



4929 - Exploring the Birth and Early Evolution of Massive Star Clusters with JWST

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>
MIRI-MRS IFU NGC1569-IR and NGC1569-A				
	1	NGC1569IR-Mosaic	MIRI Medium Resolution Spectroscopy	(1) NGC1569-IR
	2	NGC1569-BCK1	MIRI Medium Resolution Spectroscopy	(3) NGC1569-BCK1
	3	NGC1569-A	MIRI Medium Resolution Spectroscopy	(2) NGC1569-A

ABSTRACT

We propose to use JWST to map out the evolution of massive star clusters from birth to adulthood. The targets are the youngest clusters in the local dwarf galaxy NGC1569, with ages ranging from 0.5-25 Myr. Using MIRI/MRS IFU on JWST, we will image the full mid-infrared spectrum in these young embedded and partially embedded clusters; we expect to detect nebular forbidden lines, HI recombination lines, PAH features, H₂ lines, and dust continuum. The JWST data will be combined with existing submillimeter images with similar spatial resolution of excited lines of CO, HCN, and HCO⁺ and each cluster individually modeled with Cloudy. With this dataset we can observe how cluster emission properties vary with evolutionary stage and arrive at self-consistent models for forming clusters. The goal is to determine how the star-forming gas within giant clusters evolves in a changing stellar environment over time, and through modeling, measure the evolution of their stellar contents.

OBSERVING DESCRIPTION

We propose to use MIRI/MRS to obtain IFU spectra of young star clusters in the dwarf galaxy NGC1569. All four channels of the MRS will be used to obtain the full 4.9-28.8 micron spectrum at the highest spectral resolution in sources with strong mid-IR continuum. The proposal seeks to understand evolutionary patterns in the mid-IR nebular fine structure lines, PAHs, and molecules in clusters of different excitation, evolutionary stages and luminosities within the same host galaxy, which allows the initial gas conditions to be controlled. Targets include MIR1 and MIR2, deeply embedded and extremely young clusters, < 1Myr of age, with estimated masses of $1e5$ solar masses; MIR2 is so young that has not yet formed an HII region. Other targets are nearby regions with bright mid-IR continuum emission that are lower in luminosity and/or older, as well as nebulosity near older SSCs A and B. The MIRI mid-IR data will be compared with a submillimeter line survey at high resolution of the same clusters. Line fluxes from the individual regions will be statistically analyzed using regression analysis and principal component analysis. The goal is to determine how mid-IR nebular, continuum, PAH emission and molecules evolve over time in the gaseous surroundings of the youngest and most luminous star clusters.

Proposal 4929 - Targets - Exploring the Birth and Early Evolution of Massive Star Clusters with JWST

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	NGC1569-IR	RA: 04 30 47.2700 (67.6969583d) Dec: +64 51 2.30 (64.85064d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Parallax: 0" Epoch of Position: 2000	
<p><i>Comments: This position is the center for a mosaic in a partially visually obscured region with multiple compact MIR sources.</i> Category=ISM Description=[Bright nebulae, Emission nebulae, Gaseous nebulae, Molecular clouds, Photodissociation regions] Extended=YES</p>				
(2)	NGC1569-A	RA: 04 30 48.2000 (67.7008333d) Dec: +64 50 58.50 (64.84958d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000	
<p><i>Comments: Single pointing on a cluster, extended object.</i> Category=ISM Description=[Bright nebulae, Dust nebulae, Emission nebulae, H II regions, Photodissociation regions] Extended=YES</p>				
(3)	NGC1569-BCK1	RA: 04 30 34.3000 (67.6429167d) Dec: +64 52 11.00 (64.86972d) Equinox: J2000		
<p><i>Comments: Background for observations chosen by examination of Spitzer MIPS 24mic image.</i> Category=Calibration Description=[Telescope/sky background] Extended=YES</p>				

Fixed Targets

Proposal 4929 - Observation 1 - Exploring the Birth and Early Evolution of Massive Star Clusters with JWST

Wed Nov 27 16:00:10 GMT 2024

Observation	Proposal 4929, Observation 1: NGC1569IR-Mosaic Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observations:[NGC1569-BCK1 (Obs 2)] <i>Comments: The exposure on the simultaneous imaging is limited to reduce data volume.</i>						
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	
(1)	NGC1569-IR	RA: 04 30 47.2700 (67.6969583d) Dec: +64 51 2.30 (64.85064d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Parallax: 0" Epoch of Position: 2000				
<i>Comments: This position is the center for a mosaic in a partially visually obscured region with multiple compact MIR sources.</i> Category=ISM Description=[Bright nebulae, Emission nebulae, Gaseous nebulae, Molecular clouds, Photodissociation regions] Extended=YES							
Acquisition	#	Target					
1	NONE						
Template	AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction		
	All MRS	YES	FULL	Allow Auto Reorder			
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order
3	3	10.0	10.0	0.0	0.0	DEFAULT	
Dithers	#	Dither Type	Optimized For		Direction		
1	4-Point	EXTENDED SOURCE		NEGATIVE			

Proposal 4929 - Observation 1 - Exploring the Birth and Early Evolution of Massive Star Clusters with JWST

	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
Spectral Elements	1		IMAGER	F770W	FASTR1	13	1	1	Dither 1	4	4	144.302	176917
	1	SHORT(A)	MRSLONG		FASTR1	10	4	1	Dither 1	4	16	477.307	176917
	1	SHORT(A)	MRSSHORT		FASTR1	10	4	1	Dither 1	4	16	477.307	176917
	2		IMAGER	F770W	FASTR1	13	1	1	Dither 1	4	4	144.302	176917
	2	MEDIUM(B)	MRSLONG		FASTR1	10	4	1	Dither 1	4	16	477.307	176917
	2	MEDIUM(B)	MRSSHORT		FASTR1	10	4	1	Dither 1	4	16	477.307	176917
	3		IMAGER	F770W	FASTR1	13	1	1	Dither 1	4	4	144.302	176917
	3	LONG(C)	MRSLONG		FASTR1	10	4	1	Dither 1	4	16	477.307	176917
	3	LONG(C)	MRSSHORT		FASTR1	10	4	1	Dither 1	4	16	477.307	176917
Special Requirements	Sequence Observations 1, 2, 3, Non-interruptible												

Proposal 4929 - Observation 2 - Exploring the Birth and Early Evolution of Massive Star Clusters with JWST

Wed Nov 27 16:00:10 GMT 2024

Observation	Proposal 4929, Observation 2: NGC1569-BCK1 Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observation For: [NGC1569IR-Mosaic (Obs 1), NGC1569-A (Obs 3)]												
	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous				
	(3)	NGC1569-BCK1	RA: 04 30 34.3000 (67.6429167d) Dec: +64 52 11.00 (64.86972d) Equinox: J2000 <i>Comments: Background for observations chosen by examination of Spitzer MIPS 24mic image.</i> <i>Category=Calibration</i> <i>Description=[Telescope/sky background]</i> <i>Extended=YES</i>										
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging			Imager Subarray		Grating Wheel Direction			
		All MRS			YES			FULL		Allow Auto Reorder			
Dithers	#	Dither Type			Optimized For			Direction					
	1	4-Point			EXTENDED SOURCE			NEGATIVE					
Spectral Elements	#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/E xp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1		IMAGER	F770W	FASTR1	13	1	1	Dither 1	4	4	144.302	
	1	SHORT(A)	MRSLONG		FASTR1	10	4	1	Dither 1	4	16	477.307	
	1	SHORT(A)	MRSSHORT		FASTR1	10	4	1	Dither 1	4	16	477.307	
	2		IMAGER	F770W	FASTR1	13	1	1	Dither 1	4	4	144.302	
	2	MEDIUM(B)	MRSLONG		FASTR1	10	4	1	Dither 1	4	16	477.307	
	2	MEDIUM(B)	MRSSHORT		FASTR1	10	4	1	Dither 1	4	16	477.307	
	3		IMAGER	F770W	FASTR1	13	1	1	Dither 1	4	4	144.302	
	3	LONG(C)	MRSLONG		FASTR1	10	4	1	Dither 1	4	16	477.307	
	3	LONG(C)	MRSSHORT		FASTR1	10	4	1	Dither 1	4	16	477.307	

Proposal 4929 - Observation 2 - Exploring the Birth and Early Evolution of Massive Star Clusters with JWST

Special Requirements

Sequence Observations 1, 2, 3, Non-interruptible

Proposal 4929 - Observation 3 - Exploring the Birth and Early Evolution of Massive Star Clusters with JWST

Wed Nov 27 16:00:10 GMT 2024

Observation	Proposal 4929, Observation 3: NGC1569-A Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observations:[NGC1569-BCK1 (Obs 2)]												
	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous				
	(2)	NGC1569-A	RA: 04 30 48.2000 (67.7008333d) Dec: +64 50 58.50 (64.84958d) Equinox: J2000			Proper Motion RA: 0 Proper Motion Dec: 0 Parallax: 0" Epoch of Position: 2000							
Comments: <i>Single pointing on a cluster, extended object.</i> Category= <i>ISM</i> Description= <i>[Bright nebulae, Dust nebulae, Emission nebulae, H II regions, Photodissociation regions]</i> Extended= <i>YES</i>													
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging		Imager Subarray		Grating Wheel Direction				
		All MRS			YES		FULL		Allow Auto Reorder				
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	F770W	FASTR1	13	1	1	Dither 1	4	4	144.302	
	1	SHORT(A)	MRSLONG		FASTR1	10	4	1	Dither 1	4	16	477.307	
	1	SHORT(A)	MRSSHORT		FASTR1	10	4	1	Dither 1	4	16	477.307	
	2		IMAGER	F770W	FASTR1	13	1	1	Dither 1	4	4	144.302	
	2	MEDIUM(B)	MRSLONG		FASTR1	10	4	1	Dither 1	4	16	477.307	
	2	MEDIUM(B)	MRSSHORT		FASTR1	10	4	1	Dither 1	4	16	477.307	
	3		IMAGER	F770W	FASTR1	13	1	1	Dither 1	4	4	144.302	
	3	LONG(C)	MRSLONG		FASTR1	10	4	1	Dither 1	4	16	477.307	
	3	LONG(C)	MRSSHORT		FASTR1	10	4	1	Dither 1	4	16	477.307	

Proposal 4929 - Observation 3 - Exploring the Birth and Early Evolution of Massive Star Clusters with JWST

Special Requirements

Sequence Observations 1, 2, 3, Non-interruptible