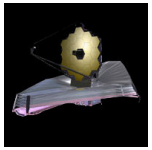

2773 - Deciphering the extended dust and gas environment of the archetypal type-1 AGN in NGC 4151 with JWST

Cycle: 2, Proposal Category: GTO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	MIRI MRS IFU	MIRI Medium Resolution Spectroscopy	(1) NGC4151-BACKGROUND
	2	MIRI MRS IFU	MIRI Medium Resolution Spectroscopy	(2) NGC4151
	3	MIRI MRS IFU	MIRI Medium Resolution Spectroscopy	(3) BD+40-2507

ABSTRACT

We propose to exploit the full capability of the MIRI spectrometer to advance immensely our understanding of the active nucleus (AGN) of NGC 4151 in the mid-IR. This galaxy is the closest with a luminous Type-1 AGN, allowing high spatial resolution (down to ~ 10 pc with the MRS) and making it the archetype to set the framework for understanding more distant examples that will be studied at these wavelengths with JWST over its lifetime. Our investigation takes full advantage of the 7 times higher angular resolution, 5 times greater spectral resolution, and ~ 60 times greater sensitivity (to an unresolved line) of JWST compared with the Spitzer IRS. These new capabilities let us probe in detail the rich dust and gas features in the mid-IR window that provide critical diagnostics of the AGN physics and its relation with the host galaxies. Specifically, we will characterize (1) the morphology, temperature and composition of the extended polar dust components associated with the the AGN narrow-line region; (2) the

ionizing AGN continuum shape between X-ray and UV bands which cannot be directly accessed for any AGNs due to intergalactic absorption; and (3) the relation of excited PAH molecules and molecular hydrogen to the gas inflow and possible star formation near the AGN. These results will complement the detailed picture of the AGN in NGC 4151 with existing multi-wavelength data across the electromagnetic spectrum.

OBSERVING DESCRIPTION

We will use MIRI/MRS to spatially resolve the mid-IR gas and dust properties of the extended structures surrounding the type-1 AGN in NGC 4151. All the channels of MIRI have been used to continuously sample the dust continuum and emission line features from 5 to 28 m. With an integration time of 50 mins in Band C, we are expected to detect the AGN-heated 11.3 m PAH emission at 10-sigma at a distance of 2 arcsec to the AGN, the faintest key feature that this proposal is targeting. Together with the 10 mins exposures in Band A and Band B, we can reach S/N ~ 2 -- 300 of the narrow line region dust emission and S/N~7-- 150 of all the major forbidden lines at the same distance. To improve the astrometry measurements, we require target acquisition on NGC 4151 nucleus with the FND filter. To avoid saturation, FAST readout pattern with 10 groups per integration is selected. As MIRI MRS is spatially under-sampled, we adopt a 4-point dither pattern optimized for extended sources. To enable accurate PSF subtraction, we observe a bright PSF at a distance 5.5 arcmin to the nuclei. Finally, to robustly constrain the polar dust morphology and strength over the FOV, dedicated background observation is planned at a blank field near the PSF star.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	NGC4151-BACKGROUND	RA: 12 10 48.0000 (182.7000000d) Dec: +39 20 0.00 (39.33333d) Equinox: J2000		
Comments: dedicated background observations of NGC 4151 *Category=Calibration* *Description=[Telescope/sky background]* *Extended=YES*				
(2)	NGC4151	RA: 12 10 32.5772 (182.6357383d) Dec: +39 24 21.06 (39.40585d) Equinox: J2000	Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[Active galactic nuclei, Active galaxies, Seyfert galaxies]* *Extended=YES*				
(3)	BD+40-2507	RA: 12 10 43.3566 (182.6806525d) Dec: +39 19 24.29 (39.32341d) Equinox: J2000	Proper Motion RA: -0.014846446223026638 sec of time/yr Proper Motion Dec: -0.04694100002780033 arcsec/yr Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Calibration* *Description=[Point spread function]* *Extended=NO*				

Observation

Proposal 2773, Observation 1: MIRI MRS IFU

Tue Sep 13 16:00:57 GMT 2022

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [MIRI MRS IFU (Obs 2), MIRI MRS IFU (Obs 3)]

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)	NGC4151-BACKGROUND	RA: 12 10 48.0000 (182.7000000d) Dec: +39 20 0.00 (39.33333d) Equinox: J2000		

Comments: dedicated background observations of NGC 4151
Category=Calibration
Description=[Telescope/sky background]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray
FND	ALL	NO	FULL

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	SHORT(A)	MRSLONG		FASTR1	25	2	1	Dither 1	4	8	566.108	
1	SHORT(A)	MRSSHORT		FASTR1	25	2	1	Dither 1	4	8	566.108	
2	MEDIUM(B)	MRSLONG		FASTR1	25	2	1	Dither 1	4	8	566.108	
2	MEDIUM(B)	MRSSHORT		FASTR1	25	2	1	Dither 1	4	8	566.108	
3	LONG(C)	MRSLONG		FASTR1	25	10	1	Dither 1	4	40	2874.941	
3	LONG(C)	MRSSHORT		FASTR1	25	10	1	Dither 1	4	40	2874.941	

Special Requirements	Sequence Observations 1, 2, 3, Non-interruptible

Observation

Proposal 2773, Observation 2: MIRI MRS IFU Tue Sep 13 16:00:57 GMT 2022

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[MIRI MRS IFU (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
(2)	NGC4151	RA: 12 10 32.5772 (182.6357383d) Dec: +39 24 21.06 (39.40585d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[Active galactic nuclei, Active galaxies, Seyfert galaxies]
Extended=YES

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	FND	FAST	4	1	1	11.1	56217

Template

Primary Channel	Simultaneous Imaging	Imager Subarray
ALL	NO	FULL

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	SHORT(A)	MRSLONG		FASTR1	25	2	1	Dither 1	4	8	566.108	
1	SHORT(A)	MRSSHORT		FASTR1	25	2	1	Dither 1	4	8	566.108	
2	MEDIUM(B)	MRSLONG		FASTR1	25	2	1	Dither 1	4	8	566.108	
2	MEDIUM(B)	MRSSHORT		FASTR1	25	2	1	Dither 1	4	8	566.108	
3	LONG(C)	MRSLONG		FASTR1	25	10	1	Dither 1	4	40	2874.941	
3	LONG(C)	MRSSHORT		FASTR1	25	10	1	Dither 1	4	40	2874.941	

Special Requirements	Sequence Observations 1, 2, 3, Non-interruptible

Observation

Proposal 2773, Observation 3: MIRI MRS IFU Tue Sep 13 16:00:57 GMT 2022

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[MIRI MRS IFU (Obs 1)]

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
(3)	BD+40-2507	RA: 12 10 43.3566 (182.6806525d) Dec: +39 19 24.29 (39.32341d) Equinox: J2000	Proper Motion RA: -0.014846446223026638 sec of time/yr Proper Motion Dec: -0.04694100002780033 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Calibration
Description=[Point spread function]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SAME	FND	FAST	4	1	1	11.1	56217

Template

Primary Channel	Simultaneous Imaging	Imager Subarray
ALL	NO	FULL

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	SHORT(A)	MRSLONG		FASTR1	25	2	1	Dither 1	4	8	566.108	
1	SHORT(A)	MRSSHORT		FASTR1	25	2	1	Dither 1	4	8	566.108	
2	MEDIUM(B)	MRSLONG		FASTR1	25	2	1	Dither 1	4	8	566.108	
2	MEDIUM(B)	MRSSHORT		FASTR1	25	2	1	Dither 1	4	8	566.108	
3	LONG(C)	MRSLONG		FASTR1	25	2	1	Dither 1	4	8	566.108	
3	LONG(C)	MRSSHORT		FASTR1	25	2	1	Dither 1	4	8	566.108	

Special Requirements	Sequence Observations 1, 2, 3, Non-interruptible