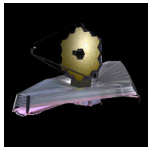

1293 - Collimation zone in Proto-Stellar Jets, the Final Frontier. MIRI MRS and Imager Simultaneous observations

Cycle: 1, Proposal Category: GTO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
MRS Observations				
	1	HH111_IFU	MIRI Medium Resolution Spectroscopy	(1) HH-111-IRS
	4	HH111_IFU_Background	MIRI Medium Resolution Spectroscopy	(4) BACKGROUND+CLEAN
Observation Folder				
	3	HH110_MIR_NIRCAM	MIRI Imaging	(3) HH110BOW

ABSTRACT

Proto-stellar jets arising from young stellar objects (YSOs) have been studied in exquisite detail over the past 50 years.
We understand in depth their emission mechanism, their interaction with the Interstellar medium and the role that they play in the formation of low/intermediate mass proto-stars. We do have reasonable models of the launching mechanisms that are "propelling" these highly collimated outflows,
however the observational evidence to test the models is quite scarce, due in grand part that the star formation process takes place at high optical

depths (>30mag),
and we have lacked the of the sub-arcsecond angular resolution that is needed at wavelengths longer than 5micron
[something that interferometric observatories like ALMA are currently addressing]. A second issue has been 'saturation', since most of the sources driving
the jets can be quite bright at infrared wavelengths, and studying the morphology & physics of the emitting central region (few AUs)
has been extremely challenging. I believe that understanding observationally the collimation of proto-stellar jets, in the frame of physics of the formation of low mass stars,
is one of the "final frontiers" to be reached in this field. In this program I will carry out high signal-to-noise observations
with MIRI MRS of one outflow jet source (originally identified as "Class 0/I") detected by Spitzer IRAC at 5.8 & 8 micron) to study the kinematics of their extended emission
as close as possible to the source and analyze the excited emission of the atomic/ionic/molecular gas.
The source I selected is HH111-IRS in the L1617 cloud in Orion (~400pc away).

Note on October 15, 2021: The observations have been modified as to reduce the data volume
and remove the 'lower threshold warning". The background observations are using SLOWR1,
and so some of the Prime target Imager observations.

In the process the allocated time has increased by 1.2% from 10.50hr allocated to 10.63hr.

Note on February 24, 2022: Co-Is have been added.

Note added onn Nov 17, 2022:
I have updated the position of the background, changed the exposure of both on-target & background
to match each other. I reduced the on-target 10% and increase background to match both.
I have also removed the "Sequence Observation 1, Non-interruptible', since is no necessary and
allows for more flexibility in the schedule

Theres is a slight increase on the Allocate Time. The current allocation time is 10.70hr, the updated proposal would be 11.22hr

that correspond to a 5% increase and my understanding is that DOES NOT need to be sent TTRB

I have also modified the order from SHORT to LONG to the desire LONG to SHORT
to be able to deal with the MRS friction.

OBSERVING DESCRIPTION

GTO program to study the collimation of jets at the source.
In this program I will carry out high signal-to-noise observations with MRS of one outflow jet source (originally identified as "Class 0/I") detected by Spitzer IRAC at 5.8 & 8 micron) to study the kinematics of their extended emission as close as possible to the source and analyze the excited emission of the atomic/ionic/molecular gas. The source I selected is HH111-IRS in the L1617 cloud in Orion (~400pc away). In this system precession of the jet has been measured (Noriega-Crespo et al. 2011) and so we know that binary interaction may be playing a major role (Fig 1) in its development. We propose to complement the MIRI MRS data with coordinated NIRCAM parallel observations of the jet itself on one of its strongest H2 emission lines (2.12um) with the goal to tight together the kinematical observations at the source with those of the outflow itself over large distances.
The observations will cover the full wavelength range available with MRS, where we do know a wealth of ro-vibrational molecular hydrogen lines are included, as well as some of the classical gas shock excited tracers like [NeII] 12.8um & [NeIII] 15.55um, plus the low excitation [Fe II] lines at 5.34, 24.51 & 25.98 um. All of them usable to infer the physical conditions of the atomic/molecular gas in the jet flow. I will perform a 2-point dither sampling per pointing (optimized for extended sources) within a small mosaic (2x2 tiles) to map a broader region around their surroundings; the inner jet/outflow can be currently traced back (in the mid-IR) to a couple of arcseconds (Spitzer's IRAC spatial resolution) near the source.
I will use the MIRI capability that allows the use of the Imager simultaneously with MRS. The Imager observations follow the MRS pattern and will be carried out with the shortest broad band filter (F560W) to obtain high spatial resolution images of the region on the relatively bright H2 S(7) 5.51um line that falls within its band pass. I will also use the new APT feature of flexible MRS exposure specification to add simultaneous imaging observations at F770W & F1130W.
Although no dedicated background observation is being planned, I believe that the mosiac covers 'enough realstate' to use the data itself to estimate the background. Spitzer observations (IRAC & MIPS) have shown the complexity of the extended emission features around HH111 and in this sense this strategy is better (more representative of the local background) than collecting a 'clean' background observation 5 degrees away.
No Target Acquisition (TA) is needed because we are aimimg to the base of the jet, not the source itself, and because this is the "collimation region" it is extended but "narrow" and standard JWST pointing accuracy (~1/2 arcsec 1-sigma radial).
In this highly collimated outflow it is over scales of hundreds of arc-seconds that one can measure the effects of what is taking place near the source;

in the case HH 111 it is the jet's precession. JWST offers the capability to carry out coordinated parallel observations with NIRCam (and other JWST instruments). I believe that it would be extremely valuable to understand the jet dynamics to tight together the kinematical process of what we will observe with MIRI MRS at the source, with the morphological changes that the outflow experiences over larger scales, and that could be measured over a larger field of view using NIRCam. Fig 2. shows a snapshot of the propose observations (with a 3x3 tile mosaic). The original Spitzer images were obtained in 2005 (PID 3315; PI Noriega-Crespo), so one should be able to measure proper motions of several of the knots in the mid infrared; something that we have been able to accomplish only in another couple of systems using Spitzer data (Raga, Noriega-Crespo et al. 2013; Noriega-Crespo et al 2014).

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HH-111-IRS	RA: 05 51 46.0430 (87.9418458d) Dec: +02 48 30.21 (2.80839d) Equinox: J2000		
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Star* *Description=[Young stellar objects]* *Extended=YES*				
(3)	HH110BOW	RA: 05 51 22.2500 (87.8427083d) Dec: +02 47 27.70 (2.79103d) Equinox: J2000		
Comments: *Category=ISM* *Description=[Stellar jets]*				
(4)	BACKGROUND+CLEAN	RA: 05 51 46.8700 (87.9452917d) Dec: +02 49 9.60 (2.81933d) Equinox: J2000	Epoch of Position: 2000	
Comments: *Category=Unidentified* *Description=[Blank field]* *Extended=NO*				

Observation

Proposal 1293, Observation 1: HH111_IFU

Tue Nov 29 15:00:29 GMT 2022

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution 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)	HH-111-IRS	RA: 05 51 46.0430 (87.9418458d) Dec: +02 48 30.21 (2.80839d) Equinox: J2000		

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Young stellar objects]
Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray
F1500W	ALL	YES	FULL

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order
2	2	10.0	10.0	0.0	0.0	DEFAULT

Dithers

#	Dither Type	Optimized For	Direction
1	2-Point	POINT 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	SLOWR1	11	1	1	Dither 1	2	2	525.578	
1	LONG(C)	MRSLONG		FASTR1	100	1	1	Dither 1	2	2	555.008	
1	LONG(C)	MRSSHORT		FASTR1	100	1	1	Dither 1	2	2	555.008	
2		IMAGER	F770W	SLOWR1	11	1	1	Dither 1	2	2	525.578	
2	MEDIUM(B)	MRSLONG		FASTR1	100	1	1	Dither 1	2	2	555.008	
2	MEDIUM(B)	MRSSHORT		FASTR1	100	1	1	Dither 1	2	2	555.008	
3		IMAGER	F560W	SLOWR1	11	1	1	Dither 1	2	2	525.578	
3	SHORT(A)	MRSLONG		FASTR1	100	1	1	Dither 1	2	2	555.008	
3	SHORT(A)	MRSSHORT		FASTR1	100	1	1	Dither 1	2	2	555.008	

Special Requirements	Aperture PA Range 77 to 94 Degrees (V3 77.0 to 94.0)

Observation

Proposal 1293, Observation 4: HH111_IFU_Background Tue Nov 29 15:00:29 GMT 2022

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

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
(4)	BACKGROUND+CLEAN	RA: 05 51 46.8700 (87.9452917d) Dec: +02 49 9.60 (2.81933d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Unidentified
Description=[Blank field]
Extended=NO

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray
F1500W	ALL	YES	FULL

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order
2	2	10.0	10.0	0.0	0.0	DEFAULT

Dithers

#	Dither Type	Optimized For	Direction
1	2-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	SLOWR1	11	1	1	Dither 1	2	2	525.578	
1	LONG(C)	MRSLONG		FASTR1	100	1	1	Dither 1	2	2	555.008	
1	LONG(C)	MRSSHORT		FASTR1	100	1	1	Dither 1	2	2	555.008	
2		IMAGER	F770W	SLOWR1	11	1	1	Dither 1	2	2	525.578	
2	MEDIUM(B)	MRSLONG		FASTR1	100	1	1	Dither 1	2	2	555.008	
2	MEDIUM(B)	MRSSHORT		FASTR1	100	1	1	Dither 1	2	2	555.008	
3		IMAGER	F560W	SLOWR1	11	1	1	Dither 1	2	2	525.578	
3	SHORT(A)	MRSLONG		FASTR1	100	1	1	Dither 1	2	2	555.008	
3	SHORT(A)	MRSSHORT		FASTR1	100	1	1	Dither 1	2	2	555.008	

Special Requirements	Aperture PA Range 77 to 94 Degrees (V3 77.0 to 94.0)

Observation

Proposal 1293, Observation 3: HH110_MIR_NIRCAM Tue Nov 29 15:00:29 GMT 2022

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Coordinated Parallel Template(s): NIRCam 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.

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	HH110BOW	RA: 05 51 22.2500 (87.8427083d) Dec: +02 47 27.70 (2.79103d) Equinox: J2000		

Comments:
Category=ISM
Description=[Stellar jets]

Template

MIRI Imaging	NIRCam Imaging
Subarray: FULL	Module: ALL Subarray: FULL

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order
3	2	15.0	15.0	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	3-POINT-MIRI-F770W-WITH-NIRCam								DEFAULT

Spectral Elements

MIRI Imaging	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F560W	FASTR1	48	2	1	Dither 1	3	6	807.537	

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	F212N	F460M	SHALLOW4	4	1	3	3	611.996	

Special Requirements	
	Sequence Visits , Non-interruptible Aperture PA Range 265 to 283 Degrees (V3 260.16455103 to 278.16455103) Visits Same PA No Parallel Attachments