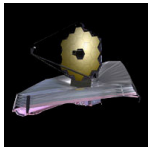

5952 - Zooming-in on the sub-grid physics of PAHs at 20% solar metallicity

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	3	MIRI	MIRI Imaging	(2) SMC-SW-Bar-3
	2	NIRCAM	NIRCam Imaging	(2) SMC-SW-Bar-3

ABSTRACT

The MIR SED of high metallicity galaxies is dominated by spectral features resulting from the fluorescence of polycyclic aromatic hydrocarbon (PAH) molecules illuminated by FUV photons. In low metallicity systems (<20% solar), Spitzer observations have revealed a deficit in PAH

emission, which so far have been explained by either the insufficient carbon content of the ISM of low metallicity galaxies to form PAHs; or by the destruction of PAHs by the hard radiation field percolating through the poorly shielded ISM of these systems. We suggest a third scenario: that the filling factor of PAH clumps decreases at low metallicity owing to the pervasive ionizing radiation field, resulting in diluted, faint emission even at the 2” resolution of Spitzer/IRAC. We propose to test this hypothesis by obtaining NIRCam and MIRI imaging of the 3.3, 7.7, 11.3, and 12.7 micron PAH features in the SMC SW Bar 3 region at the highest spatial resolution achievable in the nearby low metallicity universe (0.03 pc). We will determine the typical length-scales of PAH clumps in a quiescent star-forming environment. By comparing the observations to similar JWST images of the NGC 346 young massive star cluster (also in the SMC), we will investigate the influence of the radiation field on the spatial distribution of PAHs and their properties (size, ionization), traced by the relative strengths of the different features. The results of this investigation will inform the mechanisms responsible for the formation and destruction of PAHs. Since PAHs dominate the heating of gas in galaxies, this program will provide some important clues at a fundamental driver of galaxy evolution.

OBSERVING DESCRIPTION

We propose to obtain NIRCam and MIRI imaging of the SW Bar 3 quiescent star-forming region in the SMC, which is located at a distance of 62 koc and has a metallicity of 20% solar. We selected filters (F115W, F150W, F212W, F300M, F335M, F360M, F560W, F770W, F1000W, F1130W, F1280W, F1500W, F2100W) to sample the 3.3, 7.7, 11.3, and 12.7 micron PAH features, as well as the stellar and hot dust continua between and around the features. This will allow us to estimate and subtract those continua such that the strengths of the PAH features can be measured.

For NIRCam, we will obtain a single field centered on the peak of the 8 micron PAH emission previously detected with Spitzer/IRAC4. We will use the INTRAMODULEX pattern with 4 dithers to maximize coverage and efficiency.

For MIRI, a small (1x2) mosaic is required to cover the region. We will use a 4-point-sets dither optimized for extended sources, with starting-set=5 and number of sets = 1 (in the default positive direction) so that the pattern starts in the center of the array, which is in turned centered on the peak of the emission.

Exposure times were computed to reach a S/N > 30 on the features. The S/N is driven by the necessity to differentiate between PAH models with different sizes and ionization levels using band ratios (e.g., F770W/F1130W).

For the MIRI observations, we computed the maximum number of groups for which the background does not saturate, and estimated the corresponding number of integrations to reach the exposure time in 4 dithers. For NIRCam, we will use 8 groups/integration and 2 integrations to

reach the exposure time in 4 dithers.

There are no timing constraints or other special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	SMC-SW-Bar-3	RA: 00 45 22.3500 (11.3431250d) Dec: -73 23 0.10 (-73.38336d) Equinox: J2000		

Comments:
Category=ISM
Description=[Molecular clouds]
Extended=YES

Observation

Proposal 5952, Observation 3: MIRI

Thu Apr 03 18:00:08 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

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

(Visit 3:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	SMC-SW-Bar-3	RA: 00 45 22.3500 (11.3431250d) Dec: -73 23 0.10 (-73.38336d) Equinox: J2000		

Comments:
Category=ISM
Description=[Molecular clouds]
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				5	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	F560W	FASTR1	50	3	1	Dither 1	4	12	1687.224	174228
2	F770W	FASTR1	50	2	1	Dither 1	4	8	1121.116	
3	F1000W	FASTR1	75	4	1	Dither 1	4	16	3363.348	
4	F1130W	FASTR1	50	6	1	Dither 1	4	24	3385.549	
5	F1500W	FASTR1	35	12	1	Dither 1	4	48	4784.169	
6	F2100W	FASTR1	25	20	1	Dither 1	4	80	5760.983	

Special Requirements	Group Visits within 53.0 Days Visits Same PA

Observation

Proposal 5952, Observation 2: NIRCAM

Thu Apr 03 18:00:08 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

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
(2)	SMC-SW-Bar-3	RA: 00 45 22.3500 (11.3431250d) Dec: -73 23 0.10 (-73.38336d) Equinox: J2000		

Comments:
Category=ISM
Description=[Molecular clouds]
Extended=YES

Template

Module	Subarray	Target Placement
ALL	FULL	Module B (B4 corner)

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEX	4	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	F187N	F300M	MEDIUM8	8	2	8	4	6742.692	
2	F212N	F335M	MEDIUM8	8	2	8	4	6742.692	
3	F150W	F360M	MEDIUM8	8	2	8	4	6742.692	
4	F200W	F444W	MEDIUM8	8	2	8	4	6742.692	211658

Special Requirements

Fiducial Point Override NRCBS_FULL