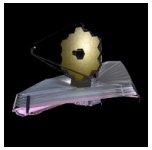

4265 - Unveiling the interplay between the circumgalactic and interstellar media in a complex protocluster environment at z=4.5

Cycle: 2, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
Dr. Jorge Ignacio Gonzalez Lopez (PI)	**Carnegie Institution of Washington**
Manuel Solimano (CoI)	Diego Portales University
Prof. Manuel Aravena (CoI) (CoPI)	Diego Portales University
Dr. Rodrigo Herrera-Camus (CoI)	Universidad de Concepcion
Prof. Ilse De Looze (CoI) (ESA Member)	Universiteit Gent
Prof. Justin Spilker (CoI)	Texas A & M University
Dr. Ken-ichi Tadaki (CoI)	Hokkai-Gakuen University
Dr. N. M. Forster Schreiber (CoI) (ESA Member)	Max-Planck-Institut fur extraterrestrische Physik
Prof. Alberto Bolatto (CoI)	University of Maryland
Prof. Amiel Sternberg (CoI)	Tel Aviv University - Wise Observatory
Dr. Deanne B Fisher (CoI)	Swinburne University of Technology
Dr. Dieter Lutz (CoI) (ESA Member)	Max-Planck-Institut fur extraterrestrische Physik
Dr. Hannah Uebler (CoI) (ESA Member)	University of Cambridge
Dr. Leopoldo Infante (CoI)	Carnegie Institution of Washington
Dr. Linda Tacconi (CoI) (ESA Member)	Max-Planck-Institut fur extraterrestrische Physik
Dr. Loreto Barcos-Munoz (CoI)	Associated Universities, Inc.
Dr. Rebecca A A Bowler (CoI) (ESA Member)	University of Manchester
Prof. Reinhard Genzel (CoI) (ESA Member)	Max-Planck-Institut fur extraterrestrische Physik
Dr. Richard I. Davies (CoI) (ESA Member)	Max-Planck-Institut fur extraterrestrische Physik
Dr. Roberto Assef (CoI)	Diego Portales University
Dr. Rychard Bouwens (CoI) (ESA Member)	Universiteit Leiden

Name	***Institution***
Dr. Sedona H. Price (CoI)	University of Pittsburgh
Prof. Sylvain Veilleux (CoI)	University of Maryland
Dr. Tanio Diaz-Santos (CoI) (ESA Member)	FORTH - Institute of Astrophysics
Dr. Thorsten Naab (CoI) (ESA Member)	Max Planck Institute for Astrophysics
Dr. Desika Narayanan (CoI)	University of Florida
Dr. Elisabete da Cunha (CoI)	University of Western Australia
Dr. Gabriela Calistro Rivera (CoI) (ESA Member)	European Southern Observatory - Germany
Dr. Renske Smit (CoI) (ESA Member)	Liverpool John Moores University
Dr. Jacqueline Hodge (CoI) (ESA Member)	Universiteit Leiden
Mr. Ikki Mitsuhashi (CoI)	University of Tokyo
Prof. Kirsten Kraiberg Knudsen (CoI) (ESA Member)	Chalmers University of Technology
Ryota Ikeda (CoI)	National Astronomical Observatory of Japan (NAOJ)
Mr. Juno Li (CoI)	University of Western Australia
Ana Carolina Posses (CoI)	Diego Portales University
Dr. Marco Palla (CoI) (ESA Member)	Ghent University
Dr. Monica Relano (CoI) (ESA Member)	Universidad de Granada
Prof. Andrea Ferrara (CoI) (ESA Member)	Scuola Normale Superiore, Pisa
Lilian Lai Yee Lee (CoI) (ESA Member)	Max-Planck-Institut fur extraterrestrische Physik
Ivana Francesca van Leeuwen (CoI) (ESA Member)	Universiteit Leiden

OBSERVATIONS

Folder	***Observation***	***Label***	***Observing Template***	***Science Target***
Observation Folder				
	1		NIRSpec IFU Spectroscopy	(1) CRISTAL-01
	2	Plan_243_v17	NIRSpec MultiObject Spectroscopy	(3) CatAfterPreImaging
	3	Pre_Imaging	NIRCam Imaging	(1) CRISTAL-01

ABSTRACT

Understanding the mechanisms that yield the formation of extended Lyman-alpha halos in the environment of massive galaxies and how this process relates to the formation of early structures (z>4) has been challenging. With JWST, we can now access the rest-frame optical regime that traces the ionized gas and stellar components necessary to constrain the feedback processes and galaxy growth in distant galaxies.

We propose to obtain sensitive NIRSpec IFU and MOS towards a dense, star-forming galaxy protocluster at z=4.5. The system is signposted by an interacting massive, infrared-luminous galaxy pair at the center, as seen in sensitive ALMA high-res [CII] imaging, and shows extended Ly-a emission as evidenced by VLT/MUSE. The Ly-a profile and spatial distribution show a spatial gradient and three spectral peaks, signaling either high escape fractions through scattering or in-situ photoionization by extended star formation. Ten bright LAEs plus 10+ other sources are found in this structure.

The proposed observations will allow us to test different galaxy formation scenarios. We will use the sensitive NIRSpec IFU H-alpha imaging to map the distribution of unobscured star formation through the system, enabling us to (i) determine the physical mechanisms that yield the extended Lyman-a emission and (ii) test the nature of the [CII] "tail" structure. The proposed NIRSpec MOS, along with publicly available NIRCam imaging, will yield a full characterization of the confirmed protoclusters members, accessing critical emission lines (H-alpha, [NII], [OIII], H-beta), enabling us to determine the stellar population properties, hardness/ionization states, and presence of AGN.

OBSERVING DESCRIPTION

We will characterize different processes happening within the protocluster. Using NIRSpec/IFU observations of the central pair of galaxies we will obtain Halpha emission observations and reveal the true nature of the previously detected Ly-alpha and [CII] emission. Additionally, we will perform NIRSpec/MOS observations of galaxy members of the protocluster that, together with NIRCam imaging from a public program (COSMOS-Web), will provide the key parameters (stellar mass and metallicity) to constrain their evolutionary phase and compare with models of galaxy evolution inside protoclusters and overdense regions.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CRISTAL-01	RA: 10 00 54.5315 (150.2272146d) Dec: +02 34 35.00 (2.57639d) Equinox: J2000		
Comments: *Category=Galaxy* *Description=[High-redshift galaxies, Interacting galaxies, Lyman-break galaxies, Starburst galaxies]* *Extended=YES*				
(2)	CRISTAL01CATALOGMSAV1	RA: 10 00 51.3100 (150.2137917d) Dec: +02 34 8.46 (2.56902d) Equinox: J2000		
Comments: *Description=[]*				
(3)	CatAfterPreImaging	RA: 10 00 50.3870 (150.2099458d) Dec: +02 34 6.03 (2.56834d) Equinox: J2000		
Comments: *Description=[]*				

Observation

Proposal 4265, Observation 1

Wed Mar 20 20:01:09 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)	CRISTAL-01	RA: 10 00 54.5315 (150.2272146d) Dec: +02 34 35.00 (2.57639d) Equinox: J2000		

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

Template

TA Method
NONE

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order
1	2	3.0	3.0	0.0	-18.0	DEFAULT

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	CYCLING	SMALL	1	9	

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	18	1	false	true	NONE	9	9	11948.301	

Special Requirements	Aperture PA Range 241.97164917 to 253.97164917 Degrees (V3 103.0 to 115.0) Offset 0.4202988907376787 arcsec, -0.12548588090643578 arcsec

Observation

Proposal 4265, Observation 2: Plan_243_v17 Wed Mar 20 20:01:09 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec MultiObject Spectroscopy

Coordinated Parallel Template(s): NIRCam 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
(3)	CatAfterPreImaging	RA: 10 00 50.3870 (150.2099458d) Dec: +02 34 6.03 (2.56834d) Equinox: J2000		

Comments:
Description=[]

Acquisition

NIRSpec MultiObject Spectroscopy	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	Filter: F110W; Readout: NRSRAPIDD6; 8 sources in 3 quads; [Optimal TA Accuracy]	SAME	F110W	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	

Template

NIRSpec MultiObject Spectroscopy	NIRCam Imaging
TA Method: MSATA	Module: ALL
Obtain Confirmation Images: No	Subarray: FULL
Science Aperture: MSA Center	Target Placement: Module Gap
Primary Candidate List: Priority_Final (19 sources)	
Filler Candidate List: Filler_Final (444 sources)	
Spectral Overlap Map: jwst-nirspec-mr	
Spectral Overlap Threshold: 1.5	

Reference Stars

Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
1	1028	150.208333	2.520794	22.140236	1	1056	150.206508	2.559803	21.929043
1	1041	150.203308	2.545583	21.707047	1	1063	150.198617	2.568997	21.38599
1	1046	150.201483	2.552659	21.70765	1	1074	150.221775	2.564927	21.926023
1	1052	150.198883	2.561171	21.916077	1	1075	150.226083	2.563409	21.537827

Dithers

#	Dither Type
1	NONE

Spectral Elements

NIRSpec MultiObject Spectroscopy	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 (G395M/F290LP)	c1	3 Shutter Slitlet	150.21976225 Degrees 2.5476952777777 777 Degrees	243.90964104082 323			3	3	3545.1
2	2 (G235M/F170LP)	c1	3 Shutter Slitlet	150.21976225 Degrees 2.5476952777777 777 Degrees	243.90964104082 323			3	3	3545.1
3	1 (G395M/F290LP)	c2	3 Shutter Slitlet	150.21817704166 668 Degrees 2.5439816666666 664 Degrees	243.90957875247 19			3	3	3545.1
4	2 (G235M/F170LP)	c2	3 Shutter Slitlet	150.21817704166 668 Degrees 2.5439816666666 664 Degrees	243.90957875247 19			3	3	3545.1

Spectral Elements

NIRCam Imaging	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F115W	F277W	MEDIUM8	10	1	3	3	3156.61	
2	F150W	F356W	MEDIUM8	10	1	3	3	3156.61	
3	F200W	F444W	MEDIUM8	10	1	3	3	3156.61	
4	F090W	F356W	MEDIUM8	10	1	3	3	3156.61	

Special Requirements

No Parallel Attachments
MSA Scheduled Aperture PA 243.9092 to 243.9092 Degrees (V3 105.334595 to 105.334595)

Observation

Proposal 4265, Observation 3: Pre_Imaging Wed Mar 20 20:01:09 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

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)	CRISTAL-01	RA: 10 00 54.5315 (150.2272146d) Dec: +02 34 35.00 (2.57639d) Equinox: J2000		

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

Template

Module	Subarray	Target Placement
B	FULL	Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEX	5	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	F356W	BRIGHT2	10	1	5	5	1073.677	