

12576 - Requiem's Return: Precision cosmology from a decade-delayed, strongly-lensed supernova and its new sibling

Cycle: 5, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	***Observation***	***Label***	***Observing Template***	***Science Target***
NIRCam-ToO				
	1	E1	NIRCam Imaging	(1) SN-R4
	3	E2	NIRCam Imaging	(1) SN-R4
	4	E3	NIRCam Imaging	(1) SN-R4
	5	E4	NIRCam Imaging	(1) SN-R4
	6	E5	NIRCam Imaging	(1) SN-R4
NIRSpec-ToO				
	2	E1-SPEC	NIRSpec Fixed Slit Spectroscopy	(1) SN-R4
Monitoring				
	10		NIRCam Imaging	(1) SN-R4
	11		NIRCam Imaging	(1) SN-R4
	12		NIRCam Imaging	(1) SN-R4
	13		NIRCam Imaging	(1) SN-R4
	14		NIRCam Imaging	(1) SN-R4

ABSTRACT

This program will capture the reappearance of a strongly lensed Type Ia supernova (SN Ia), SN Requiem, a decade after its initial discovery. Lensed by the galaxy cluster MACS J0138-2155, the first three images of SN Requiem at z=1.95 were seen in a 2016 HST visit; the fourth is predicted to appear a decade later. In 2023, this system became even more remarkable with JWST's discovery of a second lensed SN Ia in the same host galaxy, named SN Encore. Detecting SN Requiem's fourth image enables the first joint Hubble constant (H0) measurement from two lensed SNe in one system. Using archival JWST, HST, and MUSE data, we built seven lens mass models of the cluster, incorporating both statistical and systematic uncertainties, to predict SN Requiem's reappearance. If H0 = 73 km/s/Mpc, the fourth image is expected in June-Nov 2026; if H0 = 67.4 km/s/Mpc, then Apr-Sept 2027. We propose two HST cycles to monitor the cluster and catch the reappearance, triggering JWST ToO imaging and spectroscopy upon detection to measure the longest-ever lensing time delay (~10 years). This allows a Requiem+Encore H0 measurement with <3% uncertainty -- the most precise from lensed SNe to date -- and directly addresses the Hubble tension between early- and late-Universe values. Our program leverages HST WFC3/IR as the most efficient tool to monitor the system and detect SN Requiem, and JWST to capture the full UV-NIR photometric and spectroscopic evolution of this rare event.

OBSERVING DESCRIPTION

This is the JWST component to an HST+JWST proposal to detect the reappearance of the strongly lensed supernova (SN) Requiem at z=2. This is just an example follow-up program, the actual visits, filters, and exposure times will be selected to optimize follow-up given the detection phase and date of detection. We include a fixed-slit spectrum with the first visit, and then NIRCam-only spaced by 3-7 rest-frame days to fully characterize the light curve. The first visit is marked as a disruptive ToO, justified in the proposal, followed by the cadenced observations.

In addition to the triggered observations we request a single "monitoring epoch", justified in the proposal, which fills in one observing gap in the HST monitoring campaign. That gap is between November 2026-February 2027, but since we must select dates in Cycle 4 for the APT, this throws an error. We used the 2025-2026 window to calculate the program cost, and then removed this visit and requested the time for next Cycle, to be scheduled November 2026-February 2027 during HST Cycle 34. Adding hours in future cycles causes an error because this should technically be marked as a carry-over ToO since it's two HST cycles, but we cannot select both carry-over ToO and future cycle time. We therefore have removed the carry-over ToO requirement, since this program is by definition tied to the 2-cycle HST program, but this ToO should be considered "carry-over" in the sense that it can be triggered over two HST Cycles.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		
Comments: *Category=Star* *Description=[Type Ia supernovae]* *Extended=NO*				
(2)	NIRSPec-TA	RA: 01 38 2.8540 (24.5118917d) Dec: -21 55 51.17 (-21.93088d) Equinox: J2000		
Comments: *Category=Star* *Description=[O stars]*				

Generic Targets

#	Name	Criteria	Description
(3)	NIRSPec-TA-Generic	S/N>20 TA Star	

Observation

Proposal 12576, Observation 1: E1

Mon Oct 26 17:00:36 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(E1 (Obs 1)) Warning (Form): Response time < 14.0 Days is disruptive to the scheduling process. Only a limited number of disruptive ToOs will be accepted.

(E1 (Obs 1)) Warning (Form): Response time < 14.0 Days is disruptive to the scheduling process. Only a limited number of disruptive ToOs will be accepted.

(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)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F444W	BRIGHT1	8	2	8	4	1331.359	
2	F150W	F356W	BRIGHT1	8	2	8	4	1331.359	
3	F200W	F277W	BRIGHT2	6	2	8	4	1073.677	

Special Requirements

Offset 55.0 arcsec, 45.0 arcsec
On Hold On hold for SN Requiem detection
Target Of Opportunity Response Time 5 Days to 10 Days

3 After 1 by 9 Days to 21 Days
Group Observations 1, 2, Non-interruptible

Observation

Proposal 12576, Observation 3: E2

Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F444W	BRIGHT1	8	2	8	4	1331.359	
2	F150W	F356W	BRIGHT1	8	2	8	4	1331.359	
3	F200W	F277W	BRIGHT2	6	2	8	4	1073.677	

Special Requirements

Offset 55.0 arcsec, 45.0 arcsec
On Hold On hold for SN Requiem detection

3 After 1 by 9 Days to 21 Days
4 After 3 by 9 Days to 21 Days

Observation

Proposal 12576, Observation 4: E3

Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F444W	BRIGHT1	8	2	8	4	1331.359	
2	F150W	F356W	BRIGHT1	8	2	8	4	1331.359	
3	F200W	F277W	BRIGHT2	6	2	8	4	1073.677	

Special Requirements

Offset 55.0 arcsec, 45.0 arcsec
On Hold On hold for SN Requiem detection

4 After 3 by 9 Days to 21 Days
5 After 4 by 9 Days to 21 Days

Observation

Proposal 12576, Observation 5: E4

Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F444W	BRIGHT1	8	2	8	4	1331.359	
2	F150W	F356W	BRIGHT1	8	2	8	4	1331.359	
3	F200W	F277W	BRIGHT2	6	2	8	4	1073.677	

Special Requirements

Offset 55.0 arcsec, 45.0 arcsec
On Hold On hold for SN Requiem detection

5 After 4 by 9 Days to 21 Days

Observation

Proposal 12576, Observation 6: E5

Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F444W	BRIGHT1	8	2	8	4	1331.359	
2	F150W	F356W	BRIGHT1	8	2	8	4	1331.359	
3	F200W	F277W	BRIGHT2	6	2	8	4	1073.677	

Special Requirements

Offset 55.0 arcsec, 45.0 arcsec
On Hold On hold for SN Requiem detection

Observation

Proposal 12576, Observation 2: E1-SPEC Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit Spectroscopy

Diagnostics

(E1-SPEC (Obs 2)) Warning (Form): Observers are responsible for checking that target acquisition is feasible.

(E1-SPEC (Obs 2)) Warning (Form): The slew between the acquisition exposure and the farthest science exposure is 43.139 Arcsec (larger than the recommended limit of 38.000 Arcsec) and may result in reduced or no schedulability. See more information in the diagnostic browser.

(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)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Acquisition

#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
1	2 NIRSPec-TA	WATA	FULL	F110W	NRSRAPIDD6	3	1	1	171.788	

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	11	4	1	NONE	5	20	16339.557	

Special Requirements	Group Observations 1, 2, Non-interruptible

Observation

Proposal 12576, Observation 10

Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 10:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F277W	SHALLOW4	7	1	4	4	1460.201	
2	F150W	F356W	SHALLOW4	7	1	4	4	1460.201	

Special Requirements

Between Dates 20-DEC-2026:00:00:00 and 31-JAN-2027:00:00:00
Offset 55.0 arcsec, 45.0 arcsec

Observation

Proposal 12576, Observation 11

Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 11:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 11:1) 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)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F277W	SHALLOW4	7	1	4	4	1460.201	
2	F150W	F356W	SHALLOW4	7	1	4	4	1460.201	

Special Requirements

Before Date 22-NOV-2026:00:00:00
Offset 55.0 arcsec, 45.0 arcsec

Observation

Proposal 12576, Observation 12

Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 12:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 12:1) 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)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F277W	SHALLOW4	7	1	4	4	1460.201	
2	F150W	F356W	SHALLOW4	7	1	4	4	1460.201	

Special Requirements

Between Dates 29-JUN-2027:00:00:00 and 10-JUL-2027:00:00:00
Offset 55.0 arcsec, 45.0 arcsec

Observation

Proposal 12576, Observation 13

Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 13:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Visit 13:1) 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)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F277W	SHALLOW4	7	1	4	4	1460.201	
2	F150W	F356W	SHALLOW4	7	1	4	4	1460.201	

Special Requirements

Between Dates 23-AUG-2027:00:00:00 and 04-SEP-2027:00:00:00
Offset 55.0 arcsec, 45.0 arcsec

Observation

Proposal 12576, Observation 14

Mon Oct 26 17:00:37 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 14:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN-R4	RA: 01 38 2.1602 (24.5090008d) Dec: -21 55 22.41 (-21.92289d) Equinox: J2000		

Comments:
Category=Star
Description=[Type Ia supernovae]
Extended=NO

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F115W	F277W	SHALLOW4	7	1	4	4	1460.201	
2	F150W	F356W	SHALLOW4	7	1	4	4	1460.201	

Special Requirements

Between Dates 12-NOV-2027:00:00:00 and 22-NOV-2027:00:00:00
Offset 55.0 arcsec, 45.0 arcsec