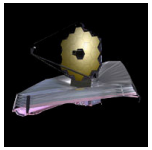

5572 - Red Monsters: Kinematics of Two ‘Universe Breaking’, Ultra-Massive Galaxies in the First Gyr

Cycle: 3, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	S1-G395H/F290LP - R 2700	NIRSpec IFU Spectroscopy	(1) S1
	3	S1-G395H/F290LP - R 2700	NIRSpec IFU Spectroscopy	(1) S1
	2	S2-G395H/F290LP - R 2700	NIRSpec IFU Spectroscopy	(2) S2

ABSTRACT

A surprising result of early JWST observations was the discovery of several extremely massive galaxies up to z~8 challenging the standard LCDM model. However, the lack of spectroscopic redshifts and/or inherent uncertainties of SED fitting sparked a debate about a possible overestimation of stellar masses. The only way to resolve this tension is dynamical masses. Here, we propose to do exactly this for two even more extreme galaxies (S1 & S3) at z_spec=5-6 discovered in deep JWST images and spectra. They are extremely red and massive - almost Milky Way mass only at ~1Gyr after the Big Bang - and have a very extended dust distribution (ALMA 1.1mm size ~6 kpc of S1). These two monsters were hiding in plain sight in the GOODS-S&N field. Despite 30 years of observations, they were only now revealed thanks to JWST. We propose NIRSpec IFU/G395H high-resolution grating observations on these two Universe breaker candidates, the only way to achieve our two scientific goals: 1) to confirm their ultra-massive nature in an independent way -- by obtaining their dynamical mass and 2) to understand the build-up of these massive beasts -- by studying their star formation, ionized gas, and dust properties in 2D distributions at high spatial resolution. This timely program will directly address the puzzle of surprisingly early massive galaxy assembly, and pave the way for understanding the formation of such extremely massive galaxies in the first 1Gyr of the Universe.

OBSERVING DESCRIPTION

We propose deep NIRSpec/IFU G395H/F290LP observations of two ultra-massive galaxies at zspec=5-6.

This setting will provide the wavelength coverage, and spatial and spectral resolution for our key science goals. We will have the coverage and spatial resolution to map the H_alpha, H_beta, [OIII], and [NII] lines. Additionally, the R2700 spectral resolution of G395H will be sufficient to

perform galaxy kinematics using H_alpha with a total SNR >= 30.

Two ultra-massive targets are:
- S1 at zspec=5.58 from GOODS-S field, total exposure time 8.9 h
- S3 at zspec=5.18 from GOODS-N field, total exposure time 7.9 h

Both targets will use NIRSpec IFU with Grating/Filter: G395H/290LP, Readout: NRSIRS2, 14-16 point "CYCLING" dither pattern with 'medium' offsets for 20 Groups.

No dedicated background exposures are required, because the IFU field of view contains sufficient empty regions for the background subtraction.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	S1	RA: 03 32 28.9100 (53.1204583d) Dec: -27 44 31.53 (-27.74209d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[High-redshift galaxies, Starburst galaxies, Ultraluminous infrared galaxies]* *Extended=YES*				
(2)	S2	RA: 12 36 56.5600 (189.2356667d) Dec: +62 12 7.37 (62.20205d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[High-redshift galaxies, Starburst galaxies, Ultraluminous infrared galaxies]* *Extended=YES*				

Observation

Proposal 5572, Observation 1: S1-G395H/F290LP - R2700

Thu Dec 05 21:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU 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)	S1	RA: 03 32 28.9100 (53.1204583d) Dec: -27 44 31.53 (-27.74209d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[High-redshift galaxies, Starburst galaxies, Ultraluminous infrared galaxies]
Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	16	

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSIRS2	20	1	false	true	NONE	16	16	23575.646	172187

Observation

Proposal 5572, Observation 3: S1-G395H/F290LP - R2700

Thu Dec 05 21:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU 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)	S1	RA: 03 32 28.9100 (53.1204583d) Dec: -27 44 31.53 (-27.74209d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[High-redshift galaxies, Starburst galaxies, Ultraluminous infrared galaxies]
Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	16	

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSIRS2	20	1	false	true	NONE	16	16	23575.646	172187

Observation

Proposal 5572, Observation 2: S2-G395H/F290LP - R2700

Thu Dec 05 21:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU 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
(2)	S2	RA: 12 36 56.5600 (189.2356667d) Dec: +62 12 7.37 (62.20205d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[High-redshift galaxies, Starburst galaxies, Ultraluminous infrared galaxies]
Extended=YES

Template

TA Method	HFF Readout Mode
NONE	false

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	14	

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSIRS2	20	1	false	true	NONE	14	14	20628.69	172187