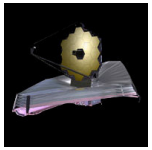

2198 - Quiescent or dusty? Unveiling the nature of extremely red galaxies at z>3

Cycle: 1, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
S67 Obs				
	1	PreimageS67	NIRCam Imaging	(5) S67NIRCAM
	3	S67v1s	NIRSpec MultiObject Spectroscopy	(16) APTCATS67V5
S156 Obs				
	2	PreimageS156	NIRCam Imaging	(6) S156NIRCAM
	4	S156_APA209.5745697	NIRSpec MultiObject Spectroscopy	(15) APTCATS156V7

ABSTRACT

Quantifying the nature and prevalence of the recently-discovered extremely-red galaxies found in Spitzer IRAC data, but not seen by Hubble, is one of the most exciting high-redshift opportunities for JWST's infrared capabilities. These galaxies are suspected of being either dusty star-forming

galaxies at z~3-6, or, most intriguingly, quiescent evolved galaxies at z~4-5. These "H-dropouts", so-named from their non-detection by Hubble's WFC3/IR camera, remain an enigma. The limited spectral coverage of the current photometric data has precluded any reliable assessment of their redshifts. And spectroscopic confirmation has been quite impractical. ALMA data has provided further confirmation, but without establishing redshifts. H-dropouts pose significant challenges to galaxy growth models (if evolved), or to our estimates of the history of galaxy build-up (if dusty star-forming). Our JWST "H-drop" pilot program uses NIRSpec/prism spectroscopy at R=100 to reveal the true nature of these extremely red galaxies. We have identified two relatively bright, plausible z~4-5 quiescent galaxies from the deepest IRAC imaging data of the GOODS-S field, plus a larger sample of H-band undetected sources in that same field. Our primary goals are to: (1) obtain the first spectroscopic redshift measurement for this enigmatic population; (2) distinguish quiescent from dusty star-forming sources; (3) constrain their physical properties including gas-phase metallicities; (4) provide new measurements for the contribution of obscured sources to the cosmic Star Formation Rate Density at z~3-6; and (5) possibly confirm the first quiescent galaxies at z~4-5. Only JWST/NIRSpec can achieve these goals.

OBSERVING DESCRIPTION

The primary goal of this program is to obtain 0.8hr deep NIRSpec/PRISM observations of a sample of H-dropout galaxies split over 2 MSA pointings, where we will take 2 configurations each. Given that our galaxy sample is by definition not detected in current HST imaging, but just in Spitzer/IRAC, we require NIRCam preimaging (the IRAC PSF is much too wide for accurate positioning of the MSA slits).

NIRCam pre-imaging acquisition:

For both pointing separately, we take the pre-imaging with a large scale dither to cover the required area to fit all candidate sources that will be observed in the MSA masks. In particular, we use the INTRASCA primary dither pattern to obtain a large scale offset of 24". At each of these positions, we use a 3-point small scale dither pattern to properly sample the PSF. We use the SHALLOW4 readout pattern with 6 groups, resulting in a total exposure time of 1868s. Images are taken in F444W (LW) to detect our candidate galaxies, and complementary F200W (SW).

NIRSpec exposures:

The observing strategy for the MSA consists of 3 nod in slits exposures. We are taking a series of 13 groups of integrations with the IRS2 readout mode, resulting in a total exposure time of 2889s. By repeating this for a second configuration at the same pointing, we reach a sample of ~15 primary galaxies, in addition to ~30-35 fillers. The MSA mask design can only be finalized after pre-imaging and once the V3 angle of JWST will be assigned.

Background Limited Special Requirement:

One of the requirements of our program is to measure faint Halpha emission lines, which are expected to lie at ~4.5micron. The peak S/N at this wavelength changes by >10% between the lowest and highest background conditions. Similarly our F444W images are affected. We therefore request ``Background Limited" observations. We set the requirement to "Background no more than 40% above minimum" for the pre-imaging and 20% for the spectra to ensure a sufficiently large scheduling window of 2.5 months.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	S67NIRCAM	RA: 03 32 18.1555 (53.0756479d) Dec: -27 50 33.92 (-27.84276d) Equinox: J2000		
Comments: *Category=Unidentified* *Description=[Blank field]*				
(6)	S156NIRCAM	RA: 03 32 38.4035 (53.1600146d) Dec: -27 53 2.94 (-27.88415d) Equinox: J2000		
Comments: *Category=Unidentified* *Description=[Blank field]*				
(15)	APTCATS156V7	RA: 03 32 36.3144 (53.1513100d) Dec: -27 52 28.34 (-27.87454d) Equinox: J2000		
Comments: *Description=[]*				
(16)	APTCATS67V5	RA: 03 32 19.7434 (53.0822642d) Dec: -27 50 39.09 (-27.84419d) Equinox: J2000		
Comments: *Description=[]*				

Observation

Proposal 2198, Observation 1: PreimageS67 Wed Jan 25 16:02:20 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

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 1:3) Warning (Form): Overheads are provisional until the Visit Planner has been run.
(Visit 1:4) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	S67NIRCAM	RA: 03 32 18.1555 (53.0756479d) Dec: -27 50 33.92 (-27.84276d) Equinox: J2000		

Comments:
Category=Unidentified
Description=[Blank field]

Template

Module	Subarray
ALL	FULL

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order
2	1	2.0	2.0	0.0	0.0	DEFAULT

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	FULLBOX	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	F200W	F444W	BRIGHT2	7	1	6	6	901.889	

Special Requirements

Sequence Visits within 53.0 Days
Visits Same PA
Background Limited. Background no more than 30th percentile above minimum

3 After 1 by 60.0 Days to <None specified>

Observation

Proposal 2198, Observation 3: S67v1s Wed Jan 25 16:02:20 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec MultiObject Spectroscopy

Diagnostics

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 3:1) Warning (Form): The recommended value is 8 Reference Stars for this template.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(16)	APTCATS67V5	RA: 03 32 19.7434 (53.0822642d) Dec: -27 50 39.09 (-27.84419d) Equinox: J2000		

Comments:
Description=[]

Acquisition

#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	Filter: CLEAR; Readout: NRSRAPIDD6; 6 sources in 4 quads; [Optimal TA Accuracy]	SAME	CLEAR	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	

Template

TA Method	Obtain Confirmation Images	Science Aperture	Primary Candidate List	Filler Candidate List	Spectral Overlap Map	Spectral Overlap Threshold
MSATA	After Target ACQ and New MSA Config	MSA Center	S67main (15 sources)	S67fillers (582 sources)	jwst-nirspec-prism	1.5

Reference Stars

Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
1	3239	53.052003	-27.863049	25.491059909393243	1	8148	53.105547	-27.830053	25.471036242145495
1	4000	53.048340	-27.857795	25.491962735805245	1	9130	53.057384	-27.823396	25.08364100111337
1	4271	53.093282	-27.855763	25.012319084848578	1	11807	53.060053	-27.808828	25.414254396557283

Confirmation

#	Confirmation Type	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time
1	c1	NRSIRS2RAPID	3	1	1	58.356
2	c2	NRSIRS2RAPID	3	1	1	58.356

Spectral Elements

#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
1	1 (PRISM/CLEAR)	c1	3 Shutter Slitlet	53.06826504166666 Degrees -27.840026111111115 Degrees	197.54071280137023			3	3	2494.7
2	1 (PRISM/CLEAR)	c2	3 Shutter Slitlet	53.06302020833334 Degrees -27.846222222222195 Degrees	197.5431695366491			3	3	2494.7

Special Requirements

Background Limited. Background no more than 20th percentile above minimum
MSA Scheduled Aperture PA 197.5341947 to 197.5341947 Degrees (V3 58.959625 to 58.959625)

3 After 1 by 60.0 Days to <None specified>

Observation

Proposal 2198, Observation 2: PreimageS156 Wed Jan 25 16:02:20 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 2:3) Warning (Form): Overheads are provisional until the Visit Planner has been run.
(Visit 2:4) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(6)	S156NIRCAM	RA: 03 32 38.4035 (53.1600146d) Dec: -27 53 2.94 (-27.88415d) Equinox: J2000		

Comments:
Category=Unidentified
Description=[Blank field]

Template

Module	Subarray
ALL	FULL

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift	Column shift	Tile Order
2	1	2.0	2.0	0.0	0.0	DEFAULT

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	FULLBOX	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	F200W	F444W	BRIGHT2	7	1	6	6	901.889	

Special Requirements

Sequence Visits within 53.0 Days
Visits Same PA
Background Limited. Background no more than 20th percentile above minimum

4 After 2 by 60.0 Days to <None specified>

Observation

Proposal 2198, Observation 4: S156_APA209.5745697 Wed Jan 25 16:02:20 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec MultiObject Spectroscopy

Diagnostics

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 4:1) Warning (Form): The recommended value is 8 Reference Stars for this template.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(15)	APTCATS156V7	RA: 03 32 36.3144 (53.1513100d) Dec: -27 52 28.34 (-27.87454d) Equinox: J2000		

Comments:
Description=[]

Acquisition

#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	Filter: F140X; Readout: NRSRAPIDD6; 5 sources in 4 quads; [Optimal TA Accuracy]	SAME	F140X	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	

Template

TA Method	Obtain Confirmation Images	Science Aperture	Primary Candidate List	Filler Candidate List	Spectral Overlap Map	Spectral Overlap Threshold
MSATA	After Target ACQ and New MSA Config	MSA Center	S156main (14 sources)	S156fillers (537 sources)	jwst-nirspec-prism	1.5

Reference Stars

Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
1	1072	53.156374	-27.913113	23.456527994248823	1	5600	53.179191	-27.870606	24.78264475213166
1	3022	53.119759	-27.893617	24.96245698099744	1	11128	53.150369	-27.857980	24.036121455734147
1	3358	53.125504	-27.889978	23.584282016052313					

Confirmation

#	Confirmation Type	Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp	Conf. Total Integrations	Conf. Total Exposure Time
1	c1	NRSIRS2RAPID	5	1	1	87.533
2	c2	NRSIRS2RAPID	5	1	1	87.533

Spectral Elements

#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
1	1 (PRISM/CLEAR)	c1	3 Shutter Slitlet	53.14672066666667 Degrees -27.881858333333355 Degrees	209.57672689860013			3	3	2450.934
2	1 (PRISM/CLEAR)	c2	3 Shutter Slitlet	53.155031875 Degrees -27.878649444444 42 Degrees	209.5728397702872			3	3	2450.934

Special Requirements

MSA Scheduled Aperture PA 209.5745697 to 209.5745697 Degrees (V3 71.0 to 71.0)

4 After 2 by 60.0 Days to <None specified>