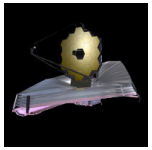

12490 - The Afterlife of SN 2024pxl: JWST Late-Time Spectroscopy of a Surviving White Dwarf

Cycle: 4, Proposal Category: DD

INVESTIGATORS

Name	*Institution*
Dr. Lindsey Kwok (PI)	**Northwestern University**
Dr. Saurabh W. Jha (CoI) (CoPI)	Rutgers the State University of New Jersey
Stephane Blondin (CoI) (ESA Member)	European Southern Observatory - Germany
Prof. Ryan Foley (CoI)	University of California - Santa Cruz
Prof. Griffin Hosseinzadeh (CoI)	University of California - San Diego
Dr. Wynn Vicente Jacobson-Galan (CoI)	California Institute of Technology
Conor Larison (CoI)	Space Telescope Science Institute
Dr. Adam Miller (CoI)	Northwestern University
Mr. Chang Liu (CoI)	Northwestern University
Nabeel Rehemtulla (CoI)	Northwestern University
Ms. Saarah Hall (CoI)	Northwestern University
Prof. David J. Sand (CoI)	University of Arizona
Dr. Huei Sears (CoI)	Rutgers the State University of New Jersey
Michaela Grace Schwab (CoI)	The University of Virginia
Dr. Ken Shen (CoI)	University of California - Berkeley
Dr. Matthew Ryan Siebert (CoI)	Space Telescope Science Institute
Dr. Mridweeka Singh (CoI)	Indian Institute of Astrophysics
Ms. Cristine Koelln (CoI) (ESA Member)	European Southern Observatory - Germany
Prof. Stefano Valenti (CoI)	University of California - Davis

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	LRS	MIRI Low Resolution Spectroscopy	(1) SN2024PXL
	2	NIRSpec Gratings	NIRSpec Fixed Slit Spectroscopy	(1) SN2024PXL

ABSTRACT

Type Iax supernovae are the most common class of peculiar thermonuclear explosions and offer key insights into how white dwarfs can fail to fully explode. SN 2024pxl, a nearby and exceptionally well-observed example, is rapidly becoming the benchmark for this class. Multi-epoch JWST NIRSpec and MIRI spectroscopy, together with extensive ground-based monitoring, strongly support the pure-deflagration scenario and the presence of a surviving bound remnant. Recent optical data reveal a surprising development: an unprecedentedly slow late-time decline that requires an energy source beyond radioactive decay. This unusually slow fading enables continued spectroscopy and makes SN 2024pxl the strongest candidate yet for directly detecting and characterizing a bound remnant left behind by an incomplete explosion. Our proposed NIRSpec and MIRI observations will capture both the narrow permitted lines associated with a remnant-driven wind in the NIR and the broader forbidden ejecta features in the MIR. The infrared regime will also allow a sensitive search for molecular CO and newly formed dust, testing whether these faint explosions contribute Fe-rich dust to the ISM. Critically, SN 2024pxl's remarkable late-time behavior was discovered after the Cycle 4 deadline, and waiting until Cycle 5 risks missing rapidly fading MIR signatures and the onset of molecule or dust formation. These Cycle 4 DDT observations at ~500 days post-peak will provide the latest infrared spectrum ever obtained for a SN Iax and yield unprecedented constraints on the explosion physics and post-explosion evolution of these weak thermonuclear events.

OBSERVING DESCRIPTION

We will obtain very late-time infrared spectroscopy of the type Iax supernova SN 2024pxl during Cycle 4 in March 2026, observing the source at approximately +500 days after peak brightness. The visit will combine NIRSpec medium-resolution observations (G140M, G235M, and G395M; R~1000) with MIRI/LRS (R~100), giving continuous coverage from 1--14 μm. This setup is essential for resolving the extremely narrow NIR permitted lines produced by the slow bound-remnant driven wind, and for capturing the broader MIR forbidden transitions that trace the cooling ejecta in a time-efficient manner.

The spectral range and resolution will allow us to search for molecular or dust signatures emerging at these epochs, as well as continuum and low-velocity (narrow) evolution associated with a bound remnant driving a radioactively powered wind. These data will represent the latest-ever infrared view of a SN Iax obtained to date and will provide strong constraints on the physical processes governing these unusually weak thermonuclear

explosions and their surviving remnants.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	SN2024PXL	RA: 17 32 27.3376 (263.1139067d) Dec: +07 03 44.67 (7.06241d) Equinox: J2000	Parallax: 0" Epoch of Position: 2000	
Comments: *Category=Star* *Description=[Supernovae, Type Ia supernovae]* *Extended=NO*				
(2)	OFFSET_STAR	RA: 17 32 31.4992 (263.1312467d) Dec: +07 03 58.99 (7.06639d) Equinox: J2000	Parallax: 0" Epoch of Position: 2000	
Comments: *Category=Star* *Description=[K stars]* *Extended=NO*				

Observation

Proposal 12490, Observation 1: LRS

Thu Feb 19 23:00:11 GMT 2026

Diagnostic Status: Warning

Observing Template: MIRI Low Resolution Spectroscopy

Diagnostics

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

(Visit 1:1) 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)	SN2024PXL	RA: 17 32 27.3376 (263.1139067d) Dec: +07 03 44.67 (7.06241d) Equinox: J2000	Parallax: 0" Epoch of Position: 2000	

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

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
1	2 OFFSET_STAR	F1000W	FASTGRPAVG	4	1	1	44.401	290863

Template

Subarray	Obtain Verification Image?
FULL	true

Dithers

#	Dither Type	No. Spectral Steps	Spectral Step Offset	No. Spatial Steps	Spatial Step Offset
1	ALONG SLIT NOD				

Pointing Verification

#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	Optional ETC ID	Filter
1	FASTR1	50	1	1	1	1	138.752		F1000W

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	Optional ETC ID
1	FASTR1	98	8	16	1	2	4390.113	281402

Special Requirements

Between Dates 01-MAR-2026:00:00:00 and 07-APR-2026:00:00:00

Group Observations 1, 2, Non-interruptible

Observation

Proposal 12490, Observation 2: NIRSpec Gratings Thu Feb 19 23:00:11 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRSpec Fixed Slit Spectroscopy

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)	SN2024PXL	RA: 17 32 27.3376 (263.1139067d) Dec: +07 03 44.67 (7.06241d) Equinox: J2000	Parallax: 0" Epoch of Position: 2000	

Comments:
Category=Star
Description=[Supernovae, 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	SAME	WATA	SUB2048	F110W	NRSRAPIDD6	3	1	1	14.452	281402

Template

HFF Readout Mode	Slit	Subarray
false	S200A1	FULL

Dithers

#	Primary Dither Positions	Sub-Pixel Pattern
1	3	NONE

Spectral Elements

#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Exp	#	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
1	G140M/F100LP	S200A1	NRSIRS2RAPID	12	3	1	NONE	3	9	1706.9	281402
2	G235M/F170LP	S200A1	NRSIRS2RAPID	17	3	2	NONE	3	9	2363.4	281402
3	G395M/F290LP	S200A1	NRSIRS2RAPID	28	3	3	NONE	3	9	3807.7	281402

Special Requirements	Group Observations 1, 2, Non-interruptible