



2221 - Star Formation along the Galactic Dust Ridge: The Brick and Cloud C

Cycle: 1, Proposal Category: GO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Adam G Ginsburg (PI)	University of Florida
Dr. Ashley Barnes (CoI) (ESA Member)	European Southern Observatory - Germany
Dr. Cara Battersby (CoI)	University of Connecticut
Prof. Elisabeth Mills (CoI)	University of Kansas Center for Research, Inc.
Dr. Jonathan Henshaw (CoI) (ESA Member)	Liverpool John Moores University
Dr. Xing Lu (CoI)	Shanghai Astronomical Observatory
Dr. Daniel Walker (CoI)	University of Connecticut

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
The Brick and Cloud C				
	3	MIRI background for Cloud C	MIRI Imaging	(2) CLOUD-C-MIRI-BACKGROUND
	1	The Brick/Cloud C, NIRCcam/MIRI	NIRCcam Imaging	(1) BRICK-IKP2016-G0.253+0.015
	2	The Brick/Cloud C, MIRI/NIRCcam	MIRI Imaging	(1) BRICK-IKP2016-G0.253+0.015

ABSTRACT

The Milky Way's Central Molecular Zone (CMZ) is a local analogue to the star-forming environments at the peak of cosmic star formation ($z \sim 2$). Under these conditions, CMZ clouds are forming stars at a rate lower than expected given their large reservoirs of dense gas. Two clouds in particular, The Brick and Cloud C, are prime examples of this, with no evidence of widespread star formation despite their extreme masses and densities. We propose to use JWST to pierce through these dark clouds to obtain a census of the embedded YSO population and to uncover recent

and ongoing low-mass star formation. Because of the relative locations of The Brick and Cloud C, MIRI will be pointed at Cloud C while NIRCам is pointed at The Brick and vice-versa. Therefore, we propose coordinated parallel observations where MIRI will search for the most deeply embedded YSOs based on their 25 micron dust emission while NIRCам will search for direct accretion signatures using the hydrogen recombination lines, H2, and CO filters. The PaAlpha and BrAlpha filters will identify the ionized flows of accreting sources, while the H2 filter shows outflow shock knots, and the CO band will exhibit either ice absorption from the cold envelope or disk emission from hot inner disks. We will use our sample of YSOs to map out the recent star formation history of these clouds and test competing theories for cloud evolution and star formation stochasticity in the CMZ.

OBSERVING DESCRIPTION

We aim to map out the Brick and Cloud C in a set of seven filters, four narrow-band (PaA 1.87 micron, BrA 4.05 micron, H2 2.12 micron, and CO 4.66 micron), two medium-band (F182M and F410M), and one wide-band long-wavelength (F2550W) filter. The narrow-band filters are used to measure specific emission features in accreting YSOs (PaA and BrA), CO ice in absorption to YSOs, and outflows from YSOs (H2), with the main aim of uniquely selecting YSOs and avoiding evolved and main-sequence star contaminants. The narrow-band PaA and BrA filters will be used to map extinction in the low-extinction outskirts where both will be detected against the diffuse ionized gas background at S/N great enough to build up pixel-by-pixel extinction maps. The medium-band filters will serve as continuum filters for their included or neighboring narrow-band filters. The wide-band filter at 25.5 microns is to select Class 0/I objects too deeply embedded to be seen in the near- and mid-infrared bands.

Both The Brick and Cloud C can be imaged simultaneously with NIRCам and MIRI. For one orientation of our observation (NIRCам on The Brick and MIRI on Cloud C), we adopted a full dither pattern with four sub-pixel dithers to optimize the spatial resolution in the NIRCам observations. For the flipped version of this observation (MIRI on The Brick and NIRCам on Cloud C), we will use the four sub-pixel dithers optimized for F2550W. For both instruments, readout modes have been chosen to keep data volume and data rate low while ensuring minimal saturation on bright sources in our field of view.

The position angle restrictions placed on these observations take into account pointing limits due to the total roll of the telescope as well as the projection of the detectors' fields of view on the sky. The primary limitation on telescope position angle is caused by the lack of availability of guide stars in our field of view. For two of the next four possible observation windows of this patch of sky, NIRCам and MIRI will be pointing simultaneously at both The Brick and Cloud C. All position angles reported provide coverage of these clouds to some degree.

Proposal 2221 - Targets - Star Formation along the Galactic Dust Ridge: The Brick and Cloud C

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	BRICK-IKP2016-G0.253+0.015	RA: 17 46 8.5500 (266.5356250d) Dec: -28 42 44.00 (-28.71222d) Equinox: J2000 <i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> <i>Category=ISM</i> <i>Description=[Molecular clouds]</i> <i>Extended=YES</i>	Epoch of Position: 2015.5	
(2)	CLOUD-C-MIRI-BACKGROUND	RA: 17 45 59.7275 (266.4988646d) Dec: -28 29 8.88 (-28.48580d) Equinox: J2000 <i>Comments:</i> <i>Category=Calibration</i> <i>Description=[Telescope/sky background]</i>			

Proposal 2221 - Observation 3 - Star Formation along the Galactic Dust Ridge: The Brick and Cloud C

Wed Mar 01 00:01:29 GMT 2023

Observation	<p>Proposal 2221, Observation 3: MIRI background for Cloud C</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: MIRI Imaging</p>										
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			
	(2)	CLOUD-C-MIRI-BACKGROUND	RA: 17 45 59.7275 (266.4988646d) Dec: -28 29 8.88 (-28.48580d) Equinox: J2000								
	<p><i>Comments:</i> <i>Category=Calibration</i> <i>Description=[Telescope/sky background]</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				1	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	F2550W	FASTR1	11	1	1	Dither 1	4	4	122.102	
Special Requirements	Sequence Observations 1, 3 within 1 Days										

Proposal 2221 - Observation 1 - Star Formation along the Galactic Dust Ridge: The Brick and Cloud C

Wed Mar 01 00:01:29 GMT 2023

Observation	Proposal 2221, Observation 1: The Brick/Cloud C, NIRCam/MIRI Diagnostic Status: Error Observing Template: NIRCam Imaging Coordinated Parallel Template(s): MIRI Imaging																																																						
	(The Brick/Cloud C, NIRCam/MIRI (Obs 1)) Error (Exposure): The combined data rate of 6.74 for prime and parallel exposures must be less than the allowed maximum of 6.19 MB/sec. (The Brick/Cloud C, NIRCam/MIRI (Obs 1)) Error (Exposure): The combined data rate of 6.74 for prime and parallel exposures must be less than the allowed maximum of 6.19 MB/sec. (The Brick/Cloud C, NIRCam/MIRI (Obs 1)) Error (Exposure): The combined data rate of 6.74 for prime and parallel exposures must be less than the allowed maximum of 6.19 MB/sec. (Visit 1:1) Warning (Form): Data Excess over lower threshold (Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.																																																						
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>BRICK-IKP2016-G0.253+0.015</td> <td>RA: 17 46 8.5500 (266.5356250d) Dec: -28 42 44.00 (-28.71222d) Equinox: J2000</td> <td>Epoch of Position: 2015.5</td> <td></td> </tr> <tr> <td colspan="5"> <i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=ISM Description=[Molecular clouds] Extended=YES </td> </tr> </tbody> </table>											#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous	(1)	BRICK-IKP2016-G0.253+0.015	RA: 17 46 8.5500 (266.5356250d) Dec: -28 42 44.00 (-28.71222d) Equinox: J2000	Epoch of Position: 2015.5		<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=ISM Description=[Molecular clouds] Extended=YES																																	
	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous																																																		
(1)	BRICK-IKP2016-G0.253+0.015	RA: 17 46 8.5500 (266.5356250d) Dec: -28 42 44.00 (-28.71222d) Equinox: J2000	Epoch of Position: 2015.5																																																				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=ISM Description=[Molecular clouds] Extended=YES																																																							
Template	NIRCam Imaging					MIRI Imaging																																																	
	Module: ALL Subarray: FULL Target Placement: Module Gap					Subarray: FULL																																																	
Dithers	<table border="1"> <thead> <tr> <th>#</th> <th>Primary Dither Type</th> <th>Primary Dithers</th> <th>Dither Size</th> <th>Subpixel Positions</th> <th>Coordinated Parallel Subpixel Selector</th> <th>Dither Direct Images Primes</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>FULLBOX</td> <td>6TIGHT</td> <td></td> <td>1</td> <td>4-POINT-WITH-MIRI-F2550W</td> <td>NO_DITHERING</td> </tr> </tbody> </table>											#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes	1	FULLBOX	6TIGHT		1	4-POINT-WITH-MIRI-F2550W	NO_DITHERING																														
	#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes																																																
1	FULLBOX	6TIGHT		1	4-POINT-WITH-MIRI-F2550W	NO_DITHERING																																																	
Spectral Elements	<table border="1"> <thead> <tr> <th>NIRCam Imaging</th> <th>Short Filter</th> <th>Long Filter</th> <th>Readout Pattern</th> <th>Groups/Int</th> <th>Integrations/Exp</th> <th>Total Integrations</th> <th>Total Dithers</th> <th>Total Exposure Time</th> <th>ETC Wkbk.Calc ID</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>F187N</td> <td>F405N+F444W</td> <td>BRIGHT2</td> <td>2</td> <td>1</td> <td>24</td> <td>24</td> <td>1030.73</td> <td></td> </tr> <tr> <td>2</td> <td>F212N</td> <td>F466N+F444W</td> <td>BRIGHT2</td> <td>2</td> <td>1</td> <td>24</td> <td>24</td> <td>1030.73</td> <td></td> </tr> <tr> <td>3</td> <td>F182M</td> <td>F410M</td> <td>BRIGHT2</td> <td>2</td> <td>1</td> <td>24</td> <td>24</td> <td>1030.73</td> <td></td> </tr> </tbody> </table>											NIRCam Imaging	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID	1	F187N	F405N+F444W	BRIGHT2	2	1	24	24	1030.73		2	F212N	F466N+F444W	BRIGHT2	2	1	24	24	1030.73		3	F182M	F410M	BRIGHT2	2	1	24	24	1030.73					
	NIRCam Imaging	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID																																													
	1	F187N	F405N+F444W	BRIGHT2	2	1	24	24	1030.73																																														
	2	F212N	F466N+F444W	BRIGHT2	2	1	24	24	1030.73																																														
3	F182M	F410M	BRIGHT2	2	1	24	24	1030.73																																															
Spectral Elements	<table border="1"> <thead> <tr> <th>MIRI Imaging</th> <th>Filter</th> <th>Readout Pattern</th> <th>Groups/Int</th> <th>Integrations/Exp</th> <th>Exposures/Dith</th> <th>Dither</th> <th>Total Dithers</th> <th>Total Integrations</th> <th>Total Exposure Time</th> <th>ETC Wkbk.Calc ID</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>F2550W</td> <td>FASTR1</td> <td>5</td> <td>1</td> <td>1</td> <td></td> <td>24</td> <td>24</td> <td>333.005</td> <td></td> </tr> <tr> <td>2</td> <td>F2550W</td> <td>FASTR1</td> <td>5</td> <td>1</td> <td>1</td> <td></td> <td>24</td> <td>24</td> <td>333.005</td> <td></td> </tr> <tr> <td>3</td> <td>F2550W</td> <td>FASTR1</td> <td>5</td> <td>1</td> <td>1</td> <td></td> <td>24</td> <td>24</td> <td>333.005</td> <td></td> </tr> </tbody> </table>											MIRI Imaging	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	1	F2550W	FASTR1	5	1	1		24	24	333.005		2	F2550W	FASTR1	5	1	1		24	24	333.005		3	F2550W	FASTR1	5	1	1		24	24	333.005	
	MIRI Imaging	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID																																												
	1	F2550W	FASTR1	5	1	1		24	24	333.005																																													
	2	F2550W	FASTR1	5	1	1		24	24	333.005																																													
3	F2550W	FASTR1	5	1	1		24	24	333.005																																														

Proposal 2221 - Observation 1 - Star Formation along the Galactic Dust Ridge: The Brick and Cloud C

Special Requirements

Aperture PA Range 87 to 93.14744876 Degrees (V3 87.0713531 to 93.21880186)
No Parallel Attachments
Sequence Observations 1, 3 within 1 Days

Proposal 2221 - Observation 2 - Star Formation along the Galactic Dust Ridge: The Brick and Cloud C

Wed Mar 01 00:01:29 GMT 2023

Observation	Proposal 2221, Observation 2: The Brick/Cloud C, MIRI/NIRCam Diagnostic Status: Error Observing Template: MIRI Imaging Coordinated Parallel Template(s): NIRCam Imaging																																																						
Diagnostics	(The Brick/Cloud C, MIRI/NIRCam (Obs 2)) Error (Exposure): The combined data rate of 6.86 for prime and parallel exposures must be less than the allowed maximum of 6.19 MB/sec. (The Brick/Cloud C, MIRI/NIRCam (Obs 2)) Error (Exposure): The combined data rate of 6.86 for prime and parallel exposures must be less than the allowed maximum of 6.19 MB/sec. (The Brick/Cloud C, MIRI/NIRCam (Obs 2)) Error (Exposure): The combined data rate of 6.86 for prime and parallel exposures must be less than the allowed maximum of 6.19 MB/sec. (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. (Visit 2:1) 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. (Visit 2:2) 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.																																																						
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>BRICK-IKP2016-G0.253+0.015</td> <td>RA: 17 46 8.5500 (266.5356250d) Dec: -28 42 44.00 (-28.71222d) Equinox: J2000</td> <td>Epoch of Position: 2015.5</td> <td></td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=ISM Description=[Molecular clouds] Extended=YES</p>											#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous	(1)	BRICK-IKP2016-G0.253+0.015	RA: 17 46 8.5500 (266.5356250d) Dec: -28 42 44.00 (-28.71222d) Equinox: J2000	Epoch of Position: 2015.5																																			
#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous																																																			
(1)	BRICK-IKP2016-G0.253+0.015	RA: 17 46 8.5500 (266.5356250d) Dec: -28 42 44.00 (-28.71222d) Equinox: J2000	Epoch of Position: 2015.5																																																				
Template	<table border="1"> <thead> <tr> <th>MIRI Imaging</th> <th>NIRCam Imaging</th> </tr> </thead> <tbody> <tr> <td>Subarray: FULL</td> <td>Module: ALL Subarray: FULL Target Placement: Module Gap</td> </tr> </tbody> </table>											MIRI Imaging	NIRCam Imaging	Subarray: FULL	Module: ALL Subarray: FULL Target Placement: Module Gap																																								
MIRI Imaging	NIRCam Imaging																																																						
Subarray: FULL	Module: ALL Subarray: FULL Target Placement: Module Gap																																																						
Mosaic	<table border="1"> <thead> <tr> <th>Rows</th> <th>Columns</th> <th>Row Overlap %</th> <th>Column Overlap %</th> <th>Row shift</th> <th>Column shift</th> <th>Tile Order</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4</td> <td>10.0</td> <td>10.0</td> <td>0.0</td> <td>0.0</td> <td>DEFAULT</td> </tr> </tbody> </table>											Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order	1	4	10.0	10.0	0.0	0.0	DEFAULT																														
Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order																																																	
1	4	10.0	10.0	0.0	0.0	DEFAULT																																																	
Dithers	<table border="1"> <thead> <tr> <th>#</th> <th>Dither Type</th> <th>Starting Point</th> <th>Number of Points</th> <th>Points</th> <th>Starting Set</th> <th>Number of Sets</th> <th>Optimized For</th> <th>Direction</th> <th>Pattern Size</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4-POINT-MIRI-F2550W-WITH-NIRCam</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>DEFAULT</td> </tr> </tbody> </table>											#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size	1	4-POINT-MIRI-F2550W-WITH-NIRCam								DEFAULT																								
#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size																																														
1	4-POINT-MIRI-F2550W-WITH-NIRCam								DEFAULT																																														
Spectral Elements	<table border="1"> <thead> <tr> <th>MIRI Imaging</th> <th>Filter</th> <th>Readout Pattern</th> <th>Groups/Int</th> <th>Integrations/Exp</th> <th>Exposures/Dith</th> <th>Dither</th> <th>Total Dithers</th> <th>Total Integrations</th> <th>Total Exposure Time</th> <th>ETC Wkbk.Calc ID</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>F2550W</td> <td>FASTR1</td> <td>11</td> <td>2</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>8</td> <td>255.304</td> <td></td> </tr> <tr> <td>2</td> <td>F2550W</td> <td>FASTR1</td> <td>11</td> <td>2</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>8</td> <td>255.304</td> <td></td> </tr> <tr> <td>3</td> <td>F2550W</td> <td>FASTR1</td> <td>11</td> <td>2</td> <td>1</td> <td>Dither 1</td> <td>4</td> <td>8</td> <td>255.304</td> <td></td> </tr> </tbody> </table>											MIRI Imaging	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	1	F2550W	FASTR1	11	2	1	Dither 1	4	8	255.304		2	F2550W	FASTR1	11	2	1	Dither 1	4	8	255.304		3	F2550W	FASTR1	11	2	1	Dither 1	4	8	255.304	
MIRI Imaging	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID																																													
1	F2550W	FASTR1	11	2	1	Dither 1	4	8	255.304																																														
2	F2550W	FASTR1	11	2	1	Dither 1	4	8	255.304																																														
3	F2550W	FASTR1	11	2	1	Dither 1	4	8	255.304																																														

Proposal 2221 - Observation 2 - Star Formation along the Galactic Dust Ridge: The Brick and Cloud C

Spectral Elements	NIRCam Imaging	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID	
	1		F187N	F405N+F444W	BRIGHT2	2	1	4	4	171.788	
	2		F212N	F466N+F444W	BRIGHT2	2	1	4	4	171.788	
	3		F182M	F410M	BRIGHT2	2	1	4	4	171.788	
Special Requirements	Group Visits within 53.0 Days Aperture PA Range 277.98425324 to 280.68425324 Degrees (V3 273.14880427 to 275.84880427) Visits Same PA No Parallel Attachments										