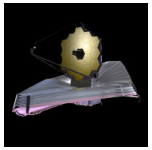

3703 - Breaking the z=10 barrier with MIRI: redshift confirmation and detection of rest-frame optical emission lines

Cycle: 2, Proposal Category: GO

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OBSERVATIONS

Folder	***Observation***	***Label***	***Observing Template***	***Science Target***
MIRI LRS GALAXY1				
	1	CEERS2-5429	MIRI Low Resolution Spectroscopy	(1) CEERS2-5429
	2	CEERS2-5429	MIRI Low Resolution Spectroscopy	(1) CEERS2-5429
	3	CEERS2-5429	MIRI Low Resolution Spectroscopy	(1) CEERS2-5429
MIRI LRS GALAXY2				
	5	GLASS-z12	MIRI Low Resolution Spectroscopy	(2) GLASS-Z12
	6	GLASS-z12	MIRI Low Resolution Spectroscopy	(2) GLASS-Z12
	7	GLASS-z12	MIRI Low Resolution Spectroscopy	(2) GLASS-Z12

ABSTRACT

The combination of both the better-than-expected science performance of JWST and the discovery of an unexpected population of bright galaxies at high redshifts might have unlocked what we thought impossible: the detection of rest-frame optical emission lines at z>10. Such emission lines are critical to confirm these extreme redshifts and to diagnose the physical conditions in these exciting objects. Here we propose to prove this by obtaining spectroscopic observations with MIRI, the only astronomical instrument capable of detecting these lines at such high redshifts (at z > 9.5, strong rest-optical lines redshift out of NIRSpec). With 9hrs on-source of MIRI/Low Resolution Spectroscopy observations per target, we will detect Hbeta/[OIII] and Halpha in two robust, bright z>10 galaxy candidates recently identified via JWST/NIRCam observations with at least 5sigma significance (or even up to ~15sigma if they are extreme line emitters as other recently confirmed galaxies). This short proposal will also test the efficiency of MIRI as a redshift machine in comparison with NIRCam, NIRSpec, and ALMA, while providing a unique opportunity to further characterize the physical properties of these early galaxies including SFRs, metallicities, dust obscuration, and other parameters.

OBSERVING DESCRIPTION

This short proposal consists of MIRI Low Resolution Spectroscopy (LRS) on two bright, z>10 galaxy candidates discovered with JWST/NIRCam. MIRI/LRS provides the required sensitivity, wavelength coverage, and spectral resolution to detect bright rest-frame optical emission lines (Halpha and Hbeta/[OIII]) with SNRs>5. To achieve the required 9hrs on-source (per target), we split the time into three independent observations. For each observation, we choose 484 groups per integration, 4 integration per exposure, and 1 exposure per specification with 2 dither positions ”along slit nod” in the APT (summing up ~3hrs). Repeating this strategy three times adds up a total exposure of 9hrs. Target acquisition (TA) observations were also included to prevent slit losses from off-nominal source placements. Finally, we note that the PA for the target GLASS-z12 was restricted within PA 42 to 65 deg (+180 values are also acceptable) to make sure the ALMA [OIII]88m tentative detection recently reported falls within the MIRI slit.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CEERS2-5429	RA: 14 19 46.3565 (214.9431521d) Dec: +52 56 32.79 (52.94244d) Equinox: J2000		
Comments: JWST/NIRCam-selected LBG candidate at z_phot=11.5, m277W=27.6 (Donnan et al. 2002; Finkelstein et al. 2022; Harikane et al. 2022). The source is also known as Maisie's galaxy. *Category=Galaxy* *Description=[Emission line galaxies, High-redshift galaxies]* *Extended=NO*				
(2)	GLASS-Z12	RA: 00 13 59.7565 (3.4989854d) Dec: -30 19 29.11 (-30.32475d) Equinox: J2000		
Comments: JWST/NIRCam-selected LBG candidate at z_phot=12.3, m277W=26.9 (Castellano et al. 2022; Naidu et al. 2022; Harikane et al. 2022) *Category=Galaxy* *Description=[Emission line galaxies, High-redshift galaxies]* *Extended=NO*				
(3)	TARGET-ACQ-STAR	RA: 14 19 40.7587 (214.9198279d) Dec: +52 57 7.41 (52.95206d) Equinox: J2000	Proper Motion RA: -12.343 mas/yr Proper Motion Dec: -15.2163 mas/yr Parallax: 0.00335" Epoch of Position: 2016	
Comments: Acquisition star for target CEERS2-5429 (Gaia DR3 1608036137875651072) *Category=Star* *Description=[K stars]* *Extended=NO*				
(4)	TARGET-ACQ-STAR-2	RA: 00 13 58.3218 (3.4930075d) Dec: -30 20 14.10 (-30.33725d) Equinox: J2000	Proper Motion RA: 5.4336 mas/yr Proper Motion Dec: -14.6924 mas/yr Parallax: 0.0042692" Epoch of Position: 2016	
Comments: Acquisition star for target GLASS-z12. Coordinates, PM, and epoch from Gaia DR3. *Category=Star* *Description=[G stars]* *Extended=NO*				

Observation

Proposal 3703, Observation 1: CEERS2-5429

Tue Jan 23 23:00:38 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Low 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)	CEERS2-5429	RA: 14 19 46.3565 (214.9431521d) Dec: +52 56 32.79 (52.94244d) Equinox: J2000		

Comments: JWST/NIRCam-selected LBG candidate at z_phot=11.5, m277W=27.6 (Donnan et al. 2002; Finkelstein et al. 2022; Harikane et al. 2022). The source is also known as Maisie's galaxy.
Category=Galaxy
Description=[Emission line galaxies, High-redshift galaxies]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	3 TARGET-ACQ-STAR	F560W	FAST	6	1	1	16.65	168116

Template

Subarray	Obtain Verification Image?
FULL	false

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	ALONG SLIT NOD				

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	121	16	32	1	2	10828.206	144728

Special Requirements	Background Limited. Background no more than 10th percentile above minimum

Observation

Proposal 3703, Observation 2: CEERS2-5429

Tue Jan 23 23:00:38 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

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)	CEERS2-5429	RA: 14 19 46.3565 (214.9431521d) Dec: +52 56 32.79 (52.94244d) Equinox: J2000		

Comments: JWST/NIRCam-selected LBG candidate at z_phot=11.5, m277W=27.6 (Donnan et al. 2002; Finkelstein et al. 2022; Harikane et al. 2022). The source is also known as Maisie's galaxy.
Category=Galaxy
Description=[Emission line galaxies, High-redshift galaxies]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	3 TARGET-ACQ-STAR	F560W	FAST	6	1	1	16.65	53396.6

Template

Subarray	Obtain Verification Image?
FULL	false

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	ALONG SLIT NOD				

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	121	16	32	1	2	10828.206	145336.1

Special Requirements	Background Limited. Background no more than 10th percentile above minimum

Observation

Proposal 3703, Observation 3: CEERS2-5429

Tue Jan 23 23:00:38 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

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
(1)	CEERS2-5429	RA: 14 19 46.3565 (214.9431521d) Dec: +52 56 32.79 (52.94244d) Equinox: J2000		

Comments: JWST/NIRCam-selected LBG candidate at z_phot=11.5, m277W=27.6 (Donnan et al. 2002; Finkelstein et al. 2022; Harikane et al. 2022). The source is also known as Maisie's galaxy.
Category=Galaxy
Description=[Emission line galaxies, High-redshift galaxies]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	3 TARGET-ACQ-STAR	F560W	FAST	6	1	1	16.65	53396.6

Template

Subarray	Obtain Verification Image?
FULL	false

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	ALONG SLIT NOD				

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	121	16	32	1	2	10828.206	145336.1

Special Requirements	Background Limited. Background no more than 10th percentile above minimum

Observation

Proposal 3703, Observation 5: GLASS-z12 Tue Jan 23 23:00:38 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Comments: The observations could also be done at the specified PA +180deg.

Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	GLASS-Z12	RA: 00 13 59.7565 (3.4989854d) Dec: -30 19 29.11 (-30.32475d) Equinox: J2000		

Comments: JWST/NIRCam-selected LBG candidate at z_phot=12.3, m277W=26.9 (Castellano et al. 2022; Naidu et al. 2022; Harikane et al. 2022)
Category=Galaxy
Description=[Emission line galaxies, High-redshift galaxies]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 TARGET-ACQ-STAR-2	F560W	FASTGRPAVG	6	1	1	66.601	53396.6

Template

Subarray	Obtain Verification Image?
FULL	false

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	ALONG SLIT NOD				

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	121	16	32	1	2	10828.206	144728

Special Requirements	Aperture PA Range 42 to 65 Degrees (V3 37.24203 to 60.24203)

Observation

Proposal 3703, Observation 6: GLASS-z12 Tue Jan 23 23:00:38 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Comments: The observations could also be done at the specified PA +180deg.

Diagnostics

(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	GLASS-Z12	RA: 00 13 59.7565 (3.4989854d) Dec: -30 19 29.11 (-30.32475d) Equinox: J2000		

Comments: JWST/NIRCam-selected LBG candidate at z_phot=12.3, m277W=26.9 (Castellano et al. 2022; Naidu et al. 2022; Harikane et al. 2022)
Category=Galaxy
Description=[Emission line galaxies, High-redshift galaxies]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 TARGET-ACQ-STAR-2	F560W	FASTGRPAVG	6	1	1	66.601	53396.6

Template

Subarray	Obtain Verification Image?
FULL	false

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	ALONG SLIT NOD				

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	121	16	32	1	2	10828.206	145336.1

Special Requirements	Aperture PA Range 42 to 65 Degrees (V3 37.24203 to 60.24203)

Observation

Proposal 3703, Observation 7: GLASS-z12 Tue Jan 23 23:00:38 GMT 2024

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Comments: The observations could also be done at the specified PA +180deg.

Diagnostics

(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	GLASS-Z12	RA: 00 13 59.7565 (3.4989854d) Dec: -30 19 29.11 (-30.32475d) Equinox: J2000		

Comments: JWST/NIRCam-selected LBG candidate at z_phot=12.3, m277W=26.9 (Castellano et al. 2022; Naidu et al. 2022; Harikane et al. 2022)
Category=Galaxy
Description=[Emission line galaxies, High-redshift galaxies]
Extended=NO

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	4 TARGET-ACQ-STAR-2	F560W	FASTGRPAVG	6	1	1	66.601	53396.6

Template

Subarray	Obtain Verification Image?
FULL	false

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	ALONG SLIT NOD				

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	FASTR1	121	16	32	1	2	10828.206	145336.1

Special Requirements	Aperture PA Range 42 to 65 Degrees (V3 37.24203 to 60.24203)