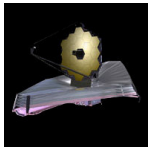

4065 - Dusty Torus, Molecular Gas, Outflows, and Binary Nucleus in the Powerful Nearby Quasar Cygnus A

Cycle: 2, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
CygA_IFU_MRS				
	1	Cyg A IFU	NIRSpec IFU Spectroscopy	(1) CYGNUS-A
	2	Cyg A MRS	MIRI Medium Resolution Spectroscopy	(3) CYGNUS-A-MRS
	3	Cyg A MRS OFF	MIRI Medium Resolution Spectroscopy	(4) CYGNUS-A-MRS-OFF
CygA_IM				
	4	CygA_MIRI_IM	MIRI Imaging	(1) CYGNUS-A
	5	CygA_MIRI_IM	MIRI Imaging	(2) CYGNUS-A-MIRIM-OFF

ABSTRACT

Cygnus A is the closest powerful radio galaxy, with a rich observational history. Its MIR-luminous quasar nucleus is enshrouded by dust, allowing detailed studies at NIR wavelengths of AGN fueling and feedback that would otherwise be hindered by the glare of the AGN. We propose a suite of JWST imaging and integral field spectroscopy with MIRI and NIRSpec in order to study the dusty molecular torus, quasar fueling and outflows, and to confirm or refute the presence of a binary supermassive black hole. We propose NIRSpec IFU and MIRI MRS observations to map the kinematics, temperature, and mass of molecular and ionized gas in the host galaxy. This will yield the kinematics and H2 temperature distribution in the 100 pc-scale disk that serves to fuel the AGN and a measurement of the warm H2 and dust mass in the unresolved 10-100pc scale torus. MIRI will also separate the AGN-heated dust continuum from the torus and NLR bi-cone, informing dusty torus models. Spectral maps in spectral lines from multiple ionization states will be used to map the mass, outflow rate, and kinetic power of AGN-driven outflows in relation to the location of the relativistic jet. The MIRI Imager will be used to isolate and measure the luminosity of the secondary nucleus, and to survey star formation throughout the host galaxy. Altogether, these observations will tell us (1) the amount of molecular gas available to fuel the dust-obscured quasar and its depletion timescale, (2) The impact of AGN and jet-driven outflows on the ISM and whether or not they are sufficient to eventually quench star formation, and (3) whether the secondary nucleus hosts an active SMBH.

OBSERVING DESCRIPTION

We use the NIRSpec IFU G235H and G395H gratings in a single dithered pointing to cover the central 3x3 arcsec^2 of Cygnus A at 1.7-5 microns with a resolution of 100 km/s. Background observations are not necessary for this bright target. We don't need leakcals since there are no extremely bright stars in the MSA footprint.

The MIRI MRS observations use an extended source dither to better sample the PSF. We use all gratings to cover the full 5-27 micron spectrum. We link the source and dedicated off-background observations by an uninterruptible sequence special requirement.

MIRI imager observations in three filters (PAH 7.7, 12.8um, 10um continuum) use the SUB256 array to avoid saturating the primary nucleus.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CYGNUS-A	RA: 19 59 28.3560 (299.8681500d) Dec: +40 44 2.11 (40.73392d) Equinox: J2000		
Comments: This object was generated by the targetselector and retrieved from the NED database. *Category=Galaxy* *Description=[Active galactic nuclei, Radio galaxies]*				
(2)	CYGNUS-A-MIRIM-OFF	RA: 19 59 30.3212 (299.8763383d) Dec: +40 46 8.16 (40.76893d) Equinox: J2000		
Comments: This object was generated by the targetselector and retrieved from the NED database. *Category=Galaxy* *Description=[Active galactic nuclei, Radio galaxies]*				
(3)	CYGNUS-A-MRS	RA: 19 59 28.3560 (299.8681500d) Dec: +40 44 2.11 (40.73392d) Equinox: J2000		
Comments: This object was generated by the targetselector and retrieved from the NED database. *Category=Galaxy* *Description=[Active galactic nuclei, Radio galaxies]*				
(4)	CYGNUS-A-MRS-OFF	RA: 19 59 33.0460 (299.8876917d) Dec: +40 45 11.09 (40.75308d) Equinox: J2000		
Comments: This object was generated by the targetselector and retrieved from the NED database. OFF position modified to put CygA in imager and avoid sources in MRS. *Category=Galaxy* *Description=[Active galactic nuclei, Radio galaxies]*				

Observation

Proposal 4065, Observation 1: Cyg A IFU

Fri Oct 20 23:01:15 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

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)	CYGNUS-A	RA: 19 59 28.3560 (299.8681500d) Dec: +40 44 2.11 (40.73392d) Equinox: J2000		

Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=Galaxy
Description=[Active galactic nuclei, Radio galaxies]

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G235H/F170LP	NRSIRS2	20	1	false	true	NONE	4	4	5893.912	
2	G395H/F290LP	NRSIRS2	20	1	false	true	NONE	4	4	5893.912	

Observation

Proposal 4065, Observation 2: Cyg A MRS

Fri Oct 20 23:01:15 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[Cyg A MRS OFF (Obs 3)]

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
(3)	CYGNUS-A-MRS	RA: 19 59 28.3560 (299.8681500d) Dec: +40 44 2.11 (40.73392d) Equinox: J2000		

Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=Galaxy
Description=[Active galactic nuclei, Radio galaxies]

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
F560W	All MRS	YES	FULL	NEUTRAL

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	F1130W	FASTR1	30	1	1	Dither 1	4	4	333.005	
1	LONG(C)	MRSLONG		FASTR1	30	1	1	Dither 1	4	4	333.005	
1	LONG(C)	MRSSHORT		FASTR1	30	1	1	Dither 1	4	4	333.005	
2		IMAGER	F770W	FASTR1	30	1	1	Dither 1	4	4	333.005	
2	MEDIUM(B)	MRSLONG		FASTR1	30	1	1	Dither 1	4	4	333.005	
2	MEDIUM(B)	MRSSHORT		FASTR1	30	1	1	Dither 1	4	4	333.005	
3		IMAGER	F1000W	FASTR1	30	1	1	Dither 1	4	4	333.005	
3	SHORT(A)	MRSLONG		FASTR1	30	1	1	Dither 1	4	4	333.005	
3	SHORT(A)	MRSSHORT		FASTR1	30	1	1	Dither 1	4	4	333.005	

Special Requirements	Sequence Observations 2, 3, Non-interruptible

Observation

Proposal 4065, Observation 3: Cyg A MRS OFF Fri Oct 20 23:01:15 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [Cyg A MRS (Obs 2)]

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
(4)	CYGNUS-A-MRS-OFF	RA: 19 59 33.0460 (299.8876917d) Dec: +40 45 11.09 (40.75308d) Equinox: J2000		

Comments: This object was generated by the targetselector and retrieved from the NED database. OFF position modified to put CygA in imager and avoid sources in MRS.
Category=Galaxy
Description=[Active galactic nuclei, Radio galaxies]

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
F560W	All MRS	YES	FULL	NEUTRAL

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	F1130W	FASTR1	30	1	1	Dither 1	4	4	333.005	
1	LONG(C)	MRSLONG		FASTR1	30	1	1	Dither 1	4	4	333.005	
1	LONG(C)	MRSSHORT		FASTR1	30	1	1	Dither 1	4	4	333.005	
2		IMAGER	F770W	FASTR1	30	1	1	Dither 1	4	4	333.005	
2	MEDIUM(B)	MRSLONG		FASTR1	30	1	1	Dither 1	4	4	333.005	
2	MEDIUM(B)	MRSSHORT		FASTR1	30	1	1	Dither 1	4	4	333.005	
3		IMAGER	F1000W	FASTR1	30	1	1	Dither 1	4	4	333.005	
3	SHORT(A)	MRSLONG		FASTR1	30	1	1	Dither 1	4	4	333.005	
3	SHORT(A)	MRSSHORT		FASTR1	30	1	1	Dither 1	4	4	333.005	

Special Requirements	Sequence Observations 2, 3, Non-interruptible

Observation

Proposal 4065, Observation 4: CygA_MIRI_IM

Fri Oct 20 23:01:15 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CYGNUS-A	RA: 19 59 28.3560 (299.8681500d) Dec: +40 44 2.11 (40.73392d) Equinox: J2000		

Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=Galaxy
Description=[Active galactic nuclei, Radio galaxies]

Template

Subarray
SUB128

Dithers

#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size
1	CYCLING	1	4		1	1			SMALL

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	17	40	1	Dither 1	4	160	342.359	
2	F1280W	FASTR1	17	40	1	Dither 1	4	160	342.359	
3	F1000W	FASTR1	17	40	1	Dither 1	4	160	342.359	

Special Requirements

Group Observations 4, 5, Non-interruptible

Observation

Proposal 4065, Observation 5: CygA_MIRI_IM Fri Oct 20 23:01:15 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	CYGNUS-A-MIRIM-OFF	RA: 19 59 30.3212 (299.8763383d) Dec: +40 46 8.16 (40.76893d) Equinox: J2000		

Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=Galaxy
Description=[Active galactic nuclei, Radio galaxies]

Template

Subarray
SUB128

Dithers

#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size
1	CYCLING	1	4		1	1			SMALL

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	17	40	1	Dither 1	4	160	342.359	
2	F1280W	FASTR1	17	40	1	Dither 1	4	160	342.359	
3	F1000W	FASTR1	17	40	1	Dither 1	4	160	342.359	

Special Requirements

Group Observations 4, 5, Non-interruptible