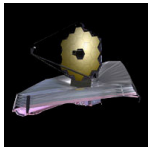

1893 - Galaxy assembly at z > 6: unraveling the origin of the spatial offset between the UV and FIR emission

Cycle: 1, Proposal Category: GO

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Stefano Carniani (PI) (ESA Member)	**Scuola Normale Superiore, Pisa**	**stefano.carniani@sns.it**
Prof. Andrea Ferrara (CoI) (ESA Member)	Scuola Normale Superiore, Pisa	andrea.ferrara@sns.it
Dr. Simona Gallerani (CoI) (ESA Member)	Scuola Normale Superiore, Pisa	simona.gallerani@sns.it
Dr. Andrea Pallottini (CoI) (ESA Member)	Scuola Normale Superiore, Pisa	andrea.pallottini@sns.it
Dr. Laura Pentericci (CoI) (ESA Member)	INAF, Osservatorio Astronomico di Roma	laura.pentericci@inaf.it
Dr. Marco Castellano (CoI) (ESA Member)	INAF, Osservatorio Astronomico di Roma	marco.castellano@inaf.it
Dr. Adriano Fontana (CoI) (ESA Member)	INAF, Osservatorio Astronomico di Roma	adriano.fontana@inaf.it
Dr. Eros Vanzella (CoI) (ESA Member)	INAF-Osservatorio di Astrofisica e Scienza dello Spazio	eros.vanzella@inaf.it
Dr. Roberto Maiolino (CoI) (ESA Member)	University of Cambridge	r.maiolino@mrao.cam.ac.uk
Evangelia Ntormousi (CoI) (ESA Member)	Scuola Normale Superiore, Pisa	evangelia.ntormousi@sns.it
Dr. Livia Vallini (CoI) (ESA Member)	Scuola Normale Superiore, Pisa	livia.vallini@sns.it
Mrs. Mahsa Kohandel (CoI) (ESA Member)	Scuola Normale Superiore, Pisa	mahsa.kohandel@sns.it
Dr. Santiago Arribas (CoI) (ESA Member)	Consejo Superior de Investigaciones Cientificas	arribas@cab.inta-csic.es
Dr. Camilla Pacifici (CoI) (US Admin CoI)	Space Telescope Science Institute - CSA - JWST	cpacifici@stsci.edu
Ms. Viola Gelli (CoI) (ESA Member)	Universita di Firenze	viola.gelli@unifi.it
Prof. Stefania Salvadori (CoI) (ESA Member)	University of Florence	stefania.salvadori@unifi.it
Prof. Andrew Bunker (CoI) (ESA Member)	University of Oxford	andy.bunker@physics.ox.ac.uk
Mr. Alex James Cameron (CoI)	University of Melbourne	alexc@student.unimelb.edu.au

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
BDF3299 observations				
	1	target	NIRSpec IFU Spectroscopy	(1) BDF3299
	2	background	NIRSpec IFU Spectroscopy	(4) BDF3299-BACKGROUND
COSMOS24108 observations				
	3	target	NIRSpec IFU Spectroscopy	(2) COSMOS24108
	4	background	NIRSpec IFU Spectroscopy	(5) COSMOS24108-BACKGROUND
A2744-YD4 observations				
	5	target	NIRSpec IFU Spectroscopy	(3) A2744-YD4
	6	background	NIRSpec IFU Spectroscopy	(6) A2744-YD4-BACKGROUND

ABSTRACT

Exploring galaxies in the first Gyr of the Universe, at z>6, is the key to understanding the galaxy assembly process. For many galaxies at z>6, ALMA observations revealed that the far-infrared (FIR) [CII] and [OIII] lines are completely consistent with systemic redshift of the galaxies, but spatially offset by several kpc from the rest-frame UV region. The physical origin of these spatial offsets is still debated and depends mainly on the galaxy and interstellar medium (ISM) properties. We therefore propose JWST/NIRSpec observations in IFU mode to obtain spatially resolved spectra of three star-forming galaxies at z=6.6-8.2. The selected targets display the clearest spatial offsets between the rest-frame UV and the FIR lines among all high-z star-forming galaxies observed with ALMA so far, which makes them a unique sample for understanding the nature of this displacement. Our proposed NIRSpec observations are designed to obtain an accurate measurement of the spectral energy distribution in the rest-frame UV and optical band at the location of both FIR line emission and UV regions. This will allow us to both investigate the properties of the ISM (gas metallicity, ionisation parameter, dust obscuration) and unveil the possible presence of satellite galaxies associated with the displaced FIR emission, thus providing key constraints to galaxy assembling models at the re-ionisation epoch.

OBSERVING DESCRIPTION

The proposed observations aim at mapping the continuum emission and optical nebular lines in three z>6.6 galaxies (COSMOS24018, BDF3299, and A2744-YD4) that show evidence of spatial offsets between rest-frame UV and FIR emission,

Observations will be performed with configuration grating/filters PRISM/CLEAR. This choice enables the detection of the bright nebular lines and continuum emission between 0.6um and 5.2um.

We will not perform Target Acquisition, since the absolute JWST pointing accuracy of 0.1arcsec is more than sufficient given the size of our targets.

The allowed PA range is defined such that contamination in the R100 spectra due to nearby sources leaking through the MSA is minimized. A off-scene exposure is set to sample the background emission. For each target we use a 8-point dither pattern with a "medium" cycling pattern that provides a good compromise between good sub-pixel sampling and removing failed open microshutters and bright sources. The FOV with complete exposures is sufficient to cover our targets

The exposure time is based on the ETC version 1.5.2.

######## version August 2021 ########
PI changed the Readout mode to reduce the data usage

COSOSM24108
No target acquisition
8-point dither pattern
23 groups, 1 integrations per dither position
Readout mode: NRSIRS2
1 exposure for estimating MSA leakage (23 groups, 1 integrations)
1 background exposure (23 groups, 1 integrations)
Total exposure time on source: 13538 sec

BDF3299
No target acquisition
8-point dither pattern
23 groups, 1 integrations per dither position
Readout mode: NRSIRS2
1 exposure for estimating MSA leakage (23 groups, 1 integrations)
1 background exposure (23 groups, 1 integrations)
Total exposure time on source: 13538 sec

A2744-YD4
No target acquisition
8-point dither pattern
23 groups, 1 integrations per dither position
Readout mode: NRSIRS2
2 exposures for estimating MSA leakage (23 groups, 1 integrations x 2)
1 background exposure (23 groups, 1 integrations)
Total exposure time on source: 13538 sec

######## version 2020 ########
COSOSM24108
No target acquisition
8-point dither pattern
115 groups, 1 integrations per dither position
Readout mode: NRSIRS2RAPID
1 exposure for estimating MSA leakage (115 groups, 1 integrations)
1 background exposure (115 groups, 1 integrations)
Total exposure time on source: 13538 sec

BDF3299
No target acquisition
8-point dither pattern
115 groups, 1 integrations per dither position
Readout mode: NRSIRS2RAPID
1 exposure for estimating MSA leakage (115 groups, 1 integrations)
1 background exposure (115 groups, 1 integrations)
Total exposure time on source: 13538 sec

A2744-YD4
No target acquisition
8-point dither pattern
115 groups, 1 integrations per dither position
Readout mode: NRSIRS2RAPID
2 exposures for estimating MSA leakage (115 groups, 1 integrations x 2)
1 background exposure (115 groups, 1 integrations)
Total exposure time on source: 13538 sec

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	BDF3299	RA: 22 28 12.3065 (337.0512771d) Dec: -35 10 0.17 (-35.16671d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[High-redshift galaxies, Lyman-alpha galaxies]* *Extended=YES*				
(2)	COSMOS24108	RA: 10 00 47.3334 (150.1972225d) Dec: +02 28 43.14 (2.47865d) Equinox: J2000		
Comments: Gaalxy at redshift 6.6294 *Category=Galaxy* *Description=[High-redshift galaxies]* *Extended=YES*				
(3)	A2744-YD4	RA: 00 14 24.9531 (3.6039712d) Dec: -30 22 56.10 (-30.38225d) Equinox: J2000		
Comments: Lyman break galaxy at redshift 8.382 *Category=Galaxy* *Description=[High-redshift galaxies]* *Extended=NO*				
(4)	BDF3299-BACKGROUND	RA: 22 28 12.4697 (337.0519571d) Dec: -35 09 57.39 (-35.16594d) Equinox: J2000		
Comments: This target is used as background target for BDF3299 *Category=Galaxy* *Description=[High-redshift galaxies]* *Extended=NO*				
(5)	COSMOS24108-BACKGROUND	RA: 10 00 47.5848 (150.1982700d) Dec: +02 28 44.53 (2.47904d) Equinox: J2000		
Comments: Gaalxy at redshift 6.6294 *Category=Galaxy* *Description=[High-redshift galaxies]* *Extended=NO*				
(6)	A2744-YD4-BACKGROUND	RA: 00 14 25.0000 (3.6041667d) Dec: -30 23 0.00 (-30.38333d) Equinox: J2000		
Comments: Lyman break galaxy at redshift 8.382 *Category=Galaxy* *Description=[High-redshift galaxies]* *Extended=NO*				

Observation

Proposal 1893, Observation 1: target

Thu Aug 05 21:00:21 GMT 2021

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[background (Obs 2)]

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)	BDF3299	RA: 22 28 12.3065 (337.0512771d) Dec: -35 10 0.17 (-35.16671d) Equinox: J2000		

Comments:
Category=Galaxy
Description=[High-redshift galaxies, Lyman-alpha galaxies]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	8	

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	PRISM/CLEAR	NRSIRS2	23	1	false	true	NONE	8	8	13538.49	
2	PRISM/CLEAR	NRSIRS2	23	1	true	false	NONE	1	1	1692.311	

Special Requirements

Aperture PA Range 205.892975 to 128.892975 Degrees (V3 67.00000015 to 350.00000015)

Sequence Observations 1, 2, Non-interruptible

Observation

Proposal 1893, Observation 2: background

Thu Aug 05 21:00:22 GMT 2021

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [target (Obs 1)]

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
(4)	BDF3299-BACKGROUND	RA: 22 28 12.4697 (337.0519571d) Dec: -35 09 57.39 (-35.16594d) Equinox: J2000		

Comments: This target is used as background target for BDF3299
Category=Galaxy
Description=[High-redshift galaxies]
Extended=NO

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	NONE				

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	PRISM/CLEAR	NRSIRS2	23	1	false	false	NONE	1	1	1692.311	

Special Requirements

Sequence Observations 1, 2, Non-interruptible

Observation

Proposal 1893, Observation 3: target

Thu Aug 05 21:00:22 GMT 2021

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[background (Obs 4)]

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
(2)	COSMOS24108	RA: 10 00 47.3334 (150.1972225d) Dec: +02 28 43.14 (2.47865d) Equinox: J2000		

Comments: Gaalxy at redshift 6.6294
Category=Galaxy
Description=[High-redshift galaxies]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	8	

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	PRISM/CLEAR	NRSIRS2	23	1	false	true	NONE	8	8	13538.49	
2	PRISM/CLEAR	NRSIRS2	23	1	true	false	NONE	1	1	1692.311	

Special Requirements

Sequence Observations 3, 4, Non-interruptible

Observation

Proposal 1893, Observation 4: background

Thu Aug 05 21:00:22 GMT 2021

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [target (Obs 3)]

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	COSMOS24108-BACKGROUND	RA: 10 00 47.5848 (150.1982700d) Dec: +02 28 44.53 (2.47904d) Equinox: J2000		

Comments: Gaalxy at redshift 6.6294
Category=Galaxy
Description=[High-redshift galaxies]
Extended=NO

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	NONE				

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	PRISM/CLEAR	NRSIRS2	23	1	false	false	NONE	1	1	1692.311	

Special Requirements

Sequence Observations 3, 4, Non-interruptible

Observation

Proposal 1893, Observation 5: target

Thu Aug 05 21:00:22 GMT 2021

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[background (Obs 6)]

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
(3)	A2744-YD4	RA: 00 14 24.9531 (3.6039712d) Dec: -30 22 56.10 (-30.38225d) Equinox: J2000		

Comments: Lyman break galaxy at redshift 8.382
Category=Galaxy
Description=[High-redshift galaxies]
Extended=NO

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	MEDIUM	1	8	

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	PRISM/CLEAR	NRSIRS2	23	1	false	true	NONE	8	8	13538.49	
2	PRISM/CLEAR	NRSIRS2	23	1	true	false	NONE	1	1	1692.311	

Special Requirements

Aperture PA Range 68.892975 to 198.892975 Degrees (V3 290.00000015 to 60.00000015)

Sequence Observations 5, 6, Non-interruptible

Observation

Proposal 1893, Observation 6: background

Thu Aug 05 21:00:22 GMT 2021

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [target (Obs 5)]

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
(6)	A2744-YD4-BACKGROUND	RA: 00 14 25.0000 (3.6041667d) Dec: -30 23 0.00 (-30.38333d) Equinox: J2000		

Comments: Lyman break galaxy at redshift 8.382
Category=Galaxy
Description=[High-redshift galaxies]
Extended=NO

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	NONE				

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	PRISM/CLEAR	NRSIRS2	23	1	true	false	NONE	1	1	1692.311	
2	PRISM/CLEAR	NRSIRS2	23	1	false	false	NONE	1	1	1692.311	

Special Requirements

Aperture PA Range 68.892975 to 198.892975 Degrees (V3 290.00000015 to 60.00000015)

Sequence Observations 5, 6, Non-interruptible