



4256 - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

Cycle: 2, 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 Imaging of NGC6822 Clouds				
	1	FIELD1 MIRI MOSAI C	MIRI Imaging	(1) NGC6822FIELD1
	2	FIELD2 MIRI MOSAI C	MIRI Imaging	(2) NGC6822FIELD2

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
	6	NGC6822 MIRI OFF	MIRI Imaging	(5) NGC6822OFF
	3	FIELD3 MIRI MOSAI C	MIRI Imaging	(3) NGC6822FIELD3
	4	FIELD4 MIRI MOSAI C	MIRI Imaging	(4) NGC6822FIELD4
MIRI Imaging of WLM Clouds				
	5	FIELD MIRI MOSAIC WLM	MIRI Imaging	(6) WLMFIELD1
	7	WLM MIRI OFF	MIRI Imaging	(7) WLMOFF

ABSTRACT

Most of the star-forming molecular gas in low metallicity galaxies is "CO dark." As a result, both the mass of molecular gas and the structure of molecular clouds remain largely unknown at low metallicity. This CO dark material is still mixed with small dust grains, so JWST mid-IR observations offer the best current prospect to observe this gas at high physical resolution and sensitivity.

To develop this capability, we propose MIRI imaging of PAH (F770W) and dust continuum (F2100W) emission towards five low metallicity molecular clouds in the Local Group galaxies NGC 6822 and WLM. Both galaxies have resolved 1-2 pc CO cores characterized by ALMA and high quality Jansky VLA imaging of the atomic gas so that the other gas phases are known. They are close enough that JWST achieves 1-3 pc resolution, sharply resolving individual clouds, yet distant enough that our small program can cover most of the known molecular gas mass in each galaxy and span a range of ISM phases.

As these are the only two galaxies with this ideal distance and high quality supporting ISM data, we argue that they are the ideal next targets to tackle this longstanding problem. The result will be some of the best ever constraints on the abundance of CO dark molecular gas, resolved measurements of the CO-to-H₂ conversion factor, a new, complete view of low metallicity cloud structure, and dramatic improvements in our understanding of how to use the mid-IR to trace this otherwise invisible gas phase.

OBSERVING DESCRIPTION

The observations use MIRI in imaging mode with the F770W and F2100W filter.

We target 4 on-galaxy fields in NGC 6822 and one off-galaxy field designed to provide background information. The five total observations are

JWST Proposal 4256 (Created: Friday, September 29, 2023 at 8:00:15 AM Eastern Standard Time) - Overview

linked in time and forced to be sequential, so that the background can be shared. In the other target WLM, we target the one complex with known CO emission in the galaxy and pair one on-galaxy mosaic with an off-galaxy background.

Each on-galaxy field uses a 1x2 MIRI mosaic to cover one of the bright star-forming complexes in the galaxy. At each pointing, we expose for 222s in F770W using a standard dither for extended source 455s in F2100W.

Proposal 4256 - Targets - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	NGC6822FIELD1	RA: 19 45 5.0000 (296.2708333d) Dec: -14 43 21.60 (-14.72267d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies]</i> <i>Extended=YES</i></p>				
(2)	NGC6822FIELD2	RA: 19 44 52.3000 (296.2179167d) Dec: -14 43 7.00 (-14.71861d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies]</i></p>				
(3)	NGC6822FIELD3	RA: 19 44 33.0000 (296.1375000d) Dec: -14 42 11.00 (-14.70306d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies]</i></p>				
(4)	NGC6822FIELD4	RA: 19 44 49.0000 (296.2041667d) Dec: -14 52 50.00 (-14.88056d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies]</i></p>				
(5)	NGC6822OFF	RA: 19 45 31.7000 (296.3820833d) Dec: -14 30 46.50 (-14.51292d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Calibration</i> <i>Description=[External flat field]</i></p>				
(6)	WLMFIELD1	RA: 00 01 57.0000 (.4875000d) Dec: -15 27 36.00 (-15.46000d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies]</i></p>				
(7)	WLMOFF	RA: 00 01 56.0000 (.4833333d) Dec: -15 21 56.00 (-15.36556d) Equinox: J2000		
<p><i>Comments:</i> <i>Category=Calibration</i> <i>Description=[External flat field]</i></p>				

Fixed Targets

Proposal 4256 - Observation 1 - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

Fri Sep 29 13:00:15 GMT 2023

Observation	Proposal 4256, Observation 1: FIELD1 MIRI MOSAIC Diagnostic Status: Warning Observing Template: MIRI Imaging										
	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Miscellaneous			
	(1)	NGC6822FIELD1	RA: 19 45 5.0000 (296.2708333d) Dec: -14 43 21.60 (-14.72267d) Equinox: J2000								
<i>Comments:</i> Category=Galaxy Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies] Extended=YES											
Template	Subarray										
	FULL										
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order				
	1	2	10.0	10.0	0.0	0.0	DEFAULT				
Dithers	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	4-Point-Sets	1	4		6	1	EXTENDED SOURCE	POSITIVE	LARGE	
Spectral Elements	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F770W	FASTR1	20	1	1	Dither 1	4	4	222.003	
	2	F2100W	FASTR1	20	2	1	Dither 1	4	8	455.107	

Proposal 4256 - Observation 1 - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

Special Requirements

Group Visits within 53.0 Days
Aperture PA Range 80 to 82 Degrees (V3 75.16455103 to 77.16455103)
Visits Same PA

Sequence Observations 1, 2, 3, 4, 6, Non-interruptible

Proposal 4256 - Observation 2 - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

Fri Sep 29 13:00:15 GMT 2023

Observation	Proposal 4256, Observation 2: FIELD2 MIRI MOSAIC Diagnostic Status: Warning Observing Template: MIRI Imaging										
	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 2:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
Diagnosics											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Miscellaneous			
	(2)	NGC6822FIELD2	RA: 19 44 52.3000 (296.2179167d) Dec: -14 43 7.00 (-14.71861d) Equinox: J2000								
<i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies]</i>											
Template	Subarray										
	FULL										
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order				
	1	2	10.0	10.0	0.0	0.0	DEFAULT				
Dithers	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	4-Point-Sets	1	4		6	1	EXTENDED SOURCE	POSITIVE	LARGE	
Spectral Elements	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F770W	FASTR1	20	1	1	Dither 1	4	4	222.003	
	2	F2100W	FASTR1	20	2	1	Dither 1	4	8	455.107	
Special Requirements	Group Visits within 53.0 Days Aperture PA Range 80 to 82 Degrees (V3 75.16455103 to 77.16455103) Visits Same PA Sequence Observations 1, 2, 3, 4, 6, Non-interruptible										

Proposal 4256 - Observation 6 - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

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Observation	Proposal 4256, Observation 6: NGC6822 MIRI OFF Diagnostic Status: Warning Observing Template: MIRI Imaging										
	(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 6:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
Diagnosics											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Miscellaneous			
	(5)	NGC6822OFF	RA: 19 45 31.7000 (296.3820833d) Dec: -14 30 46.50 (-14.51292d) Equinox: J2000								
<i>Comments:</i> <i>Category=Calibration</i> <i>Description=[External flat field]</i>											
Template	Subarray										
	FULL										
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order				
	1	2	10.0	10.0	0.0	0.0	DEFAULT				
Dithers	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	4-Point-Sets	1	4		6	1	EXTENDED SOURCE	POSITIVE	LARGE	
Spectral Elements	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F770W	FASTR1	20	1	1	Dither 1	4	4	222.003	
	2	F2100W	FASTR1	20	2	1	Dither 1	4	8	455.107	
Special Requirements	Group Visits within 53.0 Days Visits Same PA Sequence Observations 1, 2, 3, 4, 6, Non-interruptible										

Proposal 4256 - Observation 3 - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

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Observation	<p>Proposal 4256, Observation 3: FIELD3 MIRI MOSAIC</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: MIRI Imaging</p>										
Diagnostics	<p>(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> <p>(Visit 3:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>										
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Miscellaneous			
	(3)	NGC6822FIELD3	RA: 19 44 33.0000 (296.1375000d) Dec: -14 42 11.00 (-14.70306d) Equinox: J2000								
	<p><i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies]</i></p>										
Template	<p>Subarray FULL</p>										
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order				
	1	2	10.0	10.0	0.0	0.0	DEFAULT				
Dithers	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	4-Point-Sets	1	4		6	1	EXTENDED SOURCE	POSITIVE	LARGE	
Spectral Elements	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F770W	FASTR1	20	1	1	Dither 1	4	4	222.003	
	2	F2100W	FASTR1	20	2	1	Dither 1	4	8	455.107	
Special Requirements	<p>Group Visits within 53.0 Days Aperture PA Range 80 to 82 Degrees (V3 75.16455103 to 77.16455103) Visits Same PA</p> <p>Sequence Observations 1, 2, 3, 4, 6, Non-interruptible</p>										

Proposal 4256 - Observation 4 - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

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Observation	Proposal 4256, Observation 4: FIELD4 MIRI MOSAIC Diagnostic Status: Warning Observing Template: MIRI Imaging										
	(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 4:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
Diagnosics											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Miscellaneous			
	(4)	NGC6822FIELD4	RA: 19 44 49.0000 (296.2041667d) Dec: -14 52 50.00 (-14.88056d) Equinox: J2000								
<i>Comments:</i> <i>Category=Galaxy</i> <i>Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies]</i>											
Template	Subarray										
	FULL										
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order				
	1	2	10.0	10.0	0.0	0.0	DEFAULT				
Dithers	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	4-Point-Sets	1	4		6	1	EXTENDED SOURCE	POSITIVE	LARGE	
Spectral Elements	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F770W	FASTR1	20	1	1	Dither 1	4	4	222.003	
	2	F2100W	FASTR1	20	2	1	Dither 1	4	8	455.107	
Special Requirements	Group Visits within 53.0 Days Aperture PA Range 80 to 82 Degrees (V3 75.16455103 to 77.16455103) Visits Same PA Sequence Observations 1, 2, 3, 4, 6, Non-interruptible										

Proposal 4256 - Observation 5 - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

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Observation	Proposal 4256, Observation 5: FIELD MIRI MOSAIC WLM Diagnostic Status: Warning Observing Template: MIRI Imaging										
	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 5:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.										
Diagnosics											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Miscellaneous			
	(6)	WLMFIELD1	RA: 00 01 57.0000 (.4875000d) Dec: -15 27 36.00 (-15.46000d) Equinox: J2000								
<i>Comments:</i> Category=Galaxy Description=[Dwarf irregular galaxies, Magellanic Irregular Galaxies]											
Template	Subarray										
	FULL										
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order				
	1	2	10.0	10.0	0.0	0.0	DEFAULT				
Dithers	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	4-Point-Sets				6	1	EXTENDED SOURCE	POSITIVE	DEFAULT	
Spectral Elements	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F770W	FASTR1	20	1	1	Dither 1	4	4	222.003	
	2	F2100W	FASTR1	20	2	1	Dither 1	4	8	455.107	
Special Requirements	Group Visits within 53.0 Days Aperture PA Range 60 to 62 Degrees (V3 55.16455103 to 57.16455103) Visits Same PA Sequence Observations 5, 7, Non-interruptible										

Proposal 4256 - Observation 7 - Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM

Fri Sep 29 13:00:15 GMT 2023

Observation	<p>Proposal 4256, Observation 7: WLM MIRI OFF</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: MIRI Imaging</p>										
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			
	(7)	WLMOFF	RA: 00 01 56.0000 (.4833333d) Dec: -15 21 56.00 (-15.36556d) Equinox: J2000								
	<p><i>Comments:</i> <i>Category=Calibration</i> <i>Description=[External flat field]</i></p>										
Template	<p>Subarray FULL</p>										
Dithers	#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	
	1	4-Point-Sets				6	1	EXTENDED SOURCE	POSITIVE	DEFAULT	
Spectral Elements	#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F770W	FASTR1	20	1	1	Dither 1	4	4	222.003	
	2	F2100W	FASTR1	20	2	1	Dither 1	4	8	455.107	
Special Requirements	Sequence Observations 5, 7, Non-interruptible										