

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

Cycle: 1, Proposal Category: GO

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

Name	Institution	E-Mail
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OBSERVATIONS

Folder	Observation	Label	Observing Template	Science Target
MIRI aı	nd NIRSpec map	ping of the HH46 outflow	N	
	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 escavated 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).

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The integration time was set in order to detect lines of about $2x10^{-15}$ 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)			ļ
l		Dec: -51 00 36.00 (-51.01000d)			l
l		Equinox: J2000			ļ
, s	Comments: Category=Star Description=[Protostars] Extended=YES				
Targets	(2) BACKGROUND	RA: 08 25 38.7161 (126.4113171d)			
a.		Dec: -50 59 18.01 (-50.98834d)			l
		Equinox: J2000			l
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۱۴	Description=[Telescope/sky background]				
	(3) HH46IRS-NIRSPEC	RA: 08 25 43.8000 (126.4325000d)			ļ
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S S	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	

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tra	2	MEDIUM(B)	MRSLONG		FASTR1	19	2	1	Dither 1	4	8	432.906	
e C	2	MEDIUM(B)	MRSSHORT		FASTR1	19	2	1	Dither 1	4	8	432.906	
လ	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	

<u>Pr</u>	roposal 1706 - Observation 2 - PROJECT-J: PROtostellar JEt's Cradle Tested with JWST							
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Targets	(3)	HH46IRS-NIRSPEC	Dec:) (126.4325000d) (-51.01000d)							
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Mosaic	2	2		15.0)	15.0		0.0	0.0		DEFAULT	
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eme	1	G235H/F170LP	NRSIRS2RAPI D	5	4	false	true	NONE	4	16	1400.533	
Spectral Elements	2		NRSIRS2RAPI D		2	true	false	NONE	1	2	175.067	
)ectr	3		NRSIRS2RAPI D		4	false	true	NONE	4	16	1400.533	
Ŗ	4	G395H/F290LP	NRSIRS2RAPI D	5	2	true	false	NONE	1	2	175.067	

<u> 11</u>	roposal 1706 - Observation 3 - PROJECT-J: PROtostellar Jet's Cradle Tested with JWST
Requirements	Offset -2.0 arcsec, 0.25 arcsec
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Pro	posal 1706 - Obse	vation 4 - PF	ROJECT-J:	PROtostella	r JEt's C	radle Test	ted with JWS	ST			
ľ	Proposal 1706, Observation	: NIRSpec IFU								Mon Jan 23 18	:01:54 GMT 2023
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Targets	(3) HH46IRS-NIRS	SPEC RA:	08 25 43.8000 (1	26.4325000d)							
ξ		Dec	: -51 00 36.00 (-5	1.01000d)							
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t	3 G395H/F290	D NRSIRS2RAP	5	4	false	true	NONE	4	16	1400.533	
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<u>P</u>	oposal 1706 - Observation 4 - PROJECT-J: PROtostellar JEt's Cradle Tested with JWST
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