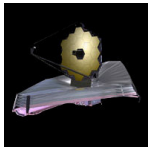

5058 - Early stars -- Properties of lensed stars at z~7

Cycle: 3, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
CLG-0451-03 high-redshift arc monitoring				
	1	Epoch 1	NIRCam Imaging	(1) CLG-0451-03
	2	Epoch 2	NIRCam Imaging	(1) CLG-0451-03
	3	Epoch 3	NIRCam Imaging	(1) CLG-0451-03
	4	Epoch 4	NIRCam Imaging	(1) CLG-0451-03

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	5	Epoch 5	NIRCam Imaging	(1) CLG-0451-03

ABSTRACT

Recent years have seen the advent of a new method to directly observe individual stars at cosmological distances through the micro-lensing effect that occurs when a star in a distant lensed galaxy crosses the caustic of a foreground lens. Its unprecedented sensitivity and spatial resolution make JWST the perfect observatory to detect and study these ultra-faint sources and indeed, every JWST observation of a lensing cluster to date has yielded at least one lensed star candidate. We propose here a small pioneering JWST/NIRCam imaging program specifically designed to monitor the highest-redshift caustic-crossing arc known to date in order to detect extremely magnified stars. The target is the spectroscopically confirmed z=6.7 arc in the cluster MS 0451.6-0305. Several characteristics of this arc make it especially well suited for detecting lensed stars: its configuration that makes it cross the caustic not once but twice and therefore yields a very large causic-crossing area in which micro-lensed stars can become observable, and its high-redshift nature which enhances the attainable magnifications. The lensing magnification pushes single stars to observed magnitudes brighter than 29 AB, depths easily achievable with JWST. Our program will not only crown the new highest-redshfit stars observed to date, but also for the first time directly constrain the radii of individual stars on such cosmological distances.

OBSERVING DESCRIPTION

We will obtain deep NIRCam imaging of the strong lensing galaxy cluster MS 0451.6-0305 aimed at monitoring the z=6.7 caustic-crossing arc that resides in this cluster in order to detect and characterize single micro-lensed stars in this arc that become visible when they cross the caustic.

Since these are transient sources, the observations are split into 5 visits, or epochs, of 2.5h integration time on target each. In each epoch, the cluster-field will be imaged to 29 AB (5-sigma) depth in each of 6 broad-band filters: F115W, F150W, F200W, F277W, F356W and F444W. The full cluster-field fits well into one NIRCam module. We apply a simple 3-point INTRAMODULEBOX dither pattern with sub-pixel dithering and make sure to place the arc in the middle of one of the module quadrants in order to obtain the smoothest possible sky background.

In order to be able to measure the transit-time of the stars on the caustic and thus constrain their radii, we require that the different visits to the cluster be observed no less than 2 days and no more than 5 days appart.
In addition, we require all observations to be taken with the same position angle to assure optimal image subtraction when searching for transient sources.

Since all of our NIRCam observations need to be observed at the same position angle, we leverage the total integration time by also taking NIRISS

imaging of a blank parallel-field in parallel. The NIRISS observations will also reach a total depth of ~29 AB at 5-sigma in 7 broad-band filters: F090W, F115W, F150W, F200W, F277W, F356W, F444W, and a 5-sigma depth of ~28 AB in one medium-band filter, F430M. These ultra-deep parallem-field observations will contribute to the efforts to detect high-redshift galaxies with JWST.

Proposal 5058 - Targets - Early stars -- Properties of lensed stars at z~7

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CLG-0451-03	RA: 04 54 9.1162 (73.5379842d) Dec: -02 59 29.49 (-2.99153d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[High-redshift galaxies]

Observation

Proposal 5058, Observation 1: Epoch 1

Mon Jan 06 18:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Coordinated Parallel Template(s): NIRISS Imaging

Diagnostics

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

(Epoch 1 (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CLG-0451-03	RA: 04 54 9.1162 (73.5379842d) Dec: -02 59 29.49 (-2.99153d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[High-redshift galaxies]

Template

NIRCam Imaging

Module: ALL

Subarray: FULL

Target Placement: Module Gap

NIRISS Imaging

Dithers

#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes
1	INTRAMODULEBOX	3		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	F115W	F277W	MEDIUM8	10	1	3	3	3156.61	144186.6
2	F150W	F356W	MEDIUM8	10	1	3	3	3156.61	144186.6
3	F200W	F444W	MEDIUM8	10	1	3	3	3156.61	144186.6

Spectral Elements

NIRISS Imaging	Filter	Grism	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W		NIS	12	2	3	6	3156.61	144186.9
2	F115W		NIS	12	2	3	6	3156.61	144186.9
3	F150W		NIS	12	2	3	6	3156.61	144186.9

Special Requirements	
	Aperture PA Range 54.92542306 to 74.92542306 Degrees (V3 55.0 to 75.0) No Parallel Attachments 2 After 1 by 2 Days to 5 Days Same V3 PA 1, 2, 3, 4, 5

Observation

Proposal 5058, Observation 2: Epoch 2 Mon Jan 06 18:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Coordinated Parallel Template(s): NIRISS Imaging

Diagnostics

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

(Epoch 2 (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CLG-0451-03	RA: 04 54 9.1162 (73.5379842d) Dec: -02 59 29.49 (-2.99153d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[High-redshift galaxies]

Template

NIRCam Imaging **NIRISS Imaging**

Module: ALL

Subarray: FULL

Target Placement: Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes
1	INTRAMODULEBOX	3		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	F115W	F277W	MEDIUM8	10	1	3	3	3156.61	144186.6
2	F150W	F356W	MEDIUM8	10	1	3	3	3156.61	144186.6
3	F200W	F444W	MEDIUM8	10	1	3	3	3156.61	144186.6

Spectral Elements

NIRISS Imaging	Filter	Grism	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F200W		NIS	12	2	3	6	3156.61	144186.9
2	F277W		NIS	12	2	3	6	3156.61	144186.9
3	F356W		NIS	12	2	3	6	3156.61	144186.9

Special Requirements	
	No Parallel Attachments 2 After 1 by 2 Days to 5 Days 3 After 2 by 2 Days to 5 Days Same V3 PA 1, 2, 3, 4, 5

Observation

Proposal 5058, Observation 3: Epoch 3 Mon Jan 06 18:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Coordinated Parallel Template(s): NIRISS Imaging

Diagnostics

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Epoch 3 (Obs 3)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CLG-0451-03	RA: 04 54 9.1162 (73.5379842d) Dec: -02 59 29.49 (-2.99153d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[High-redshift galaxies]

Template

NIRCam Imaging **NIRISS Imaging**

Module: ALL

Subarray: FULL

Target Placement: Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes
1	INTRAMODULEBOX	3		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	F115W	F277W	MEDIUM8	10	1	3	3	3156.61	144186.6
2	F150W	F356W	MEDIUM8	10	1	3	3	3156.61	144186.6
3	F200W	F444W	MEDIUM8	10	1	3	3	3156.61	144186.6

Spectral Elements

NIRISS Imaging	Filter	Grism	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F444W		NIS	12	2	3	6	3156.61	144186.9
2	F430M		NIS	12	2	3	6	3156.61	144186.10
3	F090W		NIS	12	2	3	6	3156.61	144186.9

Special Requirements	
	No Parallel Attachments 3 After 2 by 2 Days to 5 Days 4 After 3 by 2 Days to 5 Days Same V3 PA 1, 2, 3, 4, 5

Observation

Proposal 5058, Observation 4: Epoch 4 Mon Jan 06 18:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Coordinated Parallel Template(s): NIRISS Imaging

Diagnostics

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

(Epoch 4 (Obs 4)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CLG-0451-03	RA: 04 54 9.1162 (73.5379842d) Dec: -02 59 29.49 (-2.99153d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[High-redshift galaxies]

Template

NIRCam Imaging **NIRISS Imaging**

Module: ALL

Subarray: FULL

Target Placement: Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes
1	INTRAMODULEBOX	3		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	F115W	F277W	MEDIUM8	10	1	3	3	3156.61	144186.6
2	F150W	F356W	MEDIUM8	10	1	3	3	3156.61	144186.6
3	F200W	F444W	MEDIUM8	10	1	3	3	3156.61	144186.6

Spectral Elements

NIRISS Imaging	Filter	Grism	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F115W		NIS	12	2	3	6	3156.61	144186.9
2	F150W		NIS	12	2	3	6	3156.61	144186.9
3	F200W		NIS	12	2	3	6	3156.61	144186.9

Special Requirements	
	No Parallel Attachments 4 After 3 by 2 Days to 5 Days 5 After 4 by 2 Days to 5 Days Same V3 PA 1, 2, 3, 4, 5

Observation

Proposal 5058, Observation 5: Epoch 5 Mon Jan 06 18:00:10 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Coordinated Parallel Template(s): NIRISS Imaging

Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Epoch 5 (Obs 5)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	CLG-0451-03	RA: 04 54 9.1162 (73.5379842d) Dec: -02 59 29.49 (-2.99153d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[High-redshift galaxies]

Template

NIRCam Imaging **NIRISS Imaging**

Module: ALL

Subarray: FULL

Target Placement: Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes
1	INTRAMODULEBOX	3		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	F115W	F277W	MEDIUM8	10	1	3	3	3156.61	144186.6
2	F150W	F356W	MEDIUM8	10	1	3	3	3156.61	144186.6
3	F200W	F444W	MEDIUM8	10	1	3	3	3156.61	144186.6

Spectral Elements

NIRISS Imaging	Filter	Grism	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F277W		NIS	12	2	3	6	3156.61	144186.9
2	F444W		NIS	12	2	3	6	3156.61	144186.9
3	F356W		NIS	12	2	3	6	3156.61	144186.9

Special Requirements	
	No Parallel Attachments 5 After 4 by 2 Days to 5 Days Same V3 PA 1, 2, 3, 4, 5