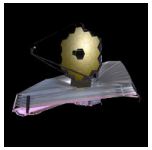

6353 - Confirming Secondary Star Formation Conditions in Nitrogen-Enriched Super Star Clusters at Cosmic Noon

Cycle: 3, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Imaging				
	1	PSZ1G311 MIRI Imaging	MIRI Imaging	(1) PSZ1-G311.65-18.48

ABSTRACT

Super star clusters (SSCs) are among the most extreme modes of star formation in the Universe. Studying the formation and early evolution of SSCs is fundamental to our understanding of star formation and feedback, and can shed light on the origin of the multiple stellar populations ubiquitously

observed in globular clusters (GCs). While these SSCs are rare in our cosmic backyard, they are more common in the young universe. Gravitational lensing offers an outstanding opportunity for studying individual SSCs at cosmological distances. We propose 9-band MIRI imaging to search for hot dust (>300K) thermal emission from two newborn SSCs in the brightest, most magnified lensed galaxy known at Cosmic Noon (z=2.37). The targets, massive enough to be globular cluster progenitors, exhibit unique nebular properties, which reveal dense, nitrogen-enriched (N-enriched) nebular clouds that have condensed out of massive star ejecta in the deep SSC potentials. MIRI is sensitive to thermal emission from only the hot dust, which can be uniquely localized to clouds in the proximity or interior of the UV-intense SSCs. Hot dust residing in the N-enriched clouds will be strong indication that they have shielded, cool neutral interiors, which may undergo Jeans collapse and host secondary star formation despite intense stellar UV irradiation. If detected, this will be strong empirical evidence supporting an origin of secondary stellar population in GCs from retained massive star ejecta in the first 10 Myr of cluster evolution. This science is uniquely achievable with MIRI.

OBSERVING DESCRIPTION

This program requests MIRI imaging of the entire Sunburst Arc in all 9 available filters, totaling 13.1 hr science time and 19.4 hr charged. We will measure the SEDs of the two targeted SSCs in 1.5 to 8 micron rest-frame, aiming to detect thermal emission from hot dust and determine the temperature. One of the SSCs is multiply-imaged 12 times, allowing for stacking to boost the SNR - all 12 images can be captured in one pointing regardless of position angle.

Our targets are faint extragalactic sources. Since MIRI imaging is sky and instrument (primary mirror and sunshield) background limited in all filters, we require medium or better background conditions. Scheduling is otherwise flexible as our targets are persistent sources.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	PSZ1-G311.65-18.48	RA: 15 50 7.9764 (237.5332350d) Dec: -78 11 26.72 (-78.19076d) Equinox: J2000		

Comments:
Category=Clusters of Galaxies
Description=[High-redshift clusters]

Observation

Proposal 6353, Observation 1: PSZ1G311 MIRI Imaging

Tue May 06 00:00:08 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI 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
(1)	PSZ1-G311.65-18.48	RA: 15 50 7.9764 (237.5332350d) Dec: -78 11 26.72 (-78.19076d) Equinox: J2000		

Comments:
Category=Clusters of Galaxies
Description=[High-redshift clusters]

Template

Subarray
FULL

Dithers

#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size
1	CYCLING	1	10						MEDIUM

Spectral Elements

#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F560W	FASTR1	20	1	1	Dither 1	10	10	555.008	
2	F770W	FASTR1	22	1	1	Dither 1	10	10	610.509	
3	F1000W	FASTR1	54	1	1	Dither 1	10	10	1498.522	
4	F1130W	FASTR1	80	4	1	Dither 1	10	40	8963.379	
5	F1280W	FASTR1	72	2	1	Dither 1	10	20	4023.808	
6	F1500W	FASTR1	55	3	1	Dither 1	10	30	4634.317	
7	F1800W	FASTR1	55	5	1	Dither 1	10	50	7742.362	
8	F2100W	FASTR1	25	14	1	Dither 1	10	140	10073.395	
9	F2550W	FASTR1	14	25	1	Dither 1	10	250	10378.65	