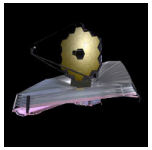

1252 - Spectral mapping of a comet's inner coma

Cycle: 1, Proposal Category: GTO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Jupiter-family comet				
	1	JFC NIRSpec IFU, prism and R2700	NIRSpec IFU Spectroscopy	(4) 22P-KOPFF
	2	JFC NIRSpec Background	NIRSpec IFU Spectroscopy	(5) 22P-KOPFF-OFFSET
	3	JFC MIRI MRS	MIRI Medium Resolution Spectroscopy	(4) 22P-KOPFF
	4	JFC MIRI Background	MIRI Medium Resolution Spectroscopy	(5) 22P-KOPFF-OFFSET
Main-belt comet				
	5	MBC NIRCam imaging	NIRCam Imaging	(3) 238P-READ
	6	MBC NIRSpec IFU prism	NIRSpec IFU Spectroscopy	(3) 238P-READ
	7	MBC NIRSpec Background	NIRSpec IFU Spectroscopy	(3) 238P-READ

ABSTRACT

Comets and asteroids delivered pre-biotic materials to the terrestrial planet zone, providing potential catalysts for life. The abundances and spatial distributions of gas and dust in the inner coma of comets provides insight into the composition and evolution of the nucleus, which in turn provides insight into the materials delivered to the early inner Solar System. We will spectrally map gas (H2O, CO2, CO, CH4, CH3OH, and others) and dust (silicates and carbonaceous materials) in the inner 1000 km of a moderately bright comet, and attempt the first detection of water vapor in the coma of a main belt comet. Key motivations driving this project are: to test the heterogeneity of a short-period comet's coma and to determine if gas coma heterogeneity is linked with dust coma heterogeneity; to demonstrate the new capabilities of JWST for the study of cometary composition; and to provide baseline observations for future cometary science investigations. JWST is expected to be the most sensitive instrument for the direct detection of water and other primary gases in comet comae. Mapping gas species in the near-infrared with JWST can provide data heretofore only delivered by in-situ spacecraft missions to 9P/Tempel 1, 67P/Churyumov-Gerasimenko, and 103P/Hartley 2. But beyond the capabilities of those missions, JWST can also map dust composition, providing a near-simultaneous census of the dominate components of a comet nucleus and coma.

This program corresponds to GTO Observation IDs: HAMMEL_0201, 0202, 0203, 0204, 0209, 0210, 0211.

OBSERVING DESCRIPTION

For the Jupiter-family comet: NIRSpec IFU prism mode and high-resolution spectroscopy for gas and water ice, MIRI IFU spectroscopy for dust. All observations have dedicated backgrounds.

For the main-belt comet: Both NIRCam and NIRSpec IFU prism mode data will be used to detect water gas at 2.7 m in the coma. The NIRSpec observation has a dedicated background. The NIRCam background can be derived in-scene or from the other module.

For both comets, the observations are sequenced together, non-interruptable, so that the full data sets are taken under a similar rotational phase of the nucleus, facilitating direct comparison of the data across different instruments. This also ensures the background observations are taken under similar conditions as the source data. The activity of both comets also vary through their orbits and the observation plans are specifically designed for the time periods when they are at their brightest for JWST. Timing constraints limit the observations to these periods.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(3)	238P-READ	TYPE=COMET,Q=2.369348671718905,E=0.2516736252480053,I=1.264083887208943,O=51.6255176951037,W=324.2067743745739,T=05-JUN-2022:10:21:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=15-SEP-2022:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=1.512106508017E-9,A2=-1.027170289308E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		
Comments: Extended=YES				
(4)	22P-KOPFF	TYPE=COMET,Q=1.55796541230831,E=0.5478729243410281,I=4.736874439187106,O=120.8649258360965,W=162.8959626357876,T=25-OCT-2015:02:28:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=14-OCT-2016:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=0.,A2=-5.177642777562E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		
Comments: Extended=YES				
(5)	22P-KOPFF-OFFSET	TYPE=COMET,Q=1.55796541230831,E=0.5478729243410281,I=4.736874439187106,O=120.8649258360965,W=162.8959626357876,T=25-OCT-2015:02:28:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=14-OCT-2016:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=0.,A2=-5.177642777562E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.	TYPE=POS_ANGLE,RAD=180,ANG=20,REF=NORTH	
Comments: Extended=YES				

Observation

Proposal 1252, Observation 1: JFC NIRSpec IFU, prism and R2700 Wed Aug 31 22:00:32 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[JFC NIRSpec Background (Obs 2), JFC MIRI MRS (Obs 3), JFC MIRI Background (Obs 4)]

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
(4)	22P-KOPFF	TYPE=COMET,Q=1.55796541230831,E=0.5478729243410281,I=4.736874439187106,O=120.8649258360965,W=162.8959626357876,T=25-OCT-2015:02:28:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=14-OCT-2016:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=0.,A2=-5.177642777562E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		

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	PRISM/CLEAR	NRSIRS2RAPID	4	1	false	true	NONE	4	4	291.778	41812.1
2	G235H/F170LP	NRSIRS2RAPID	4	1	false	true	NONE	4	4	291.778	41812.9
3	G395H/F290LP	NRSIRS2RAPID	24	1	false	true	NONE	4	4	1458.889	41812.10

Special Requirements

Between Dates 03-JUL-2022:00:00:00 and 03-SEP-2022:00:00:00

Sequence Observations 1, 2, 3, 4, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE 22P-KOPFF FROM JWST LESS THAN 0.03

Observation

Proposal 1252, Observation 2: JFC NIRSpec Background Wed Aug 31 22:00:32 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [JFC NIRSpec IFU, prism and R2700 (Obs 1), JFC MIRI MRS (Obs 3)]

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(5)	22P-KOPFF-OFFSET	TYPE=COMET,Q=1.55796541230831,E=0.5478729243410281,I=4.736874439187106,O=120.8649258360965,W=162.8959626357876,T=25-OCT-2015:02:28:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=14-OCT-2016:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=0.,A2=-5.177642777562E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.	TYPE=POS_ANGLE,RAD=180,ANG=20,REF=NORTH	

Comments: Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	2-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	PRISM/CLEAR	NRSIRS2RAPID	4	2	false	true	NONE	2	4	291.778	
2	G235H/F170LP	NRSIRS2RAPID	4	2	false	true	NONE	2	4	291.778	
3	G395H/F290LP	NRSIRS2RAPID	24	2	false	true	NONE	2	4	1458.889	

Special Requirements

Sequence Observations 1, 2, 3, 4, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE 22P-KOPFF-OFFSET FROM JWST LESS THAN 0.03

Observation

Proposal 1252, Observation 3: JFC MIRI MRS Wed Aug 31 22:00:32 GMT 2022

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[JFC NIRSpec IFU, prism and R2700 (Obs 1), JFC NIRSpec Background (Obs 2), JFC MIRI Background (Obs 4)]

Diagnostics

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(4)	22P-KOPFF	TYPE=COMET,Q=1.55796541230831,E=0.5478729243410281,I=4.736874439187106,O=120.8649258360965,W=162.8959626357876,T=25-OCT-2015:02:28:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=14-OCT-2016:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=0.,A2=-5.177642777562E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		

Comments: Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray
FND	ALL	NO	FULL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SHORT(A)	MRSLONG		FASTR1	20	1	1	Dither 1	4	4	222.003	41812.16
1	SHORT(A)	MRSSHORT		FASTR1	20	1	1	Dither 1	4	4	222.003	41812.8
2	MEDIUM(B)	MRSLONG		FASTR1	20	1	1	Dither 1	4	4	222.003	41812.17
2	MEDIUM(B)	MRSSHORT		FASTR1	20	1	1	Dither 1	4	4	222.003	41812.11
3	LONG(C)	MRSLONG		FASTR1	20	1	1	Dither 1	4	4	222.003	41812.18
3	LONG(C)	MRSSHORT		FASTR1	20	1	1	Dither 1	4	4	222.003	41812.12

Special Requirements	
	Sequence Observations 1, 2, 3, 4, Non-interruptible DEFAULT WINDOW: ANGULAR RATE 22P-KOPFF FROM JWST LESS THAN 0.03

Observation

Proposal 1252, Observation 4: JFC MIRI Background Wed Aug 31 22:00:32 GMT 2022

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [JFC NIRSpec IFU, prism and R2700 (Obs 1), JFC MIRI MRS (Obs 3)]

Diagnostics

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

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(5)	22P-KOPFF-OFFSET	TYPE=COMET,Q=1.55796541230831,E=0.5478729243410281,I=4.736874439187106,O=120.8649258360965,W=162.8959626357876,T=25-OCT-2015:02:28:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=14-OCT-2016:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=0.,A2=-5.177642777562E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.	TYPE=POS_ANGLE,RAD=180,ANG=20,REF=NORTH	

Comments: Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray
FND	ALL	NO	FULL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SHORT(A)	MRSLONG		FASTR1	20	1	1	Dither 1	4	4	222.003	
1	SHORT(A)	MRSSHORT		FASTR1	20	1	1	Dither 1	4	4	222.003	
2	MEDIUM(B)	MRSLONG		FASTR1	20	1	1	Dither 1	4	4	222.003	
2	MEDIUM(B)	MRSSHORT		FASTR1	20	1	1	Dither 1	4	4	222.003	
3	LONG(C)	MRSLONG		FASTR1	20	1	1	Dither 1	4	4	222.003	
3	LONG(C)	MRSSHORT		FASTR1	20	1	1	Dither 1	4	4	222.003	

Special Requirements	
	Sequence Observations 1, 2, 3, 4, Non-interruptible DEFAULT WINDOW: ANGULAR RATE 22P-KOPFF-OFFSET FROM JWST LESS THAN 0.03

Observation

Proposal 1252, Observation 5: MBC NIRCam imaging Wed Aug 31 22:00:32 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(3)	238P-READ	TYPE=COMET,Q=2.369348671718905,E=0.2516736252480053,I=1.264083887208943,O=51.6255176951037,W=324.2067743745739,T=05-JUN-2022:10:21:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=15-SEP-2022:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=1.512106508017E-9,A2=-1.027170289308E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		

Comments: Extended=YES

Template

Module	Subarray
ALL	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEX	5	STANDARD		1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F200W	F277W	BRIGHT1	10	1	5	5	1019.993	

Special Requirements	
	Between Dates 23-AUG-2022:00:00:00 and 10-SEP-2022:00:00:00 Offset 55.0 arcsec, -35.0 arcsec DEFAULT WINDOW: ANGULAR RATE 238P-READ FROM JWST LESS THAN 0.03

Observation

Proposal 1252, Observation 6: MBC NIRSpec IFU prism Wed Aug 31 22:00:32 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

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

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(3)	238P-READ	TYPE=COMET,Q=2.369348671718905,E=0.2516736252480053,I=1.264083887208943,O=51.6255176951037,W=324.2067743745739,T=05-JUN-2022:10:21:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=15-SEP-2022:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=1.512106508017E-9,A2=-1.027170289308E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		

Comments: Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	SMALL	11	4	

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	PRISM/CLEAR	NRSIRS2	11	1	false	true	NONE	4	4	3267.911	

Special Requirements	DEFAULT WINDOW: ANGULAR RATE 238P-READ FROM JWST LESS THAN 0.03

Observation

Proposal 1252, Observation 7: MBC NIRSpec Background Wed Aug 31 22:00:32 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(3)	238P-READ	TYPE=COMET,Q=2.369348671718905,E=0.2516736252480053,I=1.264083887208943,O=51.6255176951037,W=324.2067743745739,T=05-JUN-2022:10:21:58,TTimeScale=TDB,EQUINOX=J2000,EPOCH=15-SEP-2022:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=0.,A1=1.512106508017E-9,A2=-1.027170289308E-10,A3=0.,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		

Comments: Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	11	4	

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	PRISM/CLEAR	NRSIRS2	11	1	false	true	NONE	4	4	3267.911	

Special Requirements	
	Offset 30.0 arcsec, 30.0 arcsec DEFAULT WINDOW: ANGULAR RATE 238P-READ FROM JWST LESS THAN 0.03