



1706 - PROJECT-J: PROtostellar JEt's Cradle Tested with JWST

Cycle: 1, Proposal Category: GO

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
MIRI and NIRSpec mapping of the HH46 outflow				
	1	MIRI IFU	MIRI Medium Resolution Spectroscopy	(1) HH46IRS-MIRI
	2	MIRI background	MIRI Medium Resolution Spectroscopy	(2) BACKGROUND
	3	NIRSpec IFU	NIRSpec IFU Spectroscopy	(3) HH46IRS-NIRSPEC
	4	NIRSpec IFU	NIRSpec IFU Spectroscopy	(3) HH46IRS-NIRSPEC

ABSTRACT

Jets are intimately related to the process of star formation, representing the most prominent observational phenomenon during the early protostellar stage. However, little is known about their powering mechanism at the time of their formation, i.e. in embedded (Class0/I) sources, mostly due to the lack of sensitivity and angular resolution at IR wavelengths. We propose here to obtain spectral maps with MIRI and NIRSpec of the inner region of the HH46 IRS protostellar system, a well-studied, prototypical example of a jet surrounded by a cavity excavated by a wide-angle flow.

With these observations, we will probe the deeply embedded HH46 outflow engine with the same accuracy as has been achieved with HST in evolved T Tauri jets. A variety of atomic and molecular lines will be detected in the covered spectral range. They will be used to provide a full characterisation of the innermost jet structure and connect it to the wide angle flow impinging on the cavity walls. These observations will also yield insight into the other components of the system, i.e. the proto-star itself and its accretion disk, providing, for the first time, a full picture of the star-disk interaction region well before planetary systems are formed.

OBSERVING DESCRIPTION

We propose to perform, with MIRI-MRS and NIRSpec in IFU mode, a mosaic around the HH46 IRS protostar aimed at covering the central object, its collimated jet and wide angle wind, and the outflow excavated cavity. The main objective of these observations will be to provide high quality, continuum subtracted images of the protostellar jet and the associated cavity.

We plan to use MIRI-MRS in the 4-channels and 3 wavelength settings, and NIRSpec G235H/F170LP and G395/F290LP in order to obtain a full wavelength coverage from 2 to 28.3 micron. The spectral resolution will be in the range 1500-3500 (i.e. 85-200 km/s).

JWST Proposal 1706 (Created: Monday, January 23, 2023 at 1:01:54 PM Eastern Standard Time) - Overview

The integration time was set in order to detect lines of about 2×10^{-15} erg/s/cm²/pixel with a $S/N > 10$, according to the JWST ETC, v. 1.5.2 . Such a limit has been defined on the basis of the expected brightness of key diagnostic lines located at different wavelengths across the observed spectral range, such as the [FeII] and [FeIII] lines, predicted with our simulated spectrum of the jet emission. This sensitivity limit will in turn allow us to reach a $S/N > 200$ on the source continuum with NIRSpec, to detect weak features from the stellar photosphere.

With MIRI, the requested sensitivity is obtained with 4 integrations of 20 groups each. The maximum number of groups that avoids saturation of the central source has been chosen. The FAST readout pattern is selected to provide enough groups per integration (>10) for an optimised pipeline calibration. We also require a separate background exposure on a blank field for an optimal background subtraction. We will perform a MIRI 4x2 map oriented along the outflow adopting a 2-point dither optimised for extended sources and using a 10% of overlap.

For NIRSpec, the requested sensitivity limit will be obtained with 3 integrations of 15 groups in a 4-POINT-DITHER pattern. We will use the NRSIRS2RAPID readout mode to obtain lower readout noise. To correct for the MSA flux leakage problem, we also require a leakage correction exposure for each of the three gratings. For the map, we require a 2x2 mosaic with 10% overlap.

In total, the required science time is 12.1 hrs, while the total charged time is 23.3 hrs

Proposal 1706 - Targets - PROJECT-J: PROtostellar JEt's Cradle Tested with JWST

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HH46IRS-MIRI	RA: 08 25 43.8000 (126.4325000d) Dec: -51 00 36.00 (-51.01000d) Equinox: J2000		
<i>Comments:</i> Category=Star Description=[Protostars] Extended=YES				
(2)	BACKGROUND	RA: 08 25 38.7161 (126.4113171d) Dec: -50 59 18.01 (-50.98834d) Equinox: J2000		
<i>Comments:</i> Category=Calibration Description=[Telescope/sky background]				
(3)	HH46IRS-NIRSPEC	RA: 08 25 43.8000 (126.4325000d) Dec: -51 00 36.00 (-51.01000d) Equinox: J2000		
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=Star Description=[Protostars] Extended=YES				

Fixed Targets

Proposal 1706 - Observation 1 - PROJECT-J: PROtostellar JEt's Cradle Tested with JWST

Mon Jan 23 18:01:54 GMT 2023

Observation	Proposal 1706, Observation 1: MIRI IFU Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observations:[MIRI background (Obs 2)]												
	(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)	HH46IRS-MIRI	RA: 08 25 43.8000 (126.4325000d) Dec: -51 00 36.00 (-51.01000d) Equinox: J2000										
<i>Comments:</i> <i>Category=Star</i> <i>Description=[Protostars]</i> <i>Extended=YES</i>													
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel				Simultaneous Imaging			Imager Subarray				
	F560W	ALL				YES			BRIGHTSKY				
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order						
	4	2	10.0	10.0	0.0	0.0	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	2	1	Dither 1	4	8	38.072	
	1	SHORT(A)	MRSLONG		FASTR1	19	3	1	Dither 1	4	12	654.909	
	1	SHORT(A)	MRSSHORT		FASTR1	19	3	1	Dither 1	4	12	654.909	
	2		IMAGER	F560W	FASTR1	5	2	1	Dither 1	4	8	38.072	
	2	MEDIUM(B)	MRSLONG		FASTR1	19	3	1	Dither 1	4	12	654.909	
	2	MEDIUM(B)	MRSSHORT		FASTR1	19	3	1	Dither 1	4	12	654.909	
	3		IMAGER	F560W	FASTR1	5	2	1	Dither 1	4	8	38.072	
	3	LONG(C)	MRSLONG		FASTR1	19	3	1	Dither 1	4	12	654.909	
	3	LONG(C)	MRSSHORT		FASTR1	19	3	1	Dither 1	4	12	654.909	

Proposal 1706 - Observation 1 - PROJECT-J: PROtostellar JEt's Cradle Tested with JWST

Special Requirements

Aperture PA Range 30 to 40 Degrees (V3 30.0 to 40.0)
Offset -0.062060349388493335 arcsec, -1.9985931768322702 arcsec
Sequence Observations 1, 2, Non-interruptible

Proposal 1706 - Observation 2 - PROJECT-J: PROtostellar JEt's Cradle Tested with JWST

Mon Jan 23 18:01:54 GMT 2023

Observation	Proposal 1706, Observation 2: MIRI background Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy Background Observation For: [MIRI IFU (Obs 1)]												
	(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)	BACKGROUND	RA: 08 25 38.7161 (126.4113171d) Dec: -50 59 18.01 (-50.98834d) Equinox: J2000			Comments: Category=Calibration Description=[Telescope/sky background]							
Acquisition	#	Target											
	1	NONE											
Template	AcqFilter	Primary Channel			Simultaneous Imaging			Imager Subarray					
	F560W	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/E xp	Exposures/Dit h	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1		IMAGER	F560W	FASTR1	5	2	1	Dither 1	4	8	38.072	
	1	SHORT(A)	MRSLONG		FASTR1	19	2	1	Dither 1	4	8	432.906	
	1	SHORT(A)	MRSSHORT		FASTR1	19	2	1	Dither 1	4	8	432.906	
	2		IMAGER	F560W	FASTR1	5	2	1	Dither 1	4	8	38.072	
	2	MEDIUM(B)	MRSLONG		FASTR1	19	2	1	Dither 1	4	8	432.906	
	2	MEDIUM(B)	MRSSHORT		FASTR1	19	2	1	Dither 1	4	8	432.906	
	3		IMAGER	F560W	FASTR1	5	2	1	Dither 1	4	8	38.072	
	3	LONG(C)	MRSLONG		FASTR1	19	2	1	Dither 1	4	8	432.906	
	3	LONG(C)	MRSSHORT		FASTR1	19	2	1	Dither 1	4	8	432.906	

Special Requirements

Sequence Observations 1, 2, Non-interruptible

Proposal 1706 - Observation 3 - PROJECT-J: PROtostellar JEt's Cradle Tested with JWST

Mon Jan 23 18:01:54 GMT 2023

Observation	<p>Proposal 1706, Observation 3: NIRSpec IFU</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec IFU Spectroscopy</p>											
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)	HH46IRS-NIRSPEC	RA: 08 25 43.8000 (126.4325000d) Dec: -51 00 36.00 (-51.01000d) Equinox: J2000									
	<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Protostars]</i></p> <p><i>Extended=YES</i></p>											
Template	TA Method											
	NONE											
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order					
	2	2	15.0	15.0	0.0	0.0	DEFAULT					
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	NRSIRS2RAPID	5	4	false	true	NONE	4	16	1400.533	
	2	G235H/F170LP	NRSIRS2RAPID	5	2	true	false	NONE	1	2	175.067	
	3	G395H/F290LP	NRSIRS2RAPID	5	4	false	true	NONE	4	16	1400.533	
	4	G395H/F290LP	NRSIRS2RAPID	5	2	true	false	NONE	1	2	175.067	

Special Requirements

Offset -2.0 arcsec, 0.25 arcsec

Proposal 1706 - Observation 4 - PROJECT-J: PROtostellar JEt's Cradle Tested with JWST

Mon Jan 23 18:01:54 GMT 2023

Observation	<p>Proposal 1706, Observation 4: NIRSpec IFU</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec IFU Spectroscopy</p>											
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			
	(3)	HH46IRS-NIRSPEC	RA: 08 25 43.8000 (126.4325000d) Dec: -51 00 36.00 (-51.01000d) Equinox: J2000									
	<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Protostars]</i></p> <p><i>Extended=YES</i></p>											
Template	TA Method											
	NONE											
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order					
	2	2	15.0	15.0	0.0	0.0	DEFAULT					
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	NRSIRS2RAPID	5	4	false	true	NONE	4	16	1400.533	
	2	G235H/F170LP	NRSIRS2RAPID	5	2	true	false	NONE	1	2	175.067	
	3	G395H/F290LP	NRSIRS2RAPID	5	4	false	true	NONE	4	16	1400.533	
	4	G395H/F290LP	NRSIRS2RAPID	5	2	true	false	NONE	1	2	175.067	

Special Requirements

Offset -2.0 arcsec, 0.25 arcsec