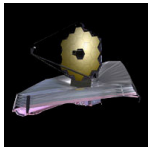

2771 - Structure, Excitation, and Proper Motions in the Symmetric HH212 Jet: Epoch 2

Cycle: 2, Proposal Category: GTO

INVESTIGATORS

Name	*Institution*
Dr. Mark J. McCaughrean (PI) (ESA Member)	**European Space Agency - ESTEC**

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
HH212 NIRCam imaging – Epoch 2				
	1	HH212 mosaic (Position 1, Epoch 2)	NIRCam Imaging	(1) HH212-POS1
	2	HH212 mosaic (Position 2, Epoch 2)	NIRCam Imaging	(2) HH212-POS2

ABSTRACT

We will carry out NIRCam imaging covering the highly-symmetric young outflow HH212 over a field of ~6.1 arcmin x 3.5 arcmin. In shocked H2, the jet is ~4 arcmin long. We will take images in seven filters: two lines of shocked molecular hydrogen (v=1–0 S(1) at 2.12 microns, F212N; v=0–0 S(9) at 4.69 microns, F470N), CO line emission (F466N), & continuum filters (F150W, F200W, F356W, F444W), partly as corresponding line+continuum filters, but also to make a more detailed assessment of faint, diffuse continuum nebulosity around the jet and protostar, as well to better identify and eliminate background galaxies, of which there are many in the field.

Since our discovery of the jet in 1994, we have been conducting a variety of near-infrared and millimetre studies, and the JWST data will advance this work in three key ways.

First, the spatial resolution in the 2.12 micron line images will be ~5 x better than our best ground-based data (seeing limited at ~0.3”), and thus allow us to resolve small-scale shock details throughout the flow, from the inner knots to the large outer bowshocks.

Second, the 2023 date of the observations will constitute a second JWST epoch for small-scale proper motions & the search for short-term intensity changes in various shock tracers.

Third, the complementary LW imaging in the H2 line at 4.69 micron will give a direct indication of the extinction in the flow by comparison with the 2.12 micron line: assuming an excitation temperature of ~2000K, the 2.12 micron/4.69 micron line ratio should be ~3, although extinction may make the ratio smaller. The larger LW pixels will also help bring the effective sensitivities closer together.

A fourth and new point is to image the jet in CO to test for emission in that tracer in the outflow.

Version 4, submitted 2023-08-10

OBSERVING DESCRIPTION

We will carry out NIRCam imaging covering the highly-symmetric young outflow HH212 over a field of ~6.1 arcmin x 3.5 arcmin. In shocked H2, the jet is ~4 arcmin long. We will take images in seven filters: two lines of shocked molecular hydrogen (v=1–0 S(1) at 2.12 microns, F212N; v=0–0 S(9) at 4.69 microns, F470N), one line of CO (F466N), & four wide-band continuum filters (F150W, F200W, F356W, F444W), the latter partly to help remove continuum emission from the narrow-band line filters, and also to better measure the faint diffuse reflection nebulosity around the jet and protostar, as well as to identify and remove galaxies.

HH212 is an elongated protostellar outflow roughly 4 arcmin long, aligned at a PA of roughly 22 degrees E of N. It is symmetric in the inner parts, but there is one additional large bowshock to the SW. Hence the nominal mosaic centre is offset with respect to the central protostar to ensure that the whole jet is covered.

The aim is to make a full-covered mosaic of the jet in seven filters (SW: F150W, F200W, F212N (repeated twice); LW: F356W, F444W, F466N, F470N) with a mosaic & dither scheme designed to fill in the inter-SCA and inter-module gaps. The SHALLOW4 read-out mode is used with NGRPS=3, with 3 primary dithers & 2 sub-pixel dithers to yield an on-source integration time of 902 sec per position.

To align NIRCam's A & B modules along the jet axis and make the most efficient mapping, V3PA = 292 degrees is needed. This will place JWST in the MAZ, but we are requesting a waiver in order to maximise observing efficiency and to yield images as similar as possible to our Cycle 1 observations.

A combination of primary dithering INTRAMODULEX with 6 primary dithers and a small ROWS=1, COLUMNS=2 mosaic is then used to map the jet. The INTRAMODULEX primary dither fills the inter-SCA gaps both transverse to and along the flow. The 2 COLUMNS with an overlap of 84% ensure that the large inter-module gap is filled along the length of the jet.

The same mosaic is made at two positions separated by ~65" perpendicular to the jet axis, to ensure that the jet does not fall in the lower S/N inter-SCA gaps, and to increase the overall field, maximising the number of stars detected for accurate registration and proper motion measurements. The full coverage is then approximately 6.1 arcmin along the jet and 3.5 arcmin transverse to it.

No separate nearby blank sky observations are planned.

This is the second epoch in a multi-cycle campaign.

Proposal 2771 - Targets - Structure, Excitation, and Proper Motions in the Symmetric HH212 Jet: Epoch 2

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HH212-POS1	RA: 05 43 48.4931 (85.9520546d) Dec: -01 02 59.11 (-1.04975d) Equinox: J2000		
Comments: *Category=Unidentified* *Description=[Infrared sources]* *Extended=YES*				
(2)	HH212-POS2	RA: 05 43 52.4673 (85.9686138d) Dec: -01 03 22.18 (-1.05616d) Equinox: J2000		
Comments: *Category=Unidentified* *Description=[Infrared sources]* *Extended=YES*				

Observation

Proposal 2771, Observation 1: HH212 mosaic (Position 1, Epoch 2) Fri Aug 11 15:02:28 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Comments: The non-interruptible requirement was removed on 2023/08/10 to eliminate the data volume warning – the requirement has been set to make the two observations within 1 day of each other.

Diagnostics

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

(Visit 1:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 1:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

(Visit 1:2) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HH212-POS1	RA: 05 43 48.4931 (85.9520546d) Dec: -01 02 59.11 (-1.04975d) Equinox: J2000		

Comments:
Category=Unidentified
Description=[Infrared sources]
Extended=YES

Template

Module	Subarray	Target Placement
ALL	FULL	Module Gap

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order
1	2	95.0	84.0	0.0	0.0	DEFAULT

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEX	6	STANDARD		1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F212N	F470N+F444W	SHALLOW4	3	1	6	6	901.889	
2	F212N	F466N+F444W	SHALLOW4	3	1	6	6	901.889	
3	F150W	F356W	SHALLOW4	3	1	6	6	901.889	
4	F200W	F444W	SHALLOW4	3	1	6	6	901.889	

Special Requirements	
	Group Visits within 53.0 Days Aperture PA Range 292 to 292 Degrees (V3 292.0713531 to 292.0713531) Visits Same PA Group Observations 1, 2 within 1 Days

Observation

Proposal 2771, Observation 2: HH212 mosaic (Position 2, Epoch 2) Fri Aug 11 15:02:28 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 2:2) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 2:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

(Visit 2:2) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	HH212-POS2	RA: 05 43 52.4673 (85.9686138d) Dec: -01 03 22.18 (-1.05616d) Equinox: J2000		

Comments:
Category=Unidentified
Description=[Infrared sources]
Extended=YES

Template

Module	Subarray	Target Placement
ALL	FULL	Module Gap

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order
1	2	95.0	84.0	0.0	0.0	DEFAULT

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEX	6	STANDARD		1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F212N	F470N+F444W	SHALLOW4	3	1	6	6	901.889	
2	F212N	F466N+F444W	SHALLOW4	3	1	6	6	901.889	
3	F150W	F356W	SHALLOW4	3	1	6	6	901.889	
4	F200W	F444W	SHALLOW4	3	1	6	6	901.889	

Special Requirements	
	Group Visits within 53.0 Days Aperture PA Range 292 to 292 Degrees (V3 292.0713531 to 292.0713531) Visits Same PA Group Observations 1, 2 within 1 Days