



2775 - A Census of Star Formation and Early Quenching in a High-z Galaxy Cluster

Cycle: 2, Proposal Category: GTO

INVESTIGATORS

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1	La Pequena	NIRCam Imaging	(1) LA-PEQUENA

ABSTRACT

We propose to obtain (resolved) Pa-alpha emission as color excess over the continuum in a galaxy cluster at $z=1.3188$ using NIRCam medium band imaging. This cluster is observed during the epoch in which clusters undergo a transition to widespread, rapid quenching. Pa-alpha in F430M (plus F356W and F460M for continuum) will secure cluster memberships and extinction-robust SFRs, mapped on sub-kpc scales, down to $SFR \sim 3 M_{\odot}/yr$ and $\log M^*/M_{\odot} \sim 9$. This will be the first census of SFGs in a cluster during this transition epoch and crucially it will probe to lower stellar masses where environmental effects are less ambiguous due to the long timescales for secular quenching in $\log M^*/M_{\odot} < 10$ galaxies. In well detected cluster members, the resolved SFR can further be used to obtain evidence of outside-in or inside-out quenching. Simultaneous short wavelength imaging in F070W and F115W will bracket the 4000A break in quiescent cluster members to $\log M^*/M_{\odot} \sim 9.7$. This accounting of cluster members and their star formation combined with NIRCam-measured morphologies and merger rates and AGN from existing data will provide a holistic view of ongoing activity and early quenching in the core and infall regions of a massive cluster, with the parameter space to identify the mechanisms driving early quenching.

OBSERVING DESCRIPTION

Target 1, a galaxy cluster, will be observed with one pointing of NIRCcam in three sets of filters: F430M+F070W, F460M+F070W, and F356W+F115W. 5sigma sensitivity will be 26.4-27mag. The main science will be in the long wavelength bands, with the Pa-alpha emission line centered in the F430M filter at the redshift of the target and spanning 4.303-4.394um given the observed velocity dispersion of 360 km/s (from X-ray and spec-z members). The F356W and F460M bands will be used as continuum to determine color excess in F430M in the emission line down to $SFR \sim 3 M_{\odot}/yr$ and $\log M^*/M_{\odot} \sim 9$. The identification of colors excess will confirm cluster membership and measure (resolved on sub-kpc scales) SFRs.

The shortwave NIRCcam bands will be used to identify the 4000A break and refine photometric redshifts in quiescent galaxies, confirming whether they have a high probability of being cluster members. The shortwave bands plus public Cycle 1 JWST data (PID 1727, F115W, F150W, F277W, F444W) and existing ancillary data will be used in conjunction with the longwave continuum bands to model the UV-NIR SED and weed out contaminants which include the weak emission lines Pa-beta at $z \sim 2.35$ and Br-gamma at $z \sim 1$ and the stellar bump at $z \sim 1.5-1.8$ in massive (brighter than $\sim 23mag$) galaxies.

Target 1 will be centered in NIRCcam module B, which has better throughput at the long wavelength end. Module A will provide a flanking field which covers the infall region of the cluster. Galaxies with photometric redshifts close to the cluster, but with no color excess and not in the cluster will form a control, field sample. The aperture PA range of 94-111.5 is requested to achieve background levels which within 10% of our targeted sensitivity, necessary to reach our target SFR.

A MIRI parallel will be done in F1280W totalling $\sim 6600s$, comparable to the MIRI F1280W parallels obtained in Cycle 1 in GOODS-S and GOODS-N (PID 1180). This will expand the area with deep 12.8um imaging, which enables discovery space up to $z \sim 3-4$ via MIRI to NIRCcam (from PID 1727) colors.

Proposal 2775 - Targets - A Census of Star Formation and Early Quenching in a High-z Galaxy Cluster

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	LA-PEQUENA	RA: 10 00 31.5300 (150.1313750d) Dec: +02 31 25.70 (2.52381d) Equinox: J2000		
<i>Comments:</i> Category= <i>Clusters of Galaxies</i> Description= <i>[Galaxy mergers, High-redshift clusters]</i>					

Proposal 2775 - Observation 1 - A Census of Star Formation and Early Quenching in a High-z Galaxy Cluster

Mon Mar 18 15:00:10 GMT 2024

Observation	Proposal 2775, Observation 1: La Pequena Diagnostic Status: Warning Observing Template: NIRCam Imaging Coordinated Parallel Template(s): MIRI Imaging <i>Comments: The aperture PA range is selected to target background levels which stay within 10% of our targeted sensitivity. The target should be centered in NIRCam module B, which has better throughput at the long wavelength end.</i>										
	(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)	LA-PEQUENA	RA: 10 00 31.5300 (150.1313750d) Dec: +02 31 25.70 (2.52381d) Equinox: J2000 <i>Comments: Category=Clusters of Galaxies Description=[Galaxy mergers, High-redshift clusters]</i>								
Template	NIRCam Imaging					MIRI Imaging					
	Module: ALL Subarray: FULL Target Placement: Module Gap					Subarray: FULL					
Dithers	#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions		Coordinated Parallel Subpixel Selector	Dither Direct Images Primes			
	1	INTRAMODULEBOX	4		1		NIRCam Only	NO_DITHERING			
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	F070W	F430M	MEDIUM8	6	1	4	4	2490.931		
	2	F070W	F460M	MEDIUM8	7	1	4	4	2920.401		
	3	F115W	F356W	SHALLOW4	6	1	4	4	1245.465		
Spectral Elements	MIRI Imaging	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	F1280W	FASTR1	111	2	1		4	8	2475.336	
	2	F1280W	FASTR1	131	2	1		4	8	2919.342	
	3	F1280W	FASTR1	112	1	1		4	4	1243.218	

Proposal 2775 - Observation 1 - A Census of Star Formation and Early Quenching in a High-z Galaxy Cluster

Special Requirements

Aperture PA Range 94 to 111.5 Degrees (V3 94.07457694 to 111.57457694)
Offset 88.0 arcsec, 0.0 arcsec
No Parallel Attachments