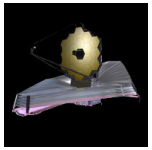

9372 - A Luminous, Red Transient at z = 3: An Extreme Test Bed for Supernova Evolution

Cycle: 3, Proposal Category: DD

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NIRSpec				
	1		NIRSpec Fixed Slit Spectroscopy	(1) C3D_SN
NIRCam				
	2		NIRCam Imaging	(1) C3D_SN
	3		NIRCam Imaging	(1) C3D_SN

ABSTRACT

The first set of four z>2 supernovae (SNe) characterized spectroscopically by JWST have suggested that the detailed properties of high-z SNe might be distinct from those in the low-z universe. Our best lever arm for probing this evolution is to characterize the most extreme transients, as their very existence traces changes in global properties like metallicity and progenitor mass. However such objects, such as pair-instability SNe (PISNe), remain purely theoretical despite their value for understanding these fundamental changes. We report the discovery of an unusually luminous and red supernova (SN) candidate, C3D SN, at a spectroscopic redshift of z = 2.99, uncovered through image subtraction of COSMOS-3D, PRIMER, and COSMOS-Web JWST/NIRCam datasets. The redshift, rest-frame B-I color, and inferred absolute magnitude of M19.7 (rest-frame I band) are inconsistent with the typical color evolution of core-collapse or Type Ia supernovae in this phase range. Instead these observations point to a more extreme origin, best-matched by a PISN. Remarkably, the transient is spatially offset from its host galaxy, enabling the opportunity to obtain a high

signal-to-noise spectrum of a rare, extreme stellar explosion in the early universe without significant host contamination. We request 8 hours of JWST NIRSpec/NIRCam time to characterize C3D SN, expanding the high-z sample required to test if and how SN properties evolve as a function of redshift.

OBSERVING DESCRIPTION

This program consists of two epochs to capture the evolution of a pair-instability supernova (PISN) candidate. The first epoch includes NIRSpec fixed-slit and 5-filter NIRCam observations, which we request in the current window ending May 27th to ensure the SN is bright enough for a spectrum. We do not include the second NIRcam epoch in the APT as it is during Cycle 4, but we have added a custom time allocation that includes this second epoch, which should be scheduled in the November-January window. The second epoch uses the same filter set and readout pattern, but with 6 groups/int and 2 integrations/exp.

Proposal 9372 - Targets - A Luminous, Red Transient at z = 3: An Extreme Test Bed for Supernova Evolution

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	C3D_SN	RA: 10 00 33.0672 (150.1377800d) Dec: +02 21 38.97 (2.36083d) Equinox: J2000		
Comments: *Category=Star* *Description=[Supernovae]*				
(2)	C3D_SN-TA	RA: 10 00 34.2221 (150.1425921d) Dec: +02 21 52.59 (2.36461d) Equinox: J2000		
Comments: *Category=Star* *Description=[O stars]*				

Observation

Proposal 9372, Observation 1

Wed Sep 03 21:00:11 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit Spectroscopy

Diagnostics

(Observation 1) Warning (Form): Observers are responsible for checking that target acquisition is feasible.

(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)	C3D_SN	RA: 10 00 33.0672 (150.1377800d) Dec: +02 21 38.97 (2.36083d) Equinox: J2000		

Comments:
Category=Star
Description=[Supernovae]

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
1	2 C3D_SN-TA	WATA	SUB2048	CLEAR	NRSRAPIDD6	3	1	1	14.452	

Template

HFF Readout Mode	Slit	Subarray
false	S200A1	FULL

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	5	NONE

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	PRISM/CLEAR	S200A1	NRSIRS2	10	3	1	NONE	5	15	11160.501	

Special Requirements	
	Before Date 28-MAY-2025:00:00:00 Group Observations 1, 2, Non-interruptible

Observation

Proposal 9372, Observation 2

Wed Sep 03 21:00:11 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(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)	C3D_SN	RA: 10 00 33.0672 (150.1377800d) Dec: +02 21 38.97 (2.36083d) Equinox: J2000		

Comments:
Category=Star
Description=[Supernovae]

Template

Module	Subarray	Target Placement
ALL	FULL	Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEX	4	STANDARD		1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F150W	F444W	BRIGHT2	6	1	4	4	515.365	
2	F150W	F277W	BRIGHT2	6	1	4	4	515.365	
3	F200W	F356W	BRIGHT2	6	1	4	4	515.365	

Special Requirements

Offset 43.0 arcsec, 40.0 arcsec

Group Observations 1, 2, Non-interruptible

Observation

Proposal 9372, Observation 3

Wed Sep 03 21:00:11 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

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

(Visit 3:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	C3D_SN	RA: 10 00 33.0672 (150.1377800d) Dec: +02 21 38.97 (2.36083d) Equinox: J2000		

Comments:
Category=Star
Description=[Supernovae]

Template

Module	Subarray	Target Placement
ALL	FULL	Module Gap

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEX	4	STANDARD		1

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F150W	F444W	BRIGHT2	6	2	8	4	1073.677	
2	F150W	F277W	BRIGHT2	6	2	8	4	1073.677	
3	F200W	F356W	BRIGHT2	6	2	8	4	1073.677	

Special Requirements

Before Date 08-JAN-2026:00:00:00
Offset 43.0 arcsec, 40.0 arcsec