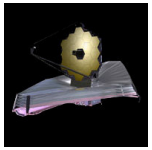

6958 - Past, present, and future of a dynamically cold disk in an extreme environment

Cycle: 4, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NIRCam Imaging				
	1	NIRCam Imaging	NIRCam Imaging	(1) HyLIRG-Imaging
MIRI imaging				
	2	MIRI imaging	MIRI Imaging	(1) HyLIRG-Imaging

ABSTRACT

We propose a small NIRCam+MIRI pilot program to image an orderly rotating, dynamically cold disk, harbored by an extreme hyper-luminous IR galaxy in an overdensity at z=2.41. The existence of disks in such strongly starbursting galaxies, revealed by deep high-resolution ALMA observations of the cold molecular gas, is hard to reconcile with the standard formation via gas-rich mergers, which should leave behind highly chaotic disk structures.

With the requested JWST images, we will accurately reconstruct stellar mass and SFR maps, modeling the effects of dust, emission lines, and AGN contamination. This will allow us to test the past and present stability of the disk with a three-pronged novel strategy. (i) We will search for a stellar

bar, a long-lived structure that would automatically imply long-term past stability on timescales of >1 Gyr. The gas distribution and kinematics already support this possibility; (ii) We will assess the present stability in 3D (in the disk plane and vertically), superseeding simplified approaches based on the Toomre Q-parameter. This will reveal unstable regions prone to fragmentation and clump formation, potentially forming a bulge and contributing to the suppression of the star formation; (iii) We will test this last hypothesis by correlating maps of clumpy star formation with the 3D disk stability maps. As a bonus, we will map the stellar mass and SFR in 4 confirmed Hy- and ULIRGs in the surrounding overdensity and detect tens of reliable photometric candidate members.

This pilot will test the soundness of our strategy, which could be successfully applied to large statistical samples covered by JWST and ultradeep ALMA observations.

OBSERVING DESCRIPTION

We ask for NIRCam and MIRI imaging of an orderly rotating, dynamically cold disk hosted by a hyper-luminous infrared galaxy at z=2.41 and its surrounding environment.

Short integrations with 6 NIRCam filters (~19 mins F090W/F150W/F200W/F277W/F356W/F444W) and 4 MIRI bands (~14-18 min with F770W/F1130W/F1500W/F1800W) will allow us to detect the emission of point-like sources on the main-sequence at z=2.41 down to Mstar~1e9.5Msun and SFR~5-10 Msun/yr. We implement standard 4-point dither pattern to sample the PSF and mitigate the effect of bad pixels and cosmic rays. The chosen pattern will fill the small gaps among NIRCam detectors while optimizing for the area with homogeneous coverage. The core of the overdensity with known IR bright members fit in a single quadrant.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HyLIRG-Imaging	RA: 08 49 33.5900 (132.3899583d) Dec: +02 14 44.60 (2.24572d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[Ultraluminous infrared galaxies]* *Extended=YES*				
(2)	FixedStarN	RA: 08 49 33.6084 (132.3900350d) Dec: +02 14 54.58 (2.24849d) Equinox: J2000		
Comments: V=17.93 mag *Category=Unidentified* *Description=[Visible sources]*				
(3)	FixedStarW	RA: 08 49 33.4875 (132.3895313d) Dec: +02 14 44.35 (2.24565d) Equinox: J2000		
Comments: *Category=Unidentified* *Description=[Visible sources]*				

Observation

Proposal 6958, Observation 1: NIRCam Imaging Fri Feb 27 22:00:23 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(NIRCam Imaging (Obs 1)) Warning (Form): By selecting Target Placement = Module Gap the target coordinates will not fall on any detector unless an appropriate Mosaic, set of Dithers or Offset Special Requirement is specified.

(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)	HyLIRG-Imaging	RA: 08 49 33.5900 (132.3899583d) Dec: +02 14 44.60 (2.24572d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Ultraluminous infrared galaxies]
Extended=YES

Template

Module	Subarray	Target Placement
ALL	FULL	Module gap (large extended source)

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEBOX	4	STANDARD		1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F150W	F356W	SHALLOW2	6	1	4	4	1159.571	
2	F200W	F444W	SHALLOW2	6	1	4	4	1159.571	
3	F090W	F277W	SHALLOW2	6	1	4	4	1159.571	

Special Requirements

Aperture PA Range 102.93842306 to 111.04542306 Degrees (V3 103.013 to 111.12)
Aperture PA Range 282.93292306 to 292.90042306 Degrees (V3 283.0075 to 292.975)
Offset 123.0 arcsec, 34.4 arcsec

Observation

Proposal 6958, Observation 2: MIRI imaging Fri Feb 27 22:00:23 GMT 2026

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HyLIRG-Imaging	RA: 08 49 33.5900 (132.3899583d) Dec: +02 14 44.60 (2.24572d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[Ultraluminous infrared galaxies]
Extended=YES

Template

Subarray
FULL

Dithers

#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size
1	CYCLING	1	4						DEFAULT

Spectral Elements

#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	F770W	FASTR1	78	1	1	Dither 1	4	4	865.812	
2	F1130W	FASTR1	101	1	1	Dither 1	4	4	1121.116	
3	F1500W	FASTR1	101	1	1	Dither 1	4	4	1121.116	
4	F1800W	FASTR1	72	1	1	Dither 1	4	4	799.212	

Special Requirements

Aperture PA Range 107.83544897 to 117.83544897 Degrees (V3 103.0 to 113.0)
Aperture PA Range 287.83544897 to 297.83544897 Degrees (V3 283.0 to 293.0)