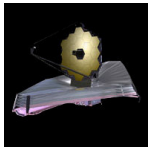

2004 - Pressure gradients of the molecular gas and their role in cloud stability in massive outflows driven by black hole jets

Cycle: 1, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Kalliopi Dasyra (PI) (ESA Member)	**University of Athens**
Dr. Francoise Combes (CoI) (ESA Member)	Observatoire de Paris
Dr. Juan Antonio Fernandez Ontiveros (CoI) (ESA Member)	Centro de Estudios de Fisica del Cosmos de Aragon (CEFCA)
Georgios Filippos Paraschos (CoI) (ESA Member)	Max-Planck-Institut fur Radioastronomie
Dr. Thomas G Bisbas (CoI) (ESA Member)	Universitat zu Koln
Dr. George Helou (CoI) (US Admin CoI)	California Institute of Technology
Dr. Lee Armus (CoI)	California Institute of Technology
Prof. Matthew A. Malkan (CoI)	University of California - Los Angeles
Dr. Luigi Spinoglio (CoI) (ESA Member)	INAF - Istituto di Astrofisica e Planetologia Spaziali

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
MIRI				
	3	IC5063 - MIRI IFU mosaic	MIRI Medium Resolution Spectroscopy	(1) IC5063
	4	MIRI Sky	MIRI Medium Resolution Spectroscopy	(2) SKY

ABSTRACT

We propose MIRI MRS observations of the nearby galaxy IC5063 that will enable us to determine the changes in the H2 gas properties that occur as radio jets propagate through a disk and initiate outflows. We will map the emission of H2 lines in order to derive the temperature, the density, and thus the pressure of the warm and tenuous medium surrounding the cold and dense molecular clouds impacted by the jets. By comparing this pressure

map with a pressure map from CO(1-0) to (4-3) ALMA data, we will quantify the changes in the external vs. internal pressure and, thus, in the stability of individual dense clouds after the jet passage. We will observationally determine, for the first time, the mass fraction of dense clouds that joins the outflow. We will examine whether the dissipation of the dense clouds that leads to their entrainment is primarily due to shocks, cosmic rays, or X-rays. From the density and the velocity of the warm H2, we will obtain a lower limit for the outflow duration based on how long ram pressure took to accelerate dense clouds to the observed velocities. From the mass and the velocity of the warm H2, we will compute the total molecular gas mass that resulted in the halo and got removed from the reservoir available for star formation. Combining gas and dust diagnostics, we will look for star formation variations along the jet. For this project, which will test fundamental physics models of the dense gas acceleration in million or billion solar mass outflows, we ask for ~2 hours of science time on the JWST. The observations will have a highly demonstrative value for the telescope, as IC5063 is a well studied galaxy, prototype of jet-driven winds.

OBSERVING DESCRIPTION

We propose for JWST MIRI MRS observations of the local galaxy IC5063, in which a radio jet impacts dense molecular clouds as it propagates through the disk. Outflows are initiated along its propagation path. Our goal is to obtain spatially-resolved information on the warm molecular gas properties, such as its density, temperature, and mass. This information will enable us to determine the conditions of the warm ISM surrounding the dense molecular clouds that are impacted by the radio jet, and to examine how the pressure of the external H2-emitting medium affects the stability of the CO-emitting dense clouds. The amount of gas originating from dissipated dense clouds and the fraction of the overall warm H2 medium that is lost to the halo and removed from the star formation reservoir will be computed. A mosaic is requested comprising both the jet trail and quiescent regions around it, so that spatial gradients between the jet-affected and unaffected regions are quantified. The mosaic needs to have a position angle between 57 -92 or 237-272 degrees. Sky observations should be executed in an interrupted sequence with the source observations.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	IC5063	RA: 20 52 2.3470 (313.0097792d) Dec: -57 04 7.62 (-57.06878d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Galaxy* *Description=[Active galactic nuclei, Elliptical galaxies, Galaxy disks, Radio jets, Radio lobes]* *Extended=YES*				
(2)	SKY	RA: 20 52 10.0000 (313.0416667d) Dec: -57 02 22.00 (-57.03944d) Equinox: J2000		
Comments: Dark region in optical and IR wavelengths north of the galaxy for sky subtraction *Category=Galaxy* *Description=[Radio jets]*				
(3)	TASTAR	RA: 20 52 9.6647 (313.0402696d) Dec: -57 04 15.41 (-57.07095d) Equinox: J2000	Proper Motion RA: 0.925 mas/yr Proper Motion Dec: 1.852 mas/yr Epoch of Position: 2015.5	
Comments: *Category=Calibration* *Description=[Target acquisition test]*				

Observation

Proposal 2004, Observation 3: IC5063 - MIRI IFU mosaic Fri Apr 14 23:01:29 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[MIRI Sky (Obs 4)]

Diagnostics

(IC5063 - MIRI IFU mosaic (Obs 3)) Warning (Form): Imager subarrays besides FULL may cause data quality issues because they do not match the target acq subarray.

(IC5063 - MIRI IFU mosaic (Obs 3)) Warning (Form): The slew between the acquisition exposure and the farthest science exposure is 80.134 Arcsec (larger than the recommended limit of 50.000 Arcsec) and may result in reduced or no schedulability. See more information in the diagnostic browser.

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	IC5063	RA: 20 52 2.3470 (313.0097792d) Dec: -57 04 7.62 (-57.06878d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Active galactic nuclei, Elliptical galaxies, Galaxy disks, Radio jets, Radio lobes]
Extended=YES

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	3 TASTAR	F1000W	FAST	10	1	1	27.75	60800

Template

Primary Channel	Simultaneous Imaging	Imager Subarray
ALL	YES	BRIGHTSKY

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order
2	2	70.5	40.0	63.5	68.5	DEFAULT

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	F560W	FASTR1	5	4	1	Dither 1	4	16	79.606	
1	LONG(C)	MRSLONG		FASTR1	21	2	1	Dither 1	4	8	477.307	60800
1	LONG(C)	MRSSHORT		FASTR1	42	1	1	Dither 1	4	4	466.207	60800
2		IMAGER	F560W	FASTR1	5	4	1	Dither 1	4	16	79.606	
2	MEDIUM(B)	MRSLONG		FASTR1	42	1	1	Dither 1	4	4	466.207	60800
2	MEDIUM(B)	MRSSHORT		FASTR1	42	1	1	Dither 1	4	4	466.207	60800
3		IMAGER	F560W	FASTR1	5	4	1	Dither 1	4	16	79.606	
3	SHORT(A)	MRSLONG		FASTR1	21	2	1	Dither 1	4	8	477.307	60800
3	SHORT(A)	MRSSHORT		FASTR1	42	1	1	Dither 1	4	4	466.207	60800

Special Requirements	
	Aperture PA Range 57 to 92 Degrees (V3 57.0 to 92.0) Aperture PA Range 237 to 272 Degrees (V3 237.0 to 272.0) Sequence Observations 3, 4, Non-interruptible

Observation

Proposal 2004, Observation 4: MIRI Sky Fri Apr 14 23:01:29 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [IC5063 - MIRI IFU mosaic (Obs 3)]

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
(2)	SKY	RA: 20 52 10.0000 (313.0416667d) Dec: -57 02 22.00 (-57.03944d) Equinox: J2000		

Comments: Dark region in optical and IR wavelengths north of the galaxy for sky subtraction
Category=Galaxy
Description=[Radio jets]

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray
FND	ALL	YES	BRIGHTSKY

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	F560W	FASTR1	5	4	1	Dither 1	4	16	79.606	
1	LONG(C)	MRSLONG		FASTR1	21	2	1	Dither 1	4	8	477.307	60800
1	LONG(C)	MRSSHORT		FASTR1	42	1	1	Dither 1	4	4	466.207	60800
2		IMAGER	F560W	FASTR1	5	4	1	Dither 1	4	16	79.606	
2	MEDIUM(B)	MRSLONG		FASTR1	42	1	1	Dither 1	4	4	466.207	60800
2	MEDIUM(B)	MRSSHORT		FASTR1	42	1	1	Dither 1	4	4	466.207	60800
3		IMAGER	F560W	FASTR1	5	4	1	Dither 1	4	16	79.606	
3	SHORT(A)	MRSLONG		FASTR1	21	2	1	Dither 1	4	8	477.307	60800
3	SHORT(A)	MRSSHORT		FASTR1	42	1	1	Dither 1	4	4	466.207	60800

Special Requirements	Sequence Observations 3, 4, Non-interruptible