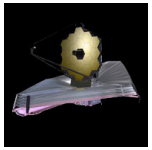

5381 - Unveiling the compact object and stellar populations of globular clusters Terzan 5 and Liller 1

Cycle: 3, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRCam Imaging	(1) CL-TERZAN-5

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	2		NIRCam Imaging	(1) CL-TERZAN-5
	3		NIRCam Imaging	(2) C-1730-333
	4		NIRCam Imaging	(2) C-1730-333

ABSTRACT

Among the Milky Way's globular clusters, Terzan 5 and Liller 1 are exceptional. Terzan 5 boasts more known pulsars than any other globular cluster, while Liller 1 exhibits unprecedented gamma-ray emission, hinting at a vast pulsar population. Both clusters are not only massive and dense but are also believed to experience the highest stellar collision rates in the Galaxy. This makes them prime sites for the formation of compact binary systems through dynamical interactions. Additionally, these clusters share the rare characteristic of multiple stellar populations, a trait only otherwise seen in Omega Centauri, suggesting they experienced several star formation episodes.

However, our understanding of the compact objects and sellar populations within these clusters has been limited due to their high levels of obscuration. We propose employing NIRCAM to capture time-series photometry of these unique environments, aiming to unveil the ultracompact binary systems and variable stars therein. This effort will provide insights into the role of dynamical processes in the formation of compact binaries—a topic now at the forefront of gravitational wave astronomy. Our program will maximize NIRCAM's potential, relying on its unmatched sensitivity, field of view, angular resolution, and wavelength capabilities. The resulting dataset promises wide-ranging applications, catering to the optical, IR, radio, X-ray, and gravitational wave communities. We anticipate that our findings and this dataset will significantly enrich the scientific legacy of JWST.

OBSERVING DESCRIPTION

Here we propose to obtain NIRCAM observations of the globular clusters Terzan 5 and Liller 1. We split the observations into a total of four 6.7 hr segments (two on Terzan 5, two on Liller 1). The observations themselves will use the BRIGHT2 readout pattern of NIRCAM, with the F200W filter in the short wavelength, and the F356W filter in the long wavelength arm. In both cases we use the FULLP subarray, and center them on the cores of the clusters.

Proposal 5381 - Targets - Unveiling the compact object and stellar populations of globular clusters Terzan 5 and Liller 1

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CL-TERZAN-5	RA: 17 48 5.0000 (267.0208333d) Dec: -24 46 48.10 (-24.78003d) Equinox: J2000	Proper Motion RA: -1.4604752501302126E-4 sec of time/yr Proper Motion Dec: -0.005242999941401649 arcsec/yr Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Stellar Cluster* *Description=[Globular star clusters]*				
(2)	C-1730-333	RA: 17 33 24.5000 (263.3520833d) Dec: -33 23 20.00 (-33.38889d) Equinox: J2000	Proper Motion RA: -4.0161864299299773E-4 sec of time/yr Proper Motion Dec: -0.007560000062767358 arcsec/yr Epoch of Position: 2015.5	
Comments: *Category=Stellar Cluster* *Description=[Globular star clusters]*				

Observation

Proposal 5381, Observation 1

Fri Apr 11 21:00:08 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 1:1) Warning (Form): Data Excess over middle threshold

(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)	CL-TERZAN-5	RA: 17 48 5.0000 (267.0208333d) Dec: -24 46 48.10 (-24.78003d) Equinox: J2000	Proper Motion RA: -1.4604752501302126E-4 sec of time/yr Proper Motion Dec: -0.005242999941401649 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Stellar Cluster
Description=[Globular star clusters]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		12

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	9	108	12	24222.153	

Observation

Proposal 5381, Observation 2

Fri Apr 11 21:00:08 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Observation 2) Warning (Form): No dither offsets specified for observation

(Visit 2:1) Warning (Form): Data Excess over middle threshold

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CL-TERZAN-5	RA: 17 48 5.0000 (267.0208333d) Dec: -24 46 48.10 (-24.78003d) Equinox: J2000	Proper Motion RA: -1.4604752501302126E-4 sec of time/yr Proper Motion Dec: -0.005242999941401649 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Stellar Cluster
Description=[Globular star clusters]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		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	9	9	1	2018.513	
2	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
3	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
4	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
5	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
6	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
7	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
8	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
9	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
10	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
11	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
12	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	

Observation

Proposal 5381, Observation 3

Fri Apr 11 21:00:08 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Observation 3) Warning (Form): No dither offsets specified for observation

(Visit 3:1) Warning (Form): Data Excess over middle threshold

(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)	C-1730-333	RA: 17 33 24.5000 (263.3520833d) Dec: -33 23 20.00 (-33.38889d) Equinox: J2000	Proper Motion RA: -4.0161864299299773E-4 sec of time/yr Proper Motion Dec: -0.007560000062767358 arcsec/yr Epoch of Position: 2015.5	

Comments:
Category=Stellar Cluster
Description=[Globular star clusters]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		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	9	9	1	2018.513	
2	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
3	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
4	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
5	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
6	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
7	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
8	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
9	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
10	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
11	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
12	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	

Observation

Proposal 5381, Observation 4

Fri Apr 11 21:00:08 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Observation 4) Warning (Form): No dither offsets specified for observation

(Visit 4:1) Warning (Form): Data Excess over middle threshold

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	C-1730-333	RA: 17 33 24.5000 (263.3520833d) Dec: -33 23 20.00 (-33.38889d) Equinox: J2000	Proper Motion RA: -4.0161864299299773E-4 sec of time/yr Proper Motion Dec: -0.007560000062767358 arcsec/yr Epoch of Position: 2015.5	

Comments:
Category=Stellar Cluster
Description=[Globular star clusters]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		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	9	9	1	2018.513	
2	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
3	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
4	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
5	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
6	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
7	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
8	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
9	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
10	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
11	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	
12	F200W	F356W	BRIGHT2	10	9	9	1	2018.513	