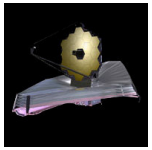

3950 - Unlocking the Early Universe for Weak Lensing with JWST: High-Precision Analysis of z=2 Galaxy Cluster XLSSC122

Cycle: 2, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	F200W+F090W	NIRCam Imaging	(2) XLSSC122BCG

ABSTRACT

XLSSC122 is a galaxy cluster at z=2 with a well-established red sequence. The cluster has a distinct XMM-Newton X-ray detection of the intracluster medium and a 7.6 sigma detection of the Sunyaev Zel'dovich decrement. These two measurements result in contrasting mass estimates. The SZ mass (M200~3e14 solar masses) is extreme for a galaxy cluster at redshift 2. Furthermore, the X-ray peak and SZ centroid are significantly offset, which may indicate a recent merger. We propose 3.3 hours of JWST NIRCam observations to enable a weak-lensing analysis that will map the mass distribution and provide an accurate mass estimate for the galaxy cluster. The high-resolution mass map that we will generate from JWST weak lensing will discern substructure better than current probes of the intracluster medium. With a robust mass estimation from weak lensing, we will inspect the rarity of XLSSC122 with cosmological models and compare the mass-to-light ratio of a galaxy cluster at cosmic noon to local clusters. Our weak-lensing analysis will also test the radial mass profile of a cluster in the early universe.

Weak lensing at this redshift has, as of yet, not been achieved. Reaching our goals requires a high number density of background galaxies that is unobtainable with the HST and can only be reached with the sensitivity, resolution, and IR filters of JWST. We provide validation tests that demonstrate the feasibility of weak lensing with the JWST. The JWST will be the telescope that allows high-z weak-lensing studies to thrive.

OBSERVING DESCRIPTION

Observations of a z=2 galaxy cluster will be done with NIRCam. The cluster has a predicted angular size of 130 arcsecs.

We want the galaxy cluster center (BCG) to be placed slightly off the center of module A. We have included an offset to the target position so that the center of the cluster is situated near the center of module A. We place no constraint on the position angle of the telescope during the observation, but the location of the BCG in module A needs to be fixed (i.e., only the position of module A is important and not module B). We need to clarify this before observing!

Two SWL filters are the primary observations.

For the first filter setup,
F200W + F356W: 8 groups, 1 exposure, 4 dithers for a total of 3350s

For the second filter setup,
F090W + F277W:10 groups, 2 exposure, 4 dithers for a total of 8461s

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	XLSSC122	RA: 02 17 44.4000 (34.4350000d) Dec: -03 45 42.90 (-3.76192d) Equinox: J2000	Epoch of Position: 2000	
Comments: *Category=Clusters of Galaxies* *Description=[High-redshift clusters]*				
(2)	XLSSC122BCG	RA: 02 17 44.2100 (34.4342083d) Dec: -03 45 31.60 (-3.75878d) Equinox: J2000		
Comments: *Category=Clusters of Galaxies* *Description=[Brightest cluster galaxies, Rich clusters]*				

Observation

Proposal 3950, Observation 1: F200W+F090W

Tue Jul 16 00:00:10 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

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
(2)	XLSSC122BCG	RA: 02 17 44.2100 (34.4342083d) Dec: -03 45 31.60 (-3.75878d) Equinox: J2000		

Comments:
Category=Clusters of Galaxies
Description=[Brightest cluster galaxies, Rich clusters]

Template

Module	Subarray	Target Placement
ALL	FULL	Module A (A3 corner)

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEBOX	8	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	F090W	F277W	MEDIUM8	9	1	8	8	7558.686	
2	F200W	F356W	SHALLOW4	10	1	8	8	4208.814	

Special Requirements

Offset -12.0 arcsec, 17.0 arcsec
Background Limited. Background no more than 40th percentile above minimum
Fiducial Point Override NRCAS_FULL

Same Aperture PA 1