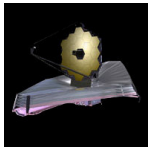

3702 - Ice observations toward massive protostars in the low-metallicity Large Magellanic Cloud

Cycle: 2, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Protostar ST6				
	1	ST6 SKY-NIRSpec	NIRSpec IFU Spectroscopy	(2) ST6-SKY-NIRSPEC
	2	ST6 NIRSpec	NIRSpec IFU Spectroscopy	(1) ST6
	3	ST6 MIRI	MIRI Medium Resolution Spectroscopy	(1) ST6
	4	ST6 SKY-MIRI	MIRI Medium Resolution Spectroscopy	(3) ST6-SKY-MIRI

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Hot Core in N83				
	5	N83-2A SKY-NIRSpec	NIRSpec IFU Spectroscopy	(5) N83-2A-SKY-NIRSPEC
	6	N83-2A NIRSpec	NIRSpec IFU Spectroscopy	(4) N83-2A
	7	N83-2A MIRI	MIRI Medium Resolution Spectroscopy	(4) N83-2A
	8	N83-2A SKY-MIRI	MIRI Medium Resolution Spectroscopy	(6) N83-2A-SKY-MIRI

ABSTRACT

One of the most important goals of astrochemistry is to understand the origin and evolution of complex organic molecules (COMs). The Large Magellanic Cloud (LMC) is the nearest laboratory for detailed studies on the formation and survival of COMs under metal poor conditions, typical for the early universe. Only very recently have gas-phase COMs been detected in the LMC with ALMA. JWST will join ALMA in revolutionizing the field of complex organic chemistry in low-metallicity environments by enabling studies of solid state COMs on spatial scales matching the gas phase observations.

We propose the NIRSpec IFU and MIRI MRS observations to map the infrared ice content in two massive protostellar envelopes in the LMC. JWST will provide spectra without contamination from the wider environment and with the high spectral resolution and sensitivity allowing for a reliable identification and detailed analysis of ice band profiles, revealing information on ice morphologies, thermal histories, and mixing environments. We will reliably measure the CH3OH ice column densities and search for larger COM ices for the first time at subsolar metallicity. JWST will reveal the level of molecular complexity in interstellar ices in the LMC. We will compare the abundances of the solid and gas state COMs to investigate formation routes that regulate the chemical complexity in star-forming regions. JWST will allow us to make a step forward toward the understanding the impact of metallicity on complex organic chemistry.

OBSERVING DESCRIPTION

We propose to use NIRSpec IFU (G395H/F290LP, 2.87-5.27 microns) and MIRI MRS (4.9-28.3 microns) to observe two protostellar envelopes in the low-metallicity LMC: N83-2A and ST6. The targets are extended, but can be observed in a single pointing.

Each NIRSpec IFU and MIRI MRS observation is associated with a dedicated background observation which is to be executed in a non-interruptible sequence.

For NIRSpec observations, we use the VERIFY_ONLY option with the F110W filter for target acquisition. We select the 4-point dither pattern and

include the "leakcal" exposure. We base the NIRSpec IFU observing time estimates on the Spitzer/IRAC photometry. Methanol and COMs around 3.6 microns have strengths of 3% of the continuum, therefore we request a S/N of 100 at 3.6 microns to detect these ice features. The total science time for all NIRSpec IFU observations is 0.98h.

For MIRI MRS observations, we do not request the target acquisition. A 4-point extended source dithering pattern for the MRS is chosen. Our program includes simultaneous MIRI imaging along with the MRS observations. We will use different filters for each of the 3 simultaneous imaging observations (corresponding to the 3 MRS grating settings): F560W, F770W, and F1000W. COMs have strengths of ~1% of the continuum at 8 microns, therefore we request a S/N of 300 to detect them. We simulate the spectra for major simple ice species and for methanol (the simplest COM) to make sure our observations will provide detections with high confidence. The total science time for all MIRI observations is 2.86h.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	ST6	RA: 05 39 41.0800 (84.9211667d) Dec: -69 29 16.80 (-69.48800d) Equinox: J2000		
Comments: *Category=Star* *Description=[Young stellar objects]* *Extended=YES*				
(2)	ST6-SKY-NIRSPEC	RA: 05 39 40.1565 (84.9173188d) Dec: -69 25 18.15 (-69.42171d) Equinox: J2000		
Comments: *Category=Calibration* *Description=[Telescope/sky background]* *Extended=YES*				
(3)	ST6-SKY-MIRI	RA: 05 39 40.1565 (84.9173188d) Dec: -69 25 18.15 (-69.42171d) Equinox: J2000		
Comments: *Category=Calibration* *Description=[Telescope/sky background]* *Extended=YES*				
(4)	N83-2A	RA: 04 54 0.1430 (73.5005958d) Dec: -69 11 55.25 (-69.19868d) Equinox: J2000		
Comments: *Category=Star* *Description=[Protostars]* *Extended=YES*				
(5)	N83-2A-SKY-NIRSPEC	RA: 04 53 53.3210 (73.4721708d) Dec: -69 12 8.90 (-69.20247d) Equinox: J2000		
Comments: *Category=Calibration* *Description=[Telescope/sky background]* *Extended=YES*				
(6)	N83-2A-SKY-MIRI	RA: 04 53 53.3210 (73.4721708d) Dec: -69 12 8.90 (-69.20247d) Equinox: J2000		
Comments: *Category=Calibration* *Description=[Telescope/sky background]* *Extended=YES*				

Observation

Proposal 3702, Observation 1: ST6 SKY-NIRSpec Fri Dec 08 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [ST6 NIRSpec (Obs 2)]

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	ST6-SKY-NIRSPEC	RA: 05 39 40.1565 (84.9173188d) Dec: -69 25 18.15 (-69.42171d) Equinox: J2000		

Comments:
Category=Calibration
Description=[Telescope/sky background]
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	G395H/F290LP	NRSIRS2RAPID	8	1	false	true	NONE	4	4	525.2	
2	G395H/F290LP	NRSIRS2RAPID	8	1	true	true	NONE	4	4	525.2	

Special Requirements

Sequence Observations 1, 2, Non-interruptible

Observation

Proposal 3702, Observation 2: ST6 NIRSpec Fri Dec 08 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[ST6 SKY-NIRSpec (Obs 1)]

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	ST6	RA: 05 39 41.0800 (84.9211667d) Dec: -69 29 16.80 (-69.48800d) Equinox: J2000		

Comments:
Category=Star
Description=[Young stellar objects]
Extended=YES

Template

TA Method
VERIFY_ONLY

Dithers

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

Pointing Verification

#	PV MSA Configuration	Filter	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Dithers	PV Total Integrations	PV Total Exposure Time
1	ALLOPEN	F110W	NRSRAPID	2	1	1	1	32.21

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	8	1	false	true	NONE	4	4	525.2	
2	G395H/F290LP	NRSIRS2RAPID	8	1	true	true	NONE	4	4	525.2	

Special Requirements	Sequence Observations 1, 2, Non-interruptible

Observation

Proposal 3702, Observation 3: ST6 MIRI Fri Dec 08 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[ST6 SKY-MIRI (Obs 4)]

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	ST6	RA: 05 39 41.0800 (84.9211667d) Dec: -69 29 16.80 (-69.48800d) Equinox: J2000		

Comments:
Category=Star
Description=[Young stellar objects]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
F1000W	All MRS	YES	FULL	NEUTRAL

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		IMAGER	F560W	FASTR1	38	3	1	Dither 1	4	12	1287.619	
1	SHORT(A)	MRSLONG		FASTR1	38	3	1	Dither 1	4	12	1287.619	
1	SHORT(A)	MRSSHORT		FASTR1	38	3	1	Dither 1	4	12	1287.619	
2		IMAGER	F770W	FASTR1	38	3	1	Dither 1	4	12	1287.619	
2	MEDIUM(B)	MRSLONG		FASTR1	38	3	1	Dither 1	4	12	1287.619	
2	MEDIUM(B)	MRSSHORT		FASTR1	38	3	1	Dither 1	4	12	1287.619	
3		IMAGER	F1000W	FASTR1	38	3	1	Dither 1	4	12	1287.619	
3	LONG(C)	MRSLONG		FASTR1	38	3	1	Dither 1	4	12	1287.619	
3	LONG(C)	MRSSHORT		FASTR1	38	3	1	Dither 1	4	12	1287.619	

Special Requirements	Sequence Observations 3, 4, Non-interruptible

Observation

Proposal 3702, Observation 4: ST6 SKY-MIRI Fri Dec 08 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [ST6 MIRI (Obs 3)]

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	ST6-SKY-MIRI	RA: 05 39 40.1565 (84.9173188d) Dec: -69 25 18.15 (-69.42171d) Equinox: J2000		

Comments:
Category=Calibration
Description=[Telescope/sky background]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
F1000W	All MRS	YES	FULL	NEUTRAL

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		IMAGER	F560W	FASTR1	38	3	1	Dither 1	4	12	1287.619	
1	SHORT(A)	MRSLONG		FASTR1	38	3	1	Dither 1	4	12	1287.619	
1	SHORT(A)	MRSSHORT		FASTR1	38	3	1	Dither 1	4	12	1287.619	
2		IMAGER	F770W	FASTR1	38	3	1	Dither 1	4	12	1287.619	
2	MEDIUM(B)	MRSLONG		FASTR1	38	3	1	Dither 1	4	12	1287.619	
2	MEDIUM(B)	MRSSHORT		FASTR1	38	3	1	Dither 1	4	12	1287.619	
3		IMAGER	F1000W	FASTR1	38	3	1	Dither 1	4	12	1287.619	
3	LONG(C)	MRSLONG		FASTR1	38	3	1	Dither 1	4	12	1287.619	
3	LONG(C)	MRSSHORT		FASTR1	38	3	1	Dither 1	4	12	1287.619	

Special Requirements	Sequence Observations 3, 4, Non-interruptible

Observation

Proposal 3702, Observation 5: N83-2A SKY-NIRSpec Fri Dec 08 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [N83-2A NIRSpec (Obs 6)]

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	N83-2A-SKY-NIRSPEC	RA: 04 53 53.3210 (73.4721708d) Dec: -69 12 8.90 (-69.20247d) Equinox: J2000		

Comments:
Category=Calibration
Description=[Telescope/sky background]
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	G395H/F290LP	NRSIRS2RAPID	6	1	false	true	NONE	4	4	408.489	
2	G395H/F290LP	NRSIRS2RAPID	6	1	true	true	NONE	4	4	408.489	

Special Requirements

Sequence Observations 5, 6, Non-interruptible

Observation

Proposal 3702, Observation 6: N83-2A NIRSpec Fri Dec 08 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[N83-2A SKY-NIRSpec (Obs 5)]

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(4)	N83-2A	RA: 04 54 0.1430 (73.5005958d) Dec: -69 11 55.25 (-69.19868d) Equinox: J2000		

Comments:
Category=Star
Description=[Protostars]
Extended=YES

Template

TA Method
VERIFY_ONLY

Dithers

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

Pointing Verification

#	PV MSA Configuration	Filter	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Dithers	PV Total Integrations	PV Total Exposure Time
1	ALLOPEN	F110W	NRSRAPID	2	1	1	1	32.21

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	6	1	false	true	NONE	4	4	408.489	
2	G395H/F290LP	NRSIRS2RAPID	6	1	true	true	NONE	4	4	408.489	

Special Requirements	Sequence Observations 5, 6, Non-interruptible

Observation

Proposal 3702, Observation 7: N83-2A MIRI Fri Dec 08 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[N83-2A SKY-MIRI (Obs 8)]

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(4)	N83-2A	RA: 04 54 0.1430 (73.5005958d) Dec: -69 11 55.25 (-69.19868d) Equinox: J2000		

Comments:
Category=Star
Description=[Protostars]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	All MRS	YES	FULL	NEUTRAL

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		IMAGER	F560W	FASTR1	40	1	1	Dither 1	4	4	444.006	
1	SHORT(A)	MRSLONG		FASTR1	40	1	1	Dither 1	4	4	444.006	
1	SHORT(A)	MRSSHORT		FASTR1	40	1	1	Dither 1	4	4	444.006	
2		IMAGER	F770W	FASTR1	40	1	1	Dither 1	4	4	444.006	
2	MEDIUM(B)	MRSLONG		FASTR1	40	1	1	Dither 1	4	4	444.006	
2	MEDIUM(B)	MRSSHORT		FASTR1	40	1	1	Dither 1	4	4	444.006	
3		IMAGER	F1000W	FASTR1	40	1	1	Dither 1	4	4	444.006	
3	LONG(C)	MRSLONG		FASTR1	40	1	1	Dither 1	4	4	444.006	
3	LONG(C)	MRSSHORT		FASTR1	40	1	1	Dither 1	4	4	444.006	

Special Requirements	Sequence Observations 7, 8, Non-interruptible

Observation

Proposal 3702, Observation 8: N83-2A SKY-MIRI Fri Dec 08 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [N83-2A MIRI (Obs 7)]

Diagnostics

(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(6)	N83-2A-SKY-MIRI	RA: 04 53 53.3210 (73.4721708d) Dec: -69 12 8.90 (-69.20247d) Equinox: J2000		

Comments:
Category=Calibration
Description=[Telescope/sky background]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	All MRS	YES	FULL	NEUTRAL

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		IMAGER	F560W	FASTR1	40	1	1	Dither 1	4	4	444.006	
1	SHORT(A)	MRSLONG		FASTR1	40	1	1	Dither 1	4	4	444.006	
1	SHORT(A)	MRSSHORT		FASTR1	40	1	1	Dither 1	4	4	444.006	
2		IMAGER	F770W	FASTR1	40	1	1	Dither 1	4	4	444.006	
2	MEDIUM(B)	MRSLONG		FASTR1	40	1	1	Dither 1	4	4	444.006	
2	MEDIUM(B)	MRSSHORT		FASTR1	40	1	1	Dither 1	4	4	444.006	
3		IMAGER	F1000W	FASTR1	40	1	1	Dither 1	4	4	444.006	
3	LONG(C)	MRSLONG		FASTR1	40	1	1	Dither 1	4	4	444.006	
3	LONG(C)	MRSSHORT		FASTR1	40	1	1	Dither 1	4	4	444.006	

Special Requirements	Sequence Observations 7, 8, Non-interruptible