres: global distribution, sources and sinks

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	Ganymede	STD=JUPITER	STD=GANYMEDE	

Comments: Extended=YES

Observation

Proposal 10128, Observation 1: Ganymede G395H+235H - 45

Tue May 05 19:00:36 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.

(Ganymede G395H+235H - 45 (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)	Ganymede	STD=JUPITER	STD=GANYMEDE	

Comments: Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

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	Optional ETC ID
1	G395H/F290LP	NRSRAPID	10	4	false	true	NONE	4	16	1889.672	
2	G235H/F170LP	NRSRAPID	5	8	false	true	NONE	4	32	2061.46	

Special Requirements

Between Dates 24-MAR-2027:00:00:00 and 14-MAY-2027:00:00:00

DEFAULT WINDOW: NOT OCCULTATION OF Ganymede BY JUPITER FROM JWST
DEFAULT WINDOW: SEPARATION OF Ganymede IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE GANYMEDE FROM JWST LESS THAN 0.075
CENTRAL MERIDIAN LONGITUDE OF Ganymede FROM JWST BETWEEN 40 50
APPARENT DIAMETER Ganymede GREATER THAN 1.5

Observation

Proposal 10128, Observation 2: Ganymede G395H+235H - 135

Tue May 05 19:00:36 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.

(Ganymede G395H+235H - 135 (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)	Ganymede	STD=JUPITER	STD=GANYMEDE	

Comments: Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

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	Optional ETC ID
1	G395H/F290LP	NRSRAPID	10	4	false	true	NONE	4	16	1889.672	
2	G235H/F170LP	NRSRAPID	5	8	false	true	NONE	4	32	2061.46	

Special Requirements

Between Dates 24-MAR-2027:00:00:00 and 14-MAY-2027:00:00:00

DEFAULT WINDOW: NOT OCCULTATION OF Ganymede BY JUPITER FROM JWST
DEFAULT WINDOW: SEPARATION OF Ganymede IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE GANYMEDE FROM JWST LESS THAN 0.075
CENTRAL MERIDIAN LONGITUDE OF Ganymede FROM JWST BETWEEN 130 140
APPARENT DIAMETER Ganymede GREATER THAN 1.5

Observation

Proposal 10128, Observation 3: Ganymede G395H+235H - 225

Tue May 05 19:00:36 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.

(Ganymede G395H+235H - 225 (Obs 3)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 3:1) 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
(1)	Ganymede	STD=JUPITER	STD=GANYMEDE	

Comments: Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

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	Optional ETC ID
1	G395H/F290LP	NRSRAPID	10	4	false	true	NONE	4	16	1889.672	
2	G235H/F170LP	NRSRAPID	5	8	false	true	NONE	4	32	2061.46	

Special Requirements

Between Dates 13-NOV-2026:00:00:00 and 02-JAN-2027:00:00:00

DEFAULT WINDOW: NOT OCCULTATION OF Ganymede BY JUPITER FROM JWST
DEFAULT WINDOW: SEPARATION OF Ganymede IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE GANYMEDE FROM JWST LESS THAN 0.075
CENTRAL MERIDIAN LONGITUDE OF Ganymede FROM JWST BETWEEN 220 230
APPARENT DIAMETER Ganymede GREATER THAN 1.5

Observation

Proposal 10128, Observation 4: Ganymede G395H+235H - 315

Tue May 05 19:00:36 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Ganymede G395H+235H - 315 (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
(1)	Ganymede	STD=JUPITER	STD=GANYMEDE	

Comments: Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

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	Optional ETC ID
1	G395H/F290LP	NRSRAPID	10	4	false	true	NONE	4	16	1889.672	
2	G235H/F170LP	NRSRAPID	5	8	false	true	NONE	4	32	2061.46	

Special Requirements

Between Dates 13-NOV-2026:00:00:00 and 02-JAN-2027:00:00:00

DEFAULT WINDOW: NOT OCCULTATION OF Ganymede BY JUPITER FROM JWST
DEFAULT WINDOW: SEPARATION OF Ganymede IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE GANYMEDE FROM JWST LESS THAN 0.075
CENTRAL MERIDIAN LONGITUDE OF Ganymede FROM JWST BETWEEN 310 320
APPARENT DIAMETER Ganymede GREATER THAN 1.5

Observation

Proposal 10128, Observation 5: Ganymede G235H - 90

Tue May 05 19:00:36 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Ganymede G235H - 90 (Obs 5)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	Ganymede	STD=JUPITER	STD=GANYMEDE	

Comments: Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

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	Optional ETC ID
1	G235H/F170LP	NRSRAPID	5	8	false	true	NONE	4	32	2061.46	

Special Requirements

Between Dates 24-MAR-2027:00:00:00 and 14-MAY-2027:00:00:00

DEFAULT WINDOW: NOT OCCULTATION OF Ganymede BY JUPITER FROM JWST
DEFAULT WINDOW: SEPARATION OF Ganymede IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE GANYMEDE FROM JWST LESS THAN 0.075
CENTRAL MERIDIAN LONGITUDE OF Ganymede FROM JWST BETWEEN 85 95
APPARENT DIAMETER Ganymede GREATER THAN 1.5

Observation

Proposal 10128, Observation 6: Ganymede G235H - 270

Tue May 05 19:00:36 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Ganymede G235H - 270 (Obs 6)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

(Visit 6:1) 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
(1)	Ganymede	STD=JUPITER	STD=GANYMEDE	

Comments: Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

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	Optional ETC ID
1	G235H/F170LP	NRSRAPID	5	8	false	true	NONE	4	32	2061.46	

Special Requirements

Between Dates 13-NOV-2026:00:00:00 and 02-JAN-2027:00:00:00

DEFAULT WINDOW: NOT OCCULTATION OF Ganymede BY JUPITER FROM JWST
DEFAULT WINDOW: SEPARATION OF Ganymede IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF Ganymede CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE GANYMEDE FROM JWST LESS THAN 0.075
CENTRAL MERIDIAN LONGITUDE OF Ganymede FROM JWST BETWEEN 265 275
APPARENT DIAMETER Ganymede GREATER THAN 1.5